BOSTON HARBOR
MASSACHUSETTS

NAVIGATION IMPROVEMENT STUDY

FINAL FEASIBILITY REPORT
AND FINAL SUPPLEMENTAL
ENVIRONMENTAL IMPACT STATEMENT
AND MASSACHUSETTS
FINAL ENVIRONMENTAL IMPACT REPORT
(EOEA #12958)

APPENDIX P

MASSACHUSETTS REGULATORY REVIEW DOCUMENTS

THIS APPENDIX WAS UPDATED APRIL 2013

BOSTON HARBOR, MASSACHUSETTS
NAVIGATION IMPROVEMENT STUDY

APPENDIX P
MASSACHUSETTS REGULATORY REVIEW DOCUMENTS

This appendix consists of several documents relative to the Commonwealth of Massachusetts' regulatory review requirements and process under the Massachusetts Environmental Policy Act (MEPA):

(1) Massport's April 2013 Draft Section 61 Water Quality Certification Findings, and correspondence with the State following selection of the final recommended plan and project depth optimization and re-initiation of agency coordination in October 2012.

(2) The Secretary of Energy and Environmental Affairs Certificate on the Draft Environmental Impact Report and attached state agency and public comment letters – for comment and response table please see Appendix A – Public Involvement

(3) The Secretary of Environmental Affairs Certificate on the ENF, including EIR Scoping requirements and attached state agency and public comment letters

(4) The MEPA Comment and Response Table listing comments received in response to publication of the Environmental Notification Form for the project at the beginning of the study, with annotated responses and references to the responsive sections of the SEIS/EIR and Feasibility Report.

(5) The Environmental Notification Form and attachments filed by Massport with the Executive Office of Environmental Affairs MEPA Office on 31 January 2003

Based on negotiations with the State, final State action on Water Quality Certification by the Massachusetts Department of Environmental Protection and Federal Consistency Review documents of the Massachusetts Office of Coastal Zone Management, as well as action by the three municipalities, the Cities of Boston, Chelsea and Revere, on local regulatory actions, have been deferred until the Design Phase of the project. The Design Phase includes several investigations and planning efforts critical to securing regulatory approvals for the project.

PART 1

MASSPORT'S DRAFT SECTION 61 FINDINGS
AND
CORRESPONDENCE WITH THE STATE FOLLOWING IDENTIFICATION OF FINAL RECOMMENDED PLAN OF IMPROVEMENT AND RE-INITIATION OF AGENCY COORDINATION IN OCTOBER 2012

MASSPORT – April 2013

Section X.X Draft Section 61 Findings for the 401 Water Quality Certificate

This section of the Final SEIS/EIR presents draft Section 61 Findings as required by M.G.L. c. 30 § 61. The Massachusetts Environmental Policy Act (MEPA) regulations [301 CMR 11.01 (3)] require review and evaluation of projects to determine whether all feasible means and measures will be used to avoid or minimize damage to the environment. No agency may act on a permit or commence a project until this finding is complete. Furthermore, the 13 June 2008 EEA Secretary's Certificate on the Draft SEIS/EIR required that the Final EIR "**include draft Section 61 Findings for the 401 Water Quality Certificate**." The Certificate continued, stating that mitigation should address temporary, short-term and long-term impacts and indicate whether the proponent will develop compensatory mitigation plans for direct and indirect mortality of fisheries resources, delayed recovery of habitat and areas of habitat that are permanently lost or altered.

This chapter contains a Draft Section 61 finding based on the EIR to comply with the Massachusetts Port Authority's (Massport) responsibilities as the project's local sponsor. A final finding will be prepared and filed with the MEPA Office by Massport after the Secretary issues a Certificate on the Final SEIS/EIR and after final design is completed by the U.S. Army Corps of Engineers (Corps).

Project Description, Purpose, and Need

The *Boston Harbor Federal Deep Draft Navigation Improvement Project* (Deep Draft Project) is planned to provide navigation channel deepening and related improvements at the Port of Boston, consistent with the goals of the study sponsor, Massport, and in response to direction from Congress in the authorizing resolution and appropriations acts. Massport's goal is to provide deeper access to their Conley Container Terminal on the Reserved Channel in South Boston at a depth at least equal to the 45 feet now available at that facility's berths. Additional smaller port improvements in the Mystic and Chelsea Rivers and in the Main Ship Channel above the Reserved Channel are also under consideration.

The following is a summary of the recommended improvements:

- Improving access to the Conley Terminal for containerships by deepening the harbor's existing 40-foot channels, turning basin and anchorage to a depth of -47 feet MLLW (with an additional two to five feet of depth in the Broad Sound North Entrance Channel (up to -52 feet MLLW).
- Deepening of the berths at the Conley Terminal by Massport to at least 50 feet Improving access to Massport's Marine Terminal in South Boston. Massport and its partners are developing the terminal for dry bulk cargo operations. The 40-foot lane of the Main Ship Channel above the Reserved Channel and below the Ted Williams Tunnel would be deepened to -45 feet MLLW.
- Improving access to Massport's Medford Street Terminal on the Mystic River for lesser draft dry bulk and break-bulk carriers. This small area of the existing 35-foot lane of the lower Mystic River Channel accessing the terminal would be deepened to -40 feet MLLW. Massport has already cleared the site and deepened the berth to -40 feet MLLW
- Improving access to the Chelsea River primarily to its petroleum terminals by deepening the existing -38-foot channel to -40 feet MLLW with widening of the channel in the bends which are located on the south side of the channel between the two bridges

For the recommended improvements, approximately 10 to 11 million cubic yards (cy) of clays, sands, and tills, all parent materials largely of glacial origin, will be dredged from the harbor bottom. In addition, up to about one million cy of rock could be removed from the harbor, some of which may require blasting. In association with this improvement work, about 150,000 cy of material would be removed to deepen some terminal berths, and about 500,000 cy of material would be removed for maintenance of the improved and adjacent Federal channels. All materials associated with the improvement project have been tested by the Corps and found suitable for ocean disposal at the Massachusetts Bay Disposal Site (MBDS) which is located about 18 miles seaward of the harbor. The project would take approximately three years to construct under contract to the Corps and cost-shared by Massport. The unconsolidated materials may be used to cap the former industrial waste site (IWS) in Massachusetts Bay in response to a request from U.S. Environmental Protection Agency (EPA). The rock may also be used by others to create reef habitat or shoreline restoration projects in Massachusetts Bay.

Without channel deepening, the containerships and bulk carriers currently using Boston Harbor will continue to experience tidal delays and many vessels will continue to be light loaded or depart Conley Terminal without loading/unloading all of their cargo to ensure that they do not miss the tidal window. In some cases, vessels that would experience a tidal delay in Boston, would bypass Boston all together so as not to jeopardize their New York Harbor arrival schedule. As carriers add larger vessels to the services that currently include Boston, they may be forced to eliminate Boston from their rotation. Also, a large part of New England cargo will continue to be shipped in or out of the Port of New York/New Jersey (PONYNJ), increasing total transportation costs. Recent trends show cargo being shifted from the PONYNJ to Boston Harbor. This shift is due to the lower landside transportation costs for cargo shipped directly into Boston Harbor. However, the increased shift in cargo from the PONYNJ to the Port of Boston Harbor is expected to cease once the carrying capacity of the ships has been maximized with the current 40-foot deep maintenance dredging.

MEPA History

As stated above, the project is undergoing MEPA review and requires the preparation of an EIR pursuant to Section 11.03 (a)(I)(a) because it requires a state permit and will alter more than ten acres of wetlands. The project requires a 401 Water Quality Certification from the Department of Environmental Protection (DEP) and it may require an 8(m) permit from the Massachusetts Water Resources Authority (MWRA). It requires an Order of Conditions from the Boston, Chelsea and Revere Conservation Commissions. Also, it will require Federal Consistency Review by Coastal Zone Management (CZM).

An ENF for the project was noticed in the *Environmental Monitor* on 8 February 2003. A Secretary's Certificate requiring preparation of an Environmental Impact Report was issued on 10 March 2003. The project also requires review under the National Environmental Policy Act (NEPA). Massport, serving as state sponsor for this federal project, requested that the MEPA/NEPA review processes be coordinated. Accordingly, the Corps and Massport submitted a joint Draft SEIS/EIR review document that was noticed in the *Environmental Monitor* on 23 April 2008 and was followed by a coordinated comment period. Although the Draft SEIS/EIR addresses both the federal and state scopes, the Secretary's Certificate on that Draft EIR (13 June 2008) contained a determination of adequacy only for those portions of the document required in the MEPA scope.

A joint Final SEIS/EIR was published on April 30, 2013, and the Secretary issued a finding ([DATE] that the document on this project adequately and properly complies with MEPA and its implementing regulations and that the proponents may proceed to the final design and permitting phases of the project.

Alternatives Considered

The objective of the *Deep Draft Project* study is to develop an optimal plan for effectively and efficiently accommodating existing and likely future deep-draft vessel traffic in the Port of Boston. The optimal plan for Federal participation must be consistent with the Corps National Economic Development (NED) perspective as set forth in the Corps Principles and Guidelines and must also account for the Regional Economic Development (RED) perspective. Plans must also account for Other Social Effects (OSE), be acceptable from the perspective of Environmental Quality (EQ), and be in concert with the Corps of Engineers Chief of Engineers' Environmental Operating Principles. Plans developed for analysis must be formulated to be complete, effective, efficient and acceptable, and to reasonably maximize net benefits.

Alternatives were evaluated based on the extent to which they met one or more of the following planning objectives:

- contribute to National Economic Development by minimizing the cost of transporting cargo to and from New England in an environmentally acceptable and sustainable manner;
- reduce current and expected future tidal delays at Boston Harbor;
- reduced current and expected future light loading requirements for vessels calling at Boston Harbor;
- reduce current lightering requirements and potential future increases in lightering for petroleum tank ships calling at Boston Harbor;
- reduce current and expected future turning and maneuvering access problems in Boston Harbor;
- maximize the beneficial use of dredged material for habitat creation and other purposes;
- consider all the previously identified opportunities in the formulation and evaluation of alternative plans, while achieving the above-listed objectives.

The National Environmental Policy Act (NEPA) and MEPA scopes also require a discussion of project alternatives. The following sections provide an overview of alternatives to the proposed project including the "No Action" Alternative, non-structural alternatives and alternative structural/navigation channel depths. Since this is a Supplemental EIS/EIR, the preferred design is evaluated in the context of disposal alternatives addressed in the BHNIP EIR/S (EOEA # 8695). Options for beneficial use of dredged materials are also considered. A detailed evaluation of alternatives is presented in section 2.0 of the Final SEIS/EIR [DATE, 2013].

No Action Alternative

Under the No Action Alternative, the proposed project would not be constructed and the benefits and impacts associated with the proposed project would not occur.

Non-Structural Alternatives

Non-structural alternatives for achieving the planning objectives for this project, in whole or in part, were examined. These alternatives do not involve dredging to improve the Port and fall into three broad categories:

- measures that allow for greater unit-loading of vessels without deepening;
- alternative sites for cargo transfer (other terminals or ports);
- alternative means of cargo transport.

Alternative Structural/Navigation Channel Depths

A range of alternative dredging scenarios were evaluated for the following project elements:

- Entrance and Main Ship Channel Deepening
- Reserved Channel and Turning Area
- President Roads Anchorage Deepening Plans
- Massport Marine Terminal (MMT) - Main Ship Channel Deepening Extension
- Mystic River Channel Modification
- Chelsea River Channel Deepening

These alternative dredging scenarios, in addition to alternative dredging methods, are described in detail in the joint Final SEIS/EIR [DATE, 2013].

Disposal Site Alternatives

Massachusetts Bay Disposal Site (MBDS)

The BHDDNIP will result in the removal of between 10 and 11 million cubic yards of glacial parent material, mainly Boston blue clay and mixed tills with compacted sands, gravel and cobble. This material has been determined uncontaminated and suitable for unconfined open water disposal. As with the BHNIP, due to the large quantity of parent material, mostly Boston blue clay, to be dredged during the BHDDNIP, and the limited alternatives available for disposal, it was determined that the most practicable and environmentally acceptable alternative is to dispose of the material at the Massachusetts Bay Disposal Site (MBDS). Approximately one million cy of rock could also be removed from the harbor. The base plan for disposal of the rock is also the MBDS.

In addition to addressing the dredged material disposal needs for the BHDDNIP, disposition of dredged material from potential concurrent maintenance projects (e.g., the 30-foot Broad Sound South Entrance Channel, the 35-foot northern lane of the Broad Sound North Entrance Channel, etc.) was considered. Maintenance materials from these project areas (estimated 500,000 cy) would need to be tested during the design phase of the improvement project, and suitability determinations made for their disposal. At this time, given the suitable determinations issued for maintenance of adjacent areas, and the location of these project features in the Outer Harbor, it is assumed that the anchorage area and entrance channel materials would be found suitable for ocean disposal and would be disposed at the Massachusetts Bay Disposal Site.

Confined Aquatic Disposal Cells

Unsuitable material would be disposed into a previously approved Confined Aquatic Disposal (CAD) cell.

At this time there is no expected need for creation of additional confined aquatic disposal (CAD) cells in Boston Harbor for this improvement dredging project. However, by the time the project is finally authorized by Congress and approved and funded for construction, some minor maintenance dredging of adjacent channel areas not maintained in the operations conducted between 1998 and 2012 may be found necessary. If so, construction of one or more smaller CAD cells from the population of previously approved but unconstructed sites may be required to properly dispose of that material. That will be an action separate and distinct from the Deep Draft Project covered by this SEIS/EIR.

Additionally, with the recent Chelsea Street Bridge replacement and channel widening, approximately 120,000 cy of material would be removed to deepen the newly widened section of the Chelsea River navigation channel. Some or all of the material would be disposed into the previously constructed CAD cell C12, in the permitted IHMDP CAD cells, or the Main Ship Channel CAD cell if allowed to remain uncapped.

Industrial Waste Site (IWS)

If found to be practicable, all or a portion of the parent material could potentially be used as cover to cap and isolate the barrel field identified by the EPA just north of the MBDS from biological resources and human interaction. The use of this site for disposal will be dependent on a number of factors and ultimately on the approval of the EPA to allow material placement in an area outside of the current designated MBDS. EPA supports investigations to use project generated material to cap the IWS.

Habitat Enhancement Site

During the proposed improvement dredging, rock ledge will be removed from the channels. This material may be used to enhance bottom habitat in the nearshore area of Massachusetts Bay. The two potential habitat enhancement sites selected for further evaluation based on depth, biological indices, and distance are Broad Sound and Massachusetts Bay. Future efforts may include additional field work to determine the suitability of the site for rock reef species recruitment. During the design phase, this proposal will be further examined in cooperation with the Commonwealth and the NMFS to further evaluate the two candidate sites identified by the Corps screening process, and develop a plan for placing the materials on the ocean floor. Monitoring of these habitat creation sites for several years after disposal would be necessary to determine rates of colonization important for future consideration of this beneficial use option for other projects.

Beneficial Use Alternatives

As previously described, the Federal NED Plan identified for this project would involve the placement of all of the dredged material and rock at the Massachusetts Bay Disposal Site (MBDS). However, it is the policy of the U.S. Army Corps of Engineers to use dredged material, where practicable, for beneficial use. Beneficial use opportunities have been identified and will be examined further in the detailed design phase of the project, if the State and the EPA express an interest in pursuing those options. A summary of these beneficial use options is provided below.

Parent Material

Suggested beneficial uses for the parent material include cap material for confined aquatic dredged material disposal sites or contaminated aquatic sites, creation of subtidal or intertidal habitat, construction uses, or for use in a landfill as a liner or as daily or final cap for landfill closures. As described above, the use of all or a portion of the unconsolidated material could also be used to cap debris at the former Industrial Waste Site (IWS) located in Massachusetts Bay.

Rock and Cobble

Several beneficial use options were evaluated for the rock that will be removed from the navigation channels. As described above, one option is to use the rock to enhance bottom habitat, increasing biological diversity in an area with limited hard bottom material and providing habitat for lobsters, reef finfish, and encrusting organisms. Two potential habitat enhancement sites, Broad Sound and Massachusetts Bay, have been identified for further evaluation. Other potential beneficial uses for the rock will also be explored, including shoreline restoration projects, and upland construction projects.

Silt

No known beneficial use options for silty material have been identified at this time.

Summary of Project Impacts

Chapter Four of this Final SEIS/EIR provides a thorough description of the primary, secondary and cumulative impacts of the proposed project and the specific mitigation measures provided to minimize the impacts. The following subsections discuss each of the major impacts identified in the FSEIS/EIR and the applicable mitigation proposed. Table xx summarizes the specific project impacts and mitigation measures.

Generally, the primary construction impact of dredging in Boston Harbor is attributable to suspended plumes which result from both dredging and disposal operations. During dredging, a plume can be created containing elevated levels of suspended sediments and associated contaminants. Sediments temporarily suspended during dredging and disposal can affect aesthetics, light penetration, feeding by benthic organisms and fish, and, at very high levels, can destroy or injure fish and benthic organisms. Since the Deep Draft project will primarily involve dredging of Boston blue clay and glacial till material, significant turbidity plumes and associated physical, chemical and biological impacts are not anticipated for the proposed project.

Dredging is also not expected to have a significant impact to movement or spawning habitat of fish populations. Impacts to benthic organisms related to habitat disruption are expected to be temporary, with recolonization anticipated in a relatively short period of time. Temporary impacts on regional air quality may occur during dredging due to an increase of regional air emissions from construction equipment. As a result of reduced regional trucking, significant air quality benefits would be expected from project implementation. Temporary socioeconomic impacts may also occur, due to displacement of lobstermen during dredging activities. Positive socioeconomic impacts world result from the continued growth nof marine shipping activity in Boston and the region and by jobs created during construction.

Potential long-term or permanent impacts could include potential fish kills and damage to local invertebrate populations and marine mammals during blasting. Marine mammals and other threatened and endangered (T&E) species could also be injured or killed by ship strikes.

All temporary, short and long term impacts have been fully evaluated and appropriate mitigation measures identified. Mitigation measures are presented in detail in this Final EIS/EIR and are summarized below.

Mitigation Measures

A range of mitigation measures have been identified to offset potential construction impacts; these measures will be included in the design of the Deep Draft Project. Best management practices will be utilized to reduce or eliminate impacts from dredging, blasting, and disposal of dredged material on air quality, natural resources, as well as social impacts. In particular, mitigation will be provided for:

- any projected exceedances of air quality thresholds,
- identifiable silty shoal material,
- blasting impacts,
- potential barge collisions with whales (in particular right whales), and
- notification to lobstermen in Boston Harbor of dredge movements.

Additional details are provided below. The plan does not, however, include mitigation for temporary impacts such as the temporary loss of benthic habitat, or temporary displacement of lobsters. No impacts to vegetated wetlands or the littoral zone are expected. Additional mitigation may be required based on the results of the investigations conducted in the Design Phase of the project. Supplemental information on these investigations may be found in Final SEIS/EIR Section 6.4 and in Appendix A Response to General Topics.

Mitigation of Air Quality Threshold Exceedances

It was originally anticipated that two to three large mechanical dredges (bucket or clamshell) would be employed on the job around the clock and year-round for the period of construction. At the conclusion of the air quality analysis it was determined that use of a third dredge would increase annual emissions beyond the level that could be reasonably addressed through biannual construction shutdowns. Accordingly, the final plan is based on two dredges working 24 hours per day, 7 days per week except during the air quality shutdown periods which will occur every other winter as described in the Final SEIS/EIR air quality section. In addition, the construction equipment would use the latest efficient engines with emission controls to further reduce air emissions. If needed, the purchase of emission credits is also being investigated as mitigation for construction air impacts. A determination will be made as to the viability of emission credits for this project during the design phase.

Mitigation of Water Quality Impacts

As noted, the majority of the dredged material associated with the Deep Draft project is Boston blue clay, glacial till material, and rock. In late 2012, Boston Harbor's Federal channels had completed a major maintenance cycle. The areas maintained include all the areas now under consideration in this improvement project for deepening. However by 2014, the earliest improvement dredging is projected to begin, some silty shoal material may redeposit in the maintenance horizon overlying the parent material to be removed by the improvement project. The cores taken during the subsurface characterization program during final design will determine if any significant shoal material remains in the improvement areas. If areas of shoal material are identified that can be removed separately (thickness of greater than two feet), then a closed bucket will be used for the silty shoal material to reduce turbidity impacts and no scow overflow will be allowed. This will minimize potential impacts to finfish or shellfish and their habitat.

Mitigation of Blasting Impacts

Mitigation procedures were modified based lessons learned from four fish mortality events observed and recorded during 14 underwater blasting events in Boston Harbor during the Corps ledge pinnacle removal maintenance project in the late fall of 2007. These fish kills occurred despite following procedures that have been successfully employed for underwater blasting for prior projects in Boston Harbor and at other locations. Methods employed during these prior projects to reduce the potential for fish kills involved the use of a side scan sonar to detect and avoid blasting during times when passing fish were present in the immediate project area, a fish startle system to deter fish from entering the blast area, and a fish observer to oversee and determine the appropriate blasting times. In addition, blast delays and stemming (filling the borehole with rock) are both methods that were employed to reduce the shock waves. A hydrophone was utilized in 2012 to collect sound pressure (waves) in order to determine a safety zone for protected species. New procedures implemented for the 2012 rock removal project were successful in eliminating fish kills during those blasting event. The 2012 blasting techniques and procedures will the form the basis for all future Boston Harbor federal blasting programs.

Mitigation of Socioeconomic Impacts

Mitigation procedures implemented to minimize socioeconomic impacts include notification to lobstermen prior to drilling, blasting and dredging operations; and use of short tow lines by barge and scow to minimize dragging which can damage lobster pots that are in the project area.

Findings

Massport finds that, with implementation of the operational mitigation measures described, all practicable means and measures will be taken to avoid or minimize adverse impacts to the environment relative to Massport actions. It is anticipated that appropriate conditions will be included in environmental permits to be issued by the DEP to ensure implementation of said measures

Specific Project Impacts and Mitigation Measures

Resource	Potential Impact	Mitigation Measures	Comments
Air Quality	Slight temporary increase of regional air emissions from construction equipment	Biannual construction shut down periods Energy efficient engines on construction equipment Purchase of air emission credits	Permanent reduction in regional air emissions after construction
Water Quality	Temporary turbidity impacts	Use of closed bucket for removal of silty shoal material	Minimal turbidity impacts associated with dredging of parent material
Fisheries	Potential fish kills from blasting	Use of side scan sonar to detect and avoid blasting during times when passing fish are present in the immediate project area Use of a fish startle system to deter fish from entering the blast area Use of a fish observer to oversee and determine the appropriate blasting times Implementation of blast delays and stemming (filling the borehole with rock) reduce the shock waves Use of a hydrophone to collect sound pressure (waves) in order to determine a safety zone for protected species	No significant impact expected to movement, or spawning habitat
T &E Species	Ship strikes with right whales, marine mammals or sea turtles	Use of marine mammal observers on board scows transmitting MBDS/IWS Dredge contractors required to monitor right whale listening buoys for right whale status in the shipping lanes	
Socioeconomic	Some temporary displacement of lobstermen	Notification to lobstermen prior to drilling, blasting and dredging operations Use of short tow lines by barge and scow to minimize dragging which can damage lobster pots that are in the project area	

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December 12, 2012

Stewart Dalzell, Deputy Director
Environmental Planning and Permitting
Massachusetts Port Authority
One Harborside Drive, Suite 200S
East Boston, MA 02128-2909

Re: Request for Advisory Opinion
EEA #12958 Boston Harbor Deep Draft Navigation Improvement Project

Dear Mr. Dalzell:

I am writing in response to your letter of November 20, 2012 in which you requested an advisory opinion as to whether changes to the above-referenced project require revisions to the Scope of the Final EIR. A Certificate on the Draft Environmental Impact Report (DEIR) was issued on June 13, 2008 and included the Scope of the Final EIR.

According to your letter and attachment (Executive Summary Figure), the project change consists of a one-foot reduction in project depth in the inner harbor from the President Roads Channel and Main Ship Channel to Massport's Conley terminal. Project depth will be reduced from 48 feet to 47 feet at mean lower low water (MLLW). This change was proposed in response to additional economic studies conducted by the U.S. Army Corps of Engineers (ACOE). No other changes are proposed to project elements that were described and analyzed in the DEIR.

Based on the review of the information you presented, I concur that the project changes do not warrant filing of a Notice of Project Change (NPC) or revisions to the Scope for the FEIR. Please contact Deirdre Buckley, MEPA Analyst, at (617) 626-1040 if you have any questions concerning this matter.

Sincerely,

Maeve Vallely-Bartlett
Assistant Secretary

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
251 Causeway Street, Suite 800, Boston, MA 02114-2136
(617) 626-1200 FAX: (617) 626-1240

November 29, 2012

Mr. John R. Kennelly
Chief of Planning
Department of the Army
New England District, Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Re: CZM Federal Consistency Review Boston Harbor Deep Draft Navigation Improvement Project – DEIR/DEIS; Boston.

Dear Mr. Kennelly:

The Massachusetts Office of Coastal Zone Management (CZM) has completed its review of the Draft Environmental Impact Report/Draft Environmental Impact Statement (DEIR/DEIS) for the proposed port improvements in the City of Boston. The project includes improving access to the Conley Terminal for containerships by deepening the harbor's existing 40-foot channels, turning basin, and anchorage to a depth of -47 feet MLLW, with an additional three feet of depth in the Broad Sound North Entrance Channel (up to -50 feet MLLW). The Massachusetts Port Authority (MassPort) would also deepen the berths in the Conley Terminal to at least -50 feet MLLW. The 40-foot lane of the Main Ship Channel above the Reserved Channel and below the Ted Williams Tunnel would be deepened to -45 feet MLLW, access to MassPort's Medford Street Terminal on the Mystic River would be improved by deepening to -40 feet MLLW, and the existing -38 foot channel in the Chelsea River would be deepened to -40 feet MLLW.

Based upon our review of applicable information, we concur with your certification and find that the activity's effects on resources and uses in Massachusetts coastal zone as proposed in the DEIR/DEIS are consistent with the CZM enforceable program policies. We look forward to reviewing the Final Feasibility Report and the joint Final Supplemental Environmental Impact Statement/Final Environmental Impact Report for consistency with CZM's enforceable program policies, when released in 2013.

If the above-referenced project is modified in any manner, including any changes resulting from permit, license or certification revisions, including those ensuing from an appeal, or the project is noted to be having effects on coastal resources or uses that are different than originally proposed, it is incumbent upon the proponent to notify CZM, submit an explanation of the nature of the change pursuant to 15 CFR 930, and submit any modified state permits, licenses, or certifications. CZM will use this information to determine if further federal consistency review is required.

Thank you for your cooperation with CZM.

Sincerely,

Bruce K. Carlisle
Director

BKC/rlb/vg
CZM# 5376

The COMMONWEALTH OF MASSACHUSETTS
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November 27, 2012

John R. Kennelly
Chief of Planning
New England District
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RE: *Boston Harbor, Massachusetts Navigation Improvement Project – Update of the Final Feasibility Report and Final Supplemental Environmental Impact Statement/Final Environmental Impact Report*

Dear Mr. Kennelly,

The staff of the Massachusetts Board of Underwater Archaeological Resources has completed its review of your letter of 11 October 2012 and attached chart regarding the final FR and FSIES/FEIR reports for the above referenced report. We offer the following comments.

The Board provided comments on the draft version of the above referenced report in its letter of 2 June 2008. Based on the information provided in your recent letter, the Board's original comments remain appropriate and applicable to the updated plan.

The Board notes the updated plan specifically calls for deepening access to the Chelsea River. This area is considered archaeological sensitive, particularly in relation to the 1775 Battle of Chelsea Creek and the loss of HMS *Diana*. The recommendation that a remote sensing archaeological survey should be conducted for the areas of potential affect in the Mystic River and Chelsea River Channels remains applicable. The Board looks forward to working with the Corps and its consultants in developing a successful surveying strategy for these areas.

Should you have any questions regarding this letter, please do not hesitate to contact me at the address above, by telephone at (617) 626-1141 or by email at victor.mastone@state.ma.us.

Sincerely,

Victor T. Mastone
Director

Cc: Brona Simon, MHC
Marc Paiva, USACE
Bob Boeri, MCZM
Stewart Dalzell, Massport

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November 9, 2012

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Concord, Massachusetts 01742-2751

Re: Boston Harbor Deep Draft Navigational Improvement Project
EOEEA #12958
Feasibility Report and Supplemental Environmental Impact Report

Dear Mr. Kennelly:

The Massachusetts Water Resources Authority (MWRA) appreciates your recent letter requesting confirmation that our previous comments on the above mentioned project are still valid and remain the same. MWRA reiterates our comments submitted on the Environmental Notification Form dated February 28, 2003 and on the Feasibility Report and Supplemental Environmental Impact Report dated June 2, 2008. MWRA's concerns continue to focus on the need to protect MWRA's infrastructure in two locations within the project area:

- Reserve Channel: where NSTAR's four-mile 115 Kv Submarine Cross Harbor Cable runs the entire length beneath the channel and continues across the Harbor to Deer Island.
- Chelsea Creek: where MWRA has an active 36-inch diameter water main that crosses the Creek supplying East Boston and Logan International Airport.

<u>Reserved Channel: NSTAR Cable</u>

NSTAR's Cross Harbor Cable originates at the K Street Substation in South Boston and services the Deer Island Treatment Plant that serves over 2.5 million people in the metropolitan Boston area. The proposed dredging plan now calls to deepen the harbor's main channels and the lower portion of the Reserved Channel at the Conley Terminal from their existing - 40 foot depth at mean lower low water (MLLW) to a depth of - 47 feet MLLW. In addition to this - 47 foot dredging level, standard procedures require adding an additional two feet (for over-dredge) and in this case, given the presence of ledge, an additional two feet must be factored into the final dredge depth. As a result of these standard dredging procedures, the actual proposed depth of dredge in the Reserve Channel is - 51 MLLW. Most recent underwater surveys have revealed that NSTAR's cable at the highest point is - 52.2, which places the cable at approximately 1.2 feet below the proposed dredging depth.

As MWRA has said in the past, MWRA's primary concern is that any blasting and dredging as part of this proposal near the cable in the Reserved Channel cannot help but pose a direct threat of damage to the cable which would result in the long-term loss of a vital energy link to its Deer Island facility and, in the process, cause a release of insulating oil in the cable to the waters of Boston Harbor, the same waters which have seen dramatic improvement in quality precisely because of the contributions of that wastewater treatment facility.

The disruption of this primary source of power to the treatment plant servicing over 43 cities and towns in metropolitan Boston would be catastrophic for MWRA over the lengthy period which would be required to replace that cable. It should be noted that even in the short term, any disruption in the use of the cable would require that MWRA depend upon and use its own back-up generating capability, which given today's fuel costs, could result in millions of dollars in annual additional expenditures charged to MWRA's ratepayers, whose municipal budgets are already substantially over-burdened. Additionally, should MWRA's sole source of back-up power fail for any reason, the environmental impacts would be disastrous.

MWRA's National Pollutant Discharge Elimination System (NPDES) Permit, issued by the U.S. EPA and the Massachusetts Department of Environmental Protection, authorizing the discharge of wastewater from the Deer Island Treatment Plant requires two separate power sources to operate MWRA's wastewater treatment and pumping facilities. Any disruption or damage to the capable would eliminate one of MWRA's two existing power sources (the cross harbor cable and the on-island power plant) thereby violating MWRA's permit condition.

For these reasons, it is extremely important that the ACOE and Massport be satisfied that any plans which NSTAR may have to protect or to relocate the cable be sufficient to ensure its integrity. To date, NSTAR has not shared its plans with MWRA. MWRA remains very concerned about the protection of the cable which is a vital and non-expendable item of infrastructure upon which MWRA relies heavily.

Chelsea River: MWRA Section 38 Water Main Crossing

MWRA understands that some dredging has already occurred in Chelsea Creek as part of the Department of Transportation's (DOT) recently completed Chelsea Street Bridge project. MWRA staff worked closely with DOT staff during that project. Now that the Bridge is complete, the proposal calls for further dredging in the channel to a depth of - 40, which is actually - 42 to accommodate a two foot over-dredge. It appears that the proposed depth of - 42 will not impact MWRA's Section 38, a 36-inch water main crossing under the Chelsea River because Section 38 is located at elevation - 45 (top of pipe).

It appears that the proposed dredging width of 175 feet will also not impact the existing water main. The 36- inch main at its - 45 foot depth has a minimum perpendicular width across Chelsea Creek of 195 feet. Therefore there is sufficient "length" of 10 feet on either side of the pipe.

Any future dredging and/or blasting in the Reserve Channel or the Chelsea Creek area should be carefully coordinated with MWRA through the 8 (m) permitting process. The Proponents should contact Mr. Ralph Francesconi at (617) 305-5827 within MWRA's Water Field Operations Group.

Please contact me at (617) 788-1165 if you have questions or need additional information. Thank you for the opportunity to comment.

Sincerely,

Marianne Connolly

Marianne Connolly
Sr. Program Manager, Regulatory Compliance

cc: Mr. Frederick Laskey, MWRA Executive Director
Michael Hornbrook, MWRA COO
Steven Remsberg, MWRA, General Counsel
Kevin McCluskey, MWRA, Dir. Public Affairs
Mike McCarthy, Work Coordination Center Mgr, MWRA
Ralph Francesconi, MWRA Water Field Operations Permitting
Michael Keegan, Project Mgr., US Army Corps of Engineers
Deb Hadden, Massport, Acting Port Director, Massport
Stewart Dalzell, Massport, Deputy Director, Env. Planning & Permitting

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THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
251 Causeway Street, Suite 800, Boston, MA 02114-2136
(617) 626-1200 FAX: (617) 626-1240

October 24, 2012

John Kennelly
Chief, Planning Branch
New England Division
U.S. Army Corps of Engineers
696 Virginia Road
Concord, MA 01742

Mr. Kennelly,

This morning, the Corps and CZM participated in a conference call regarding the Boston Harbor Deep Draft Navigational Improvement Project. As you know, CZM is in the process of initiating a federal consistency review of the DEIR/DEIS for the project, which was released in 2008. CZM participated in the review of the project as part of the Massachusetts Environmental Policy Act review. At that time, CZM indicated our support for the project and also provided comments on several issues, including the continuation of the Technical Working Group/Technical Advisory Committee, documentation of outer and lower harbor resources (including a pre- and post-blasting/dredging monitoring program), the development of a comprehensive blast plan, and the evaluation of the beneficial reuse of rock material for shore protection and upland use.

In the letter prepared by the Corps on October 16, 2012 in response to these comments, a commitment was made to continue the Technical Working Group/Technical Advisory Committee, to conduct additional resource surveys of benthic and shellfish communities, develop a sequencing plan for the project, including a comprehensive blast plan, and develop a pre- and post construction monitoring program. CZM is requesting additional information on the commitment/planning by the Corps to pursue viable options regarding alternatives for beneficial reuse beyond the creation of rock reefs, including both shore protection and upland use. Several options were discussed during both the Massachusetts dredging Team meeting held on October 19, 2012 and today's conference call, including, but not limited to, use by the Department of Conservation and Recreation for the maintenance of shore protection structures, potential use by MassPort, and use by private aggregate companies.

CZM is preparing to initiate the federal consistency review, and once the additional information has been provided, a scheduling letter will be sent to the Corps. As always, we look forward to working with the Corps on enhancing the capabilities of the port of Boston.

Regards,

Robert L. Boeri

Bob Boeri
Project Review/Dredging Coordinator
Massachusetts Office of Coastal Zone Management

The Commonwealth of Massachusetts
William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

October 18, 2012

John R. Kennelly
Chief of Planning
New England District
US Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Attn. Marc Paiva

RE: Boston Harbor Deep Draft Navigation Improvements Project. MHC #RC.323.

Dear Mr. Kennelly:

Thank you for your letter dated October 11, 2012, received by the Massachusetts Historical Commission (MHC) on October 17, 2012. Staff of the MHC have reviewed the information regarding the change in scope for the project referenced above, and the MHC's files.

Review of the MHC's files indicates that the MHC commented on May 5, 2008, in response to the Corps letter of April 10, 2008. A copy of the MHC's comments are enclosed.

The Corps, in a letter to Massachusetts Board of Underwater Archaeological Resources, dated October 4, 2007, proposed to conduct additional identification surveys for historic properties that may be affected by the project.

In regards to the project change, the MHC advises that the Corps should review the results of previous identification efforts for historic properties in the area of potential effect, and evaluate the potential of the currently proposed project to affect previously identified historic properties, or properties not yet identified that may be located in project area that have not yet been sufficiently surveyed for historic properties.

The MHC looks forward to review of scopes for any additional proposed archaeological identification and evaluation efforts, and the Corps findings and determinations in accordance with 36 CFR 800.

These comments are provided to assist in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800). Should you have any questions, please contact me.

Sincerely,

Edward L. Bell
Deputy State Historic Preservation Officer
Massachusetts Historical Commission

Enclosure (MHC 5/5/2008)

xc w/enclosure:
Stewart Dalzell, Massport
Victor T. Mastone, BUAR
Joe Bagley, Boston City Archaeologist

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PART 2

SECRETARY'S CERTIFICATION OF THE DRAFT FEASIBILITY REPORT AND SEIS/EIR

MASSACHUSETTS EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS

WITH ATTACHMENTS

The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
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June 13, 2008

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS ON THE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT/ DRAFT ENVIRONMENTAL IMPACT REPORT

PROJECT NAME	: Boston Harbor Deep Draft Navigation Improvement Project (BHDDNIP)
PROJECT MUNICIPALITY	: Boston, Chelsea and Revere
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 12958
PROJECT PROPONENT	: Massport
DATE NOTICED IN MONITOR	: April 23, 2008

Pursuant to the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and Section 11.08 of the MEPA regulations (301 CMR 11.00), I hereby determine that the Draft Supplemental Environmental Impact Statement(SEIS)/Draft Environmental Impact Report (EIR) submitted on this project **adequately and properly complies** with MEPA and its implementing regulations. The proponent may prepare and submit the Final EIR for review.

The Boston Harbor Deep Draft Navigation Improvement Project (BHDDNIP) proposes navigation channel improvements within Boston Harbor to increase the commercial viability of this working port. The Port of Boston is the largest port in New England for bulk and container cargoes and an important economic engine within the local and regional economy. The Massachusetts Port Authority (Massport) indicates that the Port handles approximately 22 million tons of cargo worth approximately $2.4 billion annually to the regional economy. Its growth is limited due to existing channel depths. This $307 million dollar project will increase the ability of the port to attract larger, deeper draft vessels and thus ensure its continued use by the shipping industry. Comments from resource agencies reflect support for the selection of the

Preferred Alternative while emphasizing the significant amount of work required in the Final EIR to ensure that improvements are planned and implemented with adequate consideration and protection of other interests in the harbor, including fisheries and recreation.

As with the Boston Harbor Navigation Improvement and Berth Dredging Project (BHNIP) (#8695), the ACOE has formed a Technical Working Group (TWG) consisting of resource agencies, environmental advocates, scientists and others, to help advise the proponent through the design, permitting and construction phases of the project. The TWG will develop conditions for the Water Quality Certificate, evaluate disposal alternatives and modify construction and monitoring techniques as necessary to ensure adequate environmental protection.

Project Description

Massport is the local sponsor for this project that will be conducted by the US Army Corps of Engineers (ACOE). The purpose of the project is to meet shipping industry needs by providing access for deeper draft bulk and container vessels to enter the harbor without experiencing tidal delays. The primary goal of the project is to provide deeper access to the Massport Conley Container Terminal; however, additional port improvements in the Main Ship Channel, the Mystic River and Chelsea River are also under consideration. Based on the draft feasibility study included with the Draft SEIS/EIR, the Preferred Alternative includes the following elements:

- deepen the Broad Sound North Entrance Channel to -50 feet mean lower low water (MLLW);
- deepen the President Roads Anchorage and Main Ship Channel to -48 feet MLLW;
- deepen the Main Channel 2,600 feet above the Turning Basin to the Massport Marine Terminal to -45 feet MLLW;
- widen the Main Ship Channel to 900 feet between President Roads Anchorage and Castle Island;
- widen the Main Ship Channel to 800 feet above Castle Island to the Reserved Channel;
- widen the channel bends at Spectacle Island and Castle Island to 1,050 feet;
- widen the Reserved Channel Turning Area to a minimum of 1,500 feet;
- deepen the Mystic River Channel to the Medford Street Terminal to -40 feet MLLW;
- deepen the Chelsea River Channel and Turning Basin to -40 feet MLLW;[1]
- widen the Chelsea River Channel at the bridge approaches, the bend between the two bridges and the area through the Chelsea Street bridge opening;
- deepen the two existing deep berths at Conley Terminal to -42 MLLW to -45 MLLW to allow vessels to employ tidal assistance to enter the Terminal; and
- deepen the Massport Marine Terminal to -45 feet MLLW.

[1] Deepening project depends upon replacement of the Chelsea Street Bridge and removal and relocation of the Keyspan gas siphon.

In addition, channel and anchorage areas not maintained in the past dredging projects may be dredged during the improvement dredging to provide alternative routes for shallow-draft traffic. Areas under consideration include the Broad Sound South Entrance Channel, the 35-foot northern lane of the Broad Sound North Entrance Channel, the Nubble Channel, and the 35-foot West Anchorage at Presidents Road. Approximately 264,000 cubic yards (cy) of maintenance material would be dredged and disposed.

The project will alter approximately 22 acres of previously undisturbed Land Under the Ocean and it could convert approximately 1,100 to 1,300 acres of soft-bottom to hard substrate. The project will take two years to design and from three to five years to complete, with construction estimated to begin in 2011. The ACOE will conduct most of the actual dredging and related mitigation while Massport may implement discrete elements of it. Channel deepening associated with the Preferred Alternative will require blasting and use of a mechanical bucket dredge. It will require removal and disposal of approximately 1,032,000 cy of rock and 11.7 million cy of dredged spoils.[2] Dredged material will consist of glacial parent material and rock ledge that is suitable for disposal at the Massachusetts Bay Disposal Site (MBDS). The glacial materials are composed primarily of Boston blue clay and mixed tills with compacted sands, gravel and cobble. Any silty material not suitable for disposal at the MBDS site will be disposed of in one of the previously permitted Confined Aquatic Disposal (CAD) Cells developed as part of the Boston Harbor Navigation Improvement Project (BHNIP). Although the material may be disposed at the MBDS, the proponent has analyzed and proposed beneficial uses. ACOE proposes to create an extensive artificial reef with the rock material and to cap the EPA Industrial Waste Site (IWS), located adjacent to the MBDS, with the parent material.

Permits and Jurisdiction

The project is undergoing MEPA review and requires the preparation of an EIR pursuant to Section 11.03 (a)(1)(a) because it requires a state permit and will alter more than ten acres of wetlands. The project requires a 401 Water Quality Certification from the Department of Environmental Protection (DEP) and it may require an 8(m) permit from the Massachusetts Water Resources Authority (MWRA). It requires an Order of Conditions from the Boston, Chelsea and Revere Conservation Commissions. Also, it will require Federal Consistency Review by Coastal Zone Management (CZM).

The project requires review under the National Environmental Policy Act (NEPA). The proponent requested that the MEPA/NEPA review processes be coordinated. Accordingly, the proponent submitted a joint Draft SEIS/EIR review document and coordinated the comment period. Although the Draft SEIS/EIR addresses both the federal and state scopes, I am issuing a determination of adequacy only for those portions of the document required in the state scope.

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[2] This estimate is based on Table 2-2. This estimate assumes a 2-foot overdepth allowance and a 1:3 side slope for ordinary material. It assumes an additional two feet where ledge is encountered and a 1:1 side slope for rock removal.

Because the proponent is a state agency and, under a cost sharing agreement, is responsible for providing a significant percentage of the project costs, MEPA jurisdiction extends to all aspects of the project that may cause significant Damage to the Environment including air quality, water quality, threatened and endangered species, marine habitat, fisheries and historic and archaeological resources.

Review of the Draft EIR

The Draft SEIS/EIR provides a thorough description of the project and all project elements. It provides a description of existing environmental conditions and resources, includes an alternatives analysis, identifies associated environmental impacts and identifies measures to avoid, minimize and mitigate project impacts.

Review of the BHNIP, the Inner Harbor Maintenance Dredging Project (IHMDP) and the Outer Harbor Maintenance Dredging Project (OHMDP)

As required, the Draft SEIS/EIR includes a section on the previous improvement dredging and maintenance dredging projects. The BHNIP included the maintenance and improvement dredging of the main shipping channels and berths within Boston's Inner Harbor. Over 784,850 cubic yards of dredged material deemed unsuitable for open-water disposal was placed within nine Confined Aquatic Disposal (CAD) cells constructed within the dredging footprint of navigation channels. The planning and permitting process for the BHNIP addressed a number of issues that are directly relevant to the design and implementation of this project. The BHNIP, which was completed in late 2002, provided a framework for creating an environmentally acceptable dredging and disposal plan. It furthered understanding of dredging operations and techniques, provided information about baseline conditions within Boston Harbor, and resulted in the development of guidelines for permitting and constructing CAD cells for disposal of contaminated materials. The recommendations included in the EIR, including water quality monitoring methodology, are informed by the experience developed during the BHNIP.

Although the BHNIP, the Inner Harbor Maintenance Project (IHMDP) and the Outer Harbor Maintenance Project (OHMDP) project provide useful framework for decision-making and baseline environmental information, this project differs from previous projects in two significant respects – the scale of the project and the type of material to be dredged. The improvement and maintenance dredging consisted primarily of dredging significant amounts of contaminated silty material for disposal at the MBDS or within CAD cells. These projects required only a relatively small amount of rock removal, the majority of which could be removed with an excavator, compared to this project. The amount of parent material to be dredged for the BHDDNIP is approximately 3 to 6 times greater than the BHNIP. The Draft SEIS/EIR identifies four fish kill events associated with 13 blasting events during the maintenance project. In light of these events, the amount of rock removal and the blasting associated with its removal is a significant concern.

Alternatives Analysis

The Draft SEIS/EIR includes a draft feasibility study and an alternatives analysis that addresses the Port of Boston's current and future role in maritime commerce and identifies potential levels of future vessel traffic and commerce. The analyses explore options for accommodating increased deep draft vessel traffic in Boston Harbor, including No Action, Non-Structural Alternatives, and Structural Alternatives/Navigational Channel Depths and it includes a cost-benefit analysis for the range of alternatives. In addition, it analyzes alternative dredging methods, dredged material disposal alternatives and beneficial use alternatives for dredged material.

Non-Structural Alternatives include measures that allow for greater unit-loading of vessels without deepening (e.g. use of tides, light-loading of vessels, and lightering), alternative sites for cargo transfer and alternative means of cargo transport. The analysis concludes that management measures are already being employed to the extent feasible and are not sufficient to support deeper draft vessels expected to be employed by the shipping industry. It indicates that there are no other ports within New England with sufficient facilities and depths to provide a viable alternative to Boston Harbor. The analysis indicates that alternative means of cargo transport consist of truck transportation of containers which increase the cost of shipping and add traffic to existing highways with associated increases in emissions of air pollutants.

Structural Alternatives examine channel deepening at a range of depths including deepening the Entrance Channel, Main Anchorage and Main Ship Channel from – 40 feet MLLW up to – 50 feet MLLW, the Mystic River Channel from –35 feet MLLW up to – 40 feet MLLW and the Chelsea River Channel from – 38 MLLW up to – 40 feet MLLW. Improvements were examined in one-foot increments. Three segments in the Main Ship Channel were selected for presentation of costs and impacts (Plan A – 45 foot, Plan B – 48 feet and Plan C – 50 feet). Improvements to support bulk cargo terminals and petroleum terminals were also examined and include: Plan D – extend Main Ship Channel above Reserved Channel to the Massport Marine Terminal to a depth of -45 feet MLLW; Plan E – deepen a small area of the Mystic River Channel up to – 40 feet MLLW to access the Massport Medford Street Terminal in Charlestown to divert smaller bulk cargo operations from the Marine Terminal; and Plan F-deepening the entire Chelsea River Channel to -40 feet to benefit the four active petroleum terminals along this waterway.

The Draft SEIS/EIR estimates dredge quantities associated with each alternative which will range from 6.4 to 15.0 million cy of parent material and 450,000 to 1.5 million cy of rock.[3] The Preferred Alternative, which is described in the introduction to this Certificate, is based on providing the highest net economic benefits while meeting the objectives of the ACOE and Massport. The Draft SEIS/EIR indicates that the Preferred Alternative will evolve based on Congressional authorizations, updated shipping trends and economic information and completion of related projects (e.g Chelsea River project is dependent upon replacement of the Chelsea Street Bridge and removal of the Keyspan gas siphon).

[3] This estimate is also based on Table 2-2.

The Draft SEIS/EIR indicates that use of a mechanical dredge is the only feasible dredging method for rock, tills, stiff clays and other glacial deposits. In addition, because low levels of turbidity are associated with dredging of hard pack Boston blue clay, the proponent asserts that water quality standards will be maintained. The Draft SEIS/EIR identified disposal alternatives evaluated during the BHNIP and indicates that MBDS was the only practical alternative for non-contaminated material and CAD cells for disposal of contaminated material. Consistent with the policy of the ACOE to use dredged material, where practicable, for beneficial use, the Draft SEIS/EIR, evaluates several alternatives to disposal at the MBDS including: use of parent material for lining landfills or capping of the EPA IWS and use of rock for creation of an artificial reef, shore protection or construction. The Draft SEIS/EIR asserts that costs and logistical challenges render use of material for lining landfills, shore protection and/or construction purposes infeasible.

The alternatives analysis is adequate for MEPA purposes. Comment letters from state agencies support the Preferred Alternative, acknowledge that the Preferred Alternative may be revised, and agree that the majority of material will be suitable for disposal at the MBDS. Although material is suitable for disposal in the MBDS, most commentors agree that evaluation of beneficial reuse alternatives for rock was not thorough and should be re-assessed prior to the filing of the Final EIR. I understand that CZM is developing an alternative for reuse of rock material by a materials handling company that would provide a beneficial reuse while minimizing project costs associated with transport and disposal of dredged material. In addition, the Final EIR should address whether any of the material would be appropriate for beach nourishment at Winthrop Beach. Although general support is expressed for habitat restoration through creation of an artificial reef, significant concern is expressed with the siting and scale of the proposed reef. If the artificial reef is intended to serve as a major mitigation commitment, the proponent will need to consult closely with state and federal agencies and, in particular, DMF and NMFS, to identify a site and develop a design that meet the project objectives.

Environmental Conditions and Impacts – Marine Resources

The Draft SEIS/EIR includes a section on existing environmental conditions and environmental impacts of dredging and dredged material disposal including water quality issues, biological resources, threatened and endangered species, and historic and archaeological resources. Information on benthic resources was compiled from data collected by ACOE, MWRA and Massport. Information on lobsters, fisheries and marine mammals is based on data collected by DMF, MWRA and from previous dredging projects. The document addresses resources and impacts related to the dredging sites, the MBDS/IWS and the artificial reef sites. In addition, it addresses the secondary impacts of the deepening project including increased ship traffic and an increase in the size of ships entering the harbor. Although the Draft SEIS/EIR generally characterizes impacts as insignificant and/or temporary in nature, it indicates that the dredging project will alter approximately 22 acres of previously undisturbed bottom and may convert more than 1,100 acres of soft-bottom to hard substrate. In addition, the project will follow over ten years of maintenance and improvement dredging in the harbor that were conducted from 1998 – 2002 (BHNIP), 2004 – 2005 (OHMDP) and the current IHMDP that will extend from 2008 to 2009. The Draft EIS/EIR indicates that, cumulatively, these dredging projects will result in temporary and permanent impacts to approximately 3,600 acres (although portions of the projects overlap).

The proponent indicates that it will use dredging protocols developed during the BHNIP to minimize turbidity and migration of dredged sediments during dredging and disposal. Measures used during blasting to minimize impacts to fisheries included an independent fisheries observer, side scan sonar fish finder and fish startle system. The Draft SEIS/EIR identifies four fish kill events associated with 13 blasting events as part of the maintenance project (ledge pinnacle removal) that occurred despite implementation of protective measures. The Draft SEIS/EIR does not provide the "After Action Report" referenced in the ENF or identify revisions to protocols or additional mitigation necessary to avoid and minimize these impacts. Although blasting presents the most significant source of risk for impacts to marine resources, the Draft SEIS/EIR does not include an analysis of the location, timing and methods of proposed blasting and anticipated impacts on marine resources. It does indicate that the project will be sequenced to minimize impacts to fisheries but it does provide a schedule that supports this or indicate what factors will be considered for sequencing. Appendix D of the Draft SEIS/EIR provides a schedule (Table D2-30) that projects blasting for a 15-month period from May of 2011 to August 2012 within the Broad Sound North Entrance Channel. Additional blasting would occur in the Chelsea River in May, 2011, in the Presidents Road Anchorage from August to September of 2012, in the Lower Reserved Channel and Turning Basin from April to August of 2013, in the Main Ship Channel Roads to Reserved Channel from August to October 2013, and in the Main Ship Channel Extension to the Massport Marine Terminal from November to December, 2013. Further, the Draft SEIS/EIR indicates that, development of more detailed data, including more extensive borings to characterize the type and quantities of rock to be removed, will not be conducted until the final design phase.

To assist the permitting agencies in their evaluation of the potential impacts of this project within the context of a growing and active harbor, the Draft SEIS/EIR includes a qualitative cumulative impacts analysis that identifies completed, ongoing and planned projects within Boston Harbor and Massachusetts Bay, including the Hubline Submarine Natural Gas Pipeline project and Everett Extension (EEA #12355) and the use of an offshore borrow site (NOMES I) by the Department of Conservation and Recreation (DCR) as a sand source for the Winthrop Shores Reservation and Restoration Program (EEA #10113). It includes a summary of the project impacts, individually and cumulatively, including the size of the impacted area, the resources impacted by the projects, and the duration of the impacts. In addition, it includes a timeline that shows when the projects are planned to occur in relation to the dredging project. This analysis underscores the amount of activity ongoing and planned within Boston Harbor with the potential to impact up to 18% of Boston Harbor. This analysis demonstrates that the BHDDNIP, HubLine and the the Winthrop Shores Reservation Restoration Program are associated with the vast majority of potential impacts (temporary and permanent).

Comment letters express significant concern with three issues – the timely development of additional data to adequately characterize sediment types and affected resources, development of mitigation to adequately avoid, minimize and mitigate impacts to fisheries, in particular from blasting impacts, and additional consideration of beneficial reuse opportunities. EPA comments indicate that the duration and magnitude of blasting described in the Draft SEIS/EIR is of a scope that has the potential for serious and significant impacts to fish and marine mammals and is the most significant source of risk for impacts to marine resources associated with the project. Comments from DMF and NMFS stress the importance of this ecosystem to fisheries and indicate the grave status of some species within Boston Harbor. DMF identifies the importance of the project site to several species of shellfish and finfish, including lobster (*Homarus americanus*), soft shell clam (*Mya arenaria*), mussels and winter flounder (*Pseudopleuronectes americanus*). In addition, several diadromous species utilize the area including rainbow smelt (*Osmerus mordax*), Atlantic tomcod (*Microgadus tomcod*), white perch (*Morone Americana*), and river herring (*Alosa spp.*). Comments from NMFS also highlight the presence of alewife (*Alosa pseuodoharengus*) and blueback herring (*Alosa aestivalis*). Boston Harbor is classified as Essential Fish Habitat (EFH) for 23 federally managed species including winter flounder and Atlantic cod. DMF has banned fishing for river herring due to population concerns and rainbow smelt is listed as a "species of concern" by NMFS. Commentors indicate that the Final EIS/EIR should include a sequencing plan, blasting plan and pre- and post-monitoring plan to ensure adequate provisions are made to avoid, minimize and mitigate project impacts.

Environmental Impacts – Air Quality

The Draft SEIS/EIR includes an air quality analysis and discusses alternatives for establishing consistency with the federal Clean Air Act (CAA) General Conformity provisions (section 176(c)(1)). MassDEP's role in a general conformity determination under federal regulation is to review and provide comments on conformity determinations. Federal actions must support the goals of the Massachusetts State Implementation Plan (SIP) and be shown not to:

- Cause or contribute to new violations of any national ambient air quality standard (NAAQS) in any area;
- Increase the frequency or severity of any existing violation of any NAAQS or interim emission reductions;
- Delay timely attainment of any NAAQs or interim emission reductions.

The Draft SEIS/EIR includes an air quality analysis for the No Build, Plan A and Plan C. The analysis indicates that emissions associated with both alternatives would exceed the general conformity deminimis thresholds.

The proponent has identifies two approaches to address general conformity. It can structure the project to ensure its emissions are below identified thresholds or it can offset the total emissions of the projects through emission reductions projects or through the purchase of emission reduction credits. The Draft SEIS/EIR indicates that, without a work stoppage, the project will likely be subject to the General Conformity provisions of the CAA. The EIR indicates that sufficient emission reductions credits are available to offset project emissions and that the costs of this alternative are equivalent to those associated with the cost of one mobilization and demobilization of the project.

The EIR identifies two options (Alternatives 1 and 2) to reduce emissions below the general conformity review thresholds. Both alternatives propose the replacement of older, higher emitting equipment with newer and cleaner burning equipment in 2011 and beyond and extend the dredging schedule to reduce annual emissions associated with the project. Alternative 1 would increase the dredging schedule by 6 months and Alternative 2 would increase the dredging project by four years. Extension of the dredging schedule through work stoppages will not reduce actual emissions associated with the project. The use of cleaner burning equipment will provide a relatively small decrease in overall emissions. Nitrogen Oxide (NO_x) emissions associated with these alternatives would remain close to the deminimis level under the general conformity requirements.

Comments from MassDEP indicate that the proponent should explore additional mitigation strategies, including the use of emission reduction credits to offset emissions. MassDEP comments also express support of the use of lower emitting nonroad engines for the project and identify the need to verify how this strategy will be implemented and enforced. In addition, MassDEP notes that if the proponent chooses to delay the project schedule, it should consider targeting dredging operations in the pre-or post-ozone season.

Comments from EPA express concern with the approach to general conformity and, in particular, with the potential impacts to marine resources associated with an extended schedule which would increase the duration of impacts and therefore the recovery period. EPA indicates that the proponent should further consider the use of emission credits and/or offsets and that the approach to general conformity be fully vetted for public review as part of the environmental review document rather than addressed during the final design process. They note that a general conformity analysis requires a public review process and issuance of a final conformity determination prior to the issuance of the Record of Decision (ROD) and, therefore, draft conformity findings should be reviewed prior to the close of the NEPA process.

Impacts to Historic and Archaeological Resources

The Draft SEIS/EIR identifies potential impacts to historic and archaeological resources. It indicates that, based on remote sensing surveys and vibracore investigations, significant cultural resources are unlikely to be encountered in the Main Ship Channel, the extension of the Main Ship Channel above the Turning Basin and in the Mystic River. It indicates that borings and remote sensing surveys should be conducted for the widening of the Chelsea River Channel to assess the presence of cultural resources. The Draft EIS/EIR indicates that the proponent will continue its consultations with the Massachusetts Historical Commission (MHC) and the Massachusetts Board of Underwater Archaeological Resources (BUAR).

Conclusion

Review of the Draft SEIS/EIR, review of comment letters and consultation with state agencies indicate support for the proposed project. Although additional review of alternatives is not warranted, there are significant outstanding issues that must be resolved regarding development of measures to avoid, minimize and mitigate project impacts. These outstanding issues can be addressed in the Final EIR and the proponent may prepare and submit the Final

EIR for review. I expect that the proponent will fully address the issues identified in the Scope below. In particular, I note that failure to adequately characterize resources could lead to requirement of more conservative mitigation measures in state permits.

In the event that the Final EIS does not fully address issues, the comment letter from EPA has noted that a supplemental NEPA process may be necessary to provide to agencies and the public supplemental information during the design phase of the project. I note that the MEPA regulations allow the filing of a Notice of Project Change (NPC) subsequent to the review of the Final EIR that can be used to provide public review of significant changes to the project and/or development of additional information/analysis.

SCOPE

The Final EIR should follow Section 11.07 of the MEPA regulations for outline and content, as modified by this scope. It should include a copy of this Certificate and of each comment received.

<u>Marine Resources</u>

Regulatory Consistency

The Water Quality Certificate, issued by MassDEP, will be the vehicle for establishing enforceable mitigation commitments. Adequate resource characterization and development of mitigation commitments will be necessary for CZM to issue a federal consistency statement. The Final EIR should provide additional information on 401 Water Quality Certification standards and criteria and demonstrate how the project is being designed to ensure consistency with these requirements. MassDEP, as the permitting agency, will incorporate requirements for fisheries protection into the Water Quality Certificate based on consultation with DMF. As noted previously, provision of adequate resource characterization and mitigation developed in response to these findings will balance the need for more conservative mitigation approaches such as strict dredging windows. Best management practices will need to be developed based on available technology.

The ACOE has committed to convening an interagency underwater blasting technical working group with federal and state resource agencies to focus on construction sequencing for several areas of the harbor, constraints on work during certain tidal and weather conditions, operational changes and equipment changes. As noted previously, the Final EIR must provide more information on sequencing including the location, timing and methods of proposed blasting and anticipated impacts on marine resources. The Final EIR should further illustrate how much hard bottom is impacted, how much will be converted to other habitat and how much may be created within the project site. In addition, a pre- and post-monitoring plan must be developed for the project as a whole, including the artificial reef if that remains as a project component.

The Final EIR should identify total impacts (permanent and temporary) to Land Under the Ocean. It should include a timeline and plans that clearly illustrate where and when the BHNIP, IHMDP, OHMDP and the BHDDNIP overlap. It should provide a plan that clearly delineates areas that BHDDNIP will alter that have not been disturbed by the BHNIP, IHMDP and OHMDP. The Final EIR should include maps that clearly delineate resource areas including eelgrass beds and shellfish habitat. In addition, the Final EIR should assess noise impacts associated with the blasting, in particular, for blasting associated with the Mystic River and Chelsea River.

Monitoring Program

Resource agencies identify the need for an environmental monitoring plan to assess the recovery period of impacted areas. The monitoring plan should be included in the Final EIR. Its scope and duration should be developed in consultation with the working group. It should include pre- and post-monitoring, real-time information on the impacts of blasting and reporting protocols. The Final EIR should identify the extent of suspended sediment dispersion resulting from dredge operations and indicate how the plume is modeled and verified.

Resource Characterization

Comments from CZM and DMF indicate that additional information on shellfish, fish, benthic infauna and epifauna, and other species of decapod crustaceans is necessary to adequately evaluate baseline conditions and recovery. The lack of site specific data for the blast area is of particular concern due to potential impacts to relatively stable exposed bedrock seafloor habitat. A minimum of one year of fisheries data should be collected to support the development of a sequencing plan. The total amount of conversion of soft-bottom habitat to hard substrate should be identified and conversion should be identified on project plans.

In addition, CZM notes that the Draft SEIS/EIR identifies the presence of scallops in the outer and lower harbor, with areas of coarser-grain material and encourages the development of additional resource characterization and monitoring to further characterize these resources. DMF notes particular concern with softshell clam habitat that will be impacted by dredging in the Chelsea River, including permanent loss through habitat conversion. The Final EIR should include a clear delineation of the shellfish habitat potentially impacted by dredging and assess the functional loss to other species. The Final EIR should identify measures to avoid, minimize and mitigate impacts to these resources. In addition, the Final EIR should identify any elements of the project that are located within the Cod Conservation Zone.

The proponent should consult with MassDEP, as the permitting agency, DMF and CZM regarding further characterization of resources prior to the filing of the Final EIR.

Sequencing Plan

The sequencing plan should include a plan for sequencing the most disruptive and potentially damaging aspects of the project (e.g. blasting) to avoid sensitive locations during critical times of year. Additional resource characterization, including a minimum of one year of biological surveys to assess fisheries resources and use of habitat, should be completed to support a rational sequencing plan. It should identify the volumes of material that will be dredged in what time periods and it should consider timing of disposal (i.e. dredge contaminated in early phases so that it can be capped with clean material dredged in subsequent phases). The Proponent should consult with DEP, as the permitting agency, and DMF to determine what additional data is necessary to support the sequencing plan and the monitoring plan. As noted previously, the proponent may choose to more fully characterize the resources affected by the project or may be subject to a more conservative management approach including time-of-year restrictions.

The proponent should establish plans for communication with the fishing and lobstering communities regarding construction activities and timing to avoid impacts and conflicts.

Blasting Plan

The blasting plan should be included in Final EIR to understand impacts and potential recovery of the area and plan for modifications that may be necessary as the project proceeds. ACOE has indicated it will provide an "After Action Report" to provide information and determine what lessons can be learned from 2007 fish kills. This report must be included in the Final EIR and will inform development of the blasting plan. The blasting plan should consider avoidance measures such as shifting of channel limits and, where feasible, removal of rock with a large toothed bucket mounted on an excavator. It should consider additional technological approaches, sequencing and time of year restrictions. Technological approaches could include use of additional acoustic fish exclusion devices and consideration of bubble curtains. The proponent should commit to provide an independent third party observer that will consult with the TWG and ensure procedures are followed or modified on a real-time basis.

Threatened and Endangered Species, Marine Mammals

Comments from NMFS indicate that its previous determination that the project is likely to have no adverse affect on marine mammals was based on removal of two to six cy of material and did not identify the need for blasting for rock removal. NMFS comments indicate the need to reinitiate consultation and provide additional information regarding the potential impacts of blasting on marine mammals.

EPA has indicated that ACOE should evaluate the potential for impacts of blasting on the recently installed buoy listening and monitoring system. This system was designed to reduce the likelihood of ships colliding with whales by providing close to real time information regarding the presence of whales in the shipping channel.

<u>Disposal and Reuse of Dredged Materials</u>

The Draft EIS/EIR proposes to use dredged materials to cap the EPA IWS and to create an artificial reef. The Draft EIS/EIR indicates that five sites were evaluated for creation of an artificial reef based on ACOE siting criteria. These were narrowed to two sites - one site in Massachusetts Bay and one site in Broad Sound. The Draft EIS/EIR indicates that, dependent upon the final alternative selected and the reef design, the project would alter 220 to 530 acres of soft bottom habitat.

As noted previously, comment letters indicate the need to re-assess beneficial uses for the rock material. Comments urge the proponent to reconsider upland disposal options as a first priority and creation of the proposed reef as a secondary consideration. The proponent should consult with CZM regarding an upland disposal alternative that is being developed by its staff and address its viability in the Final EIS/EIR.

Comment letters indicate that, based on the information provided in the Draft EIS/EIR, both sites support a diverse and abundant benthic community, include substantial hard bottom habitat and are productive for managed species such as winter flounder and red hake. Comments from DMF indicate that the proponent should use the DMF Artificial Reef Policy for developing site selection and monitoring and consider application of the site selection model used by DMF for creation of the Hub Line cobble reef. If the proponent wants to include an artificial reef alternative in the Final EIR, it should continue consultation with the TWG to develop alternatives that may better meet the identified goal of providing fish habitat. The Final EIR should define more precisely the potential for impacts associated with the project, assess the loss of soft bottom habitat and related impacts and include a monitoring program to document colonization rates and other indicators of habitat creation.

EPA and CZM support use of parent material to cap the IWS in Massachusetts Bay. EPA comments indicate that the capping of the site is an opportunity to further reduce the remaining risk associated with waste barrels that may still exist at the site. The results of the preliminary capping demonstration, which will be conducted as part of the OHMDP, should be reviewed by the TWG and included in the Final EIR.

The Final EIR should address whether any of the material that will be dredged is appropriate for placement on Winthrop Beach for its beach nourishment program (EEA #10113). The proponent should assess the compatibility of material with Winthrop Beach using the additional geotechnical investigations that will be conducted for the BHDDNIP. The proponent should consult with the DCR and the Town of Winthrop regarding this assessment.

Technical Working Group (TWG)

The EIR clearly states the proponent's commitment to ongoing participation in the project by the TWG. I expect the TWG will participate in the development of the Final EIR, as well as final design, to further develop monitoring and mitigation requirements. Close cooperation between the proponent and state and federal agencies during the design phase of the project must be built in to ensure that final plan meets goals of the proponent while avoiding, minimizing and mitigating project impacts. During dredging operations, the TWG should be convened on a regular basis to assess the success of control measures and review project progress.

CZM has suggested the creation of a technical advisory sub-committee, facilitated by an independent, third-party contractor, to manage unforeseen developments as they arise during the construction phase of the project. The contractor would coordinate with the independent fisheries observer during dredging operations to provide a rapid, coordinated response from agency and community representatives. The Final EIR should indicate whether the proponent will incorporate this measure into its management plan.

Air Quality

I urge the proponent to provide a revised approach to conformity within the Final EIR and to consult with and EPA and MassDEP regarding this approach. As noted previously, comment letters, including letters from MassDEP and EPA, indicate that the proponent should explore additional mitigation strategies, including the use of emission reduction credits to offset project related emissions. The Final EIR should identify how use of lower emitting nonroad engines and extension of the dredging schedule will implemented and enforced and should consider targeting dredging operations in the pre-or post-ozone season. In addition, the Final EIR should identify impacts to marine resources associated with an extended schedule. Consistent with EPA's comment that draft conformity findings should be reviewed prior to the close of the NEPA process and issuance of the Record of Decision (ROD), the Final EIR should provide additional information regarding measures for establishing consistency with general conformity and include a general conformity finding. Consistent with comment letters, I urge the proponent to commit to the purchase of emission reduction credits.

Historic and Archaeological Resources

Comments from MHC indicate that it anticipates continued consultation with ACOE regarding the methodology and results of its cultural resource surveys. Comments from BUAR indicate that it has consulted with ACOE regarding mitigation for previous dredging projects and has been satisfied with findings and recommendations of archaeological surveys conducted to date. BUAR concurs with the recommendation that a remote sensing archaeological survey should be conducted for the areas of potential affect in the Mystic River and Chelsea River channels.

Harbor Infrastructure

The EIR identifies potential conflicts with existing harbor infrastructure including tunnels and utility crossings. It identifies a potential conflict with the 115 Kv Submarine Power Cable that extends from the Reserved Channel to Deer Island and is the primary source of power to the Deer Island Treatment plant. The cable construction, operation and maintenance and associated substations is borne entirely by the MWRA and its ratepayers. The proposed limit of the project may deepen the Reserved Channel at or deeper than the current location of this cable. NSTAR documents indicate that the cable was installed at approximately -50 feet MLLW with variations higher and lower along its course. The permit for the cable required it to be buried at -60 feet MLLW to avoid conflicts with deepening projects. The Draft SEIS/EIR indicates that the

ACOE, which issued a Section 10 permit for the cable, has referred the matter to the U.S. Attorneys' office as an enforcement action. The U.S. Attorney's office is negotiating with MWRA and NSTAR to address the conflict with the BHDDNIP.

MWRA comments express significant concern with the impacts of blasting and dredging on this cable and identify the need for additional survey work to determine the precise location and depth of the cable.

The Final EIR should provide an update on negotiations, indicate who will be responsible for identifying actual locations and depths of existing infrastructure that could be directly affected by the project's construction, who is responsible for related costs, and asses the feasibility and cost of relocating the cable.

MWRA comments also note that work within the Chelsea River must be carefully coordinated with the MWRA to avoid impacts to its 36" water main and three wastewater crossings. In addition, the comments note that this element may require a 8(m) permit.

Mitigation

The Draft SEIS/EIR identifies the following measures to avoid, minimize and mitigate project impacts:

- Sequencing to minimize impacts on fish and shellfish populations;
- Preparation of an "after action report" to provide information on all of the blasting events associated with fish kills;
- Establishment of an interagency underwater blasting technical working group comprised of federal and state resource agencies;
- Use of a fisheries observer, side scan sonar fish finder and fish startle system to minimize impacts to fisheries during blasting;
- Prohibition on blasting when schools of fish, sea turtles or mammals are observed in the vicinity;
- For any disposal of contaminated material, proponent will follow protocol for disposal in CAD cells developed through BHNIP;
- Creation of artificial reef with rock material to preserve space in MBDS and provide mitigation for habitat impacts;
- Remote sensing surveys and borings of the northern portion of the Presidents Road Anchorage and area of the Chelsea River proposed for widening to identify historic resources and proposed rock reef sites;
- Remote sensing surveys of proposed rock reef sites to identify historic resources; and
- Development of a disposal plan at the MBDS and a capping plan at the IWS to avoid located shipwrecks;
- Development of a communications system to provide notice to lobstermen and fishermen prior to drilling, blasting and dredging operations; and

- Replacement of older, higher emitting equipment with newer and cleaner burning equipment in 2011 and beyond and extension of the dredging schedule to reduce annual emissions associated with the project.

The Final EIR should include an updated and revised mitigation section including a summary of all mitigation measures to which the proponent has committed. It should include draft Section 61 Findings for the 401 Water Quality Certificate. Mitigation should address temporary, short-term and long-term impacts.

It should indicate whether the proponent will develop compensatory mitigation plans for direct and indirect mortality of fisheries resources, delayed recovery of habitat and areas of habitat that are permanently lost or altered.

Response to Comments

To ensure that the issues raised by commentors are addressed, the Final EIR should include a response to comments. This directive is not intended to, and shall not be construed to, enlarge the scope of the Final EIR beyond what has been expressly identified in the initial scoping Certificate or this Certificate. The Final EIR should include a copy of this Certificate and a copy of each comment letter received. I defer to the proponent as it develops the format for this section, but it should provide clear answers to questions raised.

I note the comment letter submitted by the Town of Winthrop expressing concern with the scale of the proposed project, impacts on fisheries habitat and potential changes to sediment transport patterns. I expect the ACOE will provide a response to those issues that are within the Scope of this Certificate and, in particular, address the potential of the project to affect long-term sediment transport patterns.

Circulation

The Final EIR should be circulated in compliance with Section 11.16 of the MEPA regulations. Copies should be sent to any state agencies from which the proponent will seek permits or approvals, to the list of "comments received" below, to the Conservation Commissions in Boston, Revere and Chelsea and copies should be provided to the public library in Boston, Revere and Chelsea.

June 13, 2008
Date

Ian A. Bowles

Comments received:

6/2/08	Board of Underwater Archaeology (BUAR)
5/28/08	Coastal Zone Management (CZM)
6/3/08	Department of Environmental Protection (DEP)
6/2/08	Division of Marine Fisheries (DMF)
5/5/08	Massachusetts Historical Commission
6/2/08	Massachusetts Water Resources Authority (MWRA)
5/23/08	U.S. Environmental Protection Agency (EPA)
6/2/08	National Marine Fisheries Service (NMFS)
6/2/08	City of Boston/The Environment Department
6/2/08	The Boston Harbor Association (TBHA)
6/2/08	Save the Harbor/Save the Bay
5/30/08	Town of Winthrop/Town Council

IAB/CDB/cdb

The COMMONWEALTH OF MASSACHUSETTS
BOARD OF UNDERWATER ARCHAEOLOGICAL RESOURCES
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
251 Causeway Street, Suite 800, Boston, MA 02114-2136
Tel. (617) 626-1200 Fax (617) 626-1240 Web Site: www.mass.gov/czm/buar/index.htm

June 2, 2008

Curtis L. Thalken
Colonel, District Engineer
New England District
US Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

RE: *Boston Harbor, Massachusetts Navigation Improvement Project - Draft Feasibility Report and Supplemental Environmental Impact Statement and Massachusetts Draft Environmental Impact Report* (EOEA #12958)

Dear Colonel Thalken:

The staff of the Massachusetts Board of Underwater Archaeological Resources has completed its review of Appendix M (Cultural Resources Investigations and Coordination) of the above referenced report and offers the following comments.

The Board has been in regular consultation with the Corps in developing a satisfactory research design and methodology to locate and identify potential submerged archaeological resources that could be impacted by this project. The Board has concurred with the findings and recommendations of the archaeological surveys conducted to date in support of this project (as detailed in the Board's correspondence of 26 August 2002, 18 July, 9 September 2003 and 22 June 2006), specifically for the Main Ship Channel, Reserved Channel and its Turning Area, President Road Channel Reach and Anchorage, and the North Entrance Channel from Broad Sound.

Comment BUAR #1

The Board also concurs with this report's recommendation that a remote sensing archaeological survey should be conducted for the areas of potential affect in the Mystic River and Chelsea River Channels, should proposals to deepen these areas be implemented. The Board looks forward to working with the Corps and its consultants in developing a successful surveying strategy for these areas.

Comment BUAR #2

Should you have any questions regarding this letter, please do not hesitate to contact me at the address above, by telephone at (617) 626-1141 or by email at victor.mastone@state.ma.us.

Sincerely,

Victor T. Mastone
Director

Cc: Brona Simon, MHC
Marc Paiva, USACE-NED
Bob Boeri, MCZM
Brad Washburn, MCZM
Deirdre Buckley, MEPA
Ellen Berkland, City of Boston

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
251 Causeway Street, Suite 800, Boston, MA 02114-2136
(617) 626-1200 FAX: (617) 626-1240

June 2, 2008

Curtis L. Thalken, Colonel
U.S. Army Corps of Engineers
District Engineer
ATTN: Programs and Project Management Division (Mr. Michael Keegan)
696 Virginia Road
Concord, MA 01742-2751

RE: Feasibility Report and Draft Supplemental Environmental Impact Statement/Environmental Impact Report (Draft SEIS/EIR), Boston Harbor Deep Draft Navigation Improvement Project; Boston, Chelsea, Revere

Dear Colonel Thalken,

The Massachusetts Office of Coastal Zone Management (CZM) has completed its review of the above-referenced Feasibility Report and Draft Supplemental Environmental Impact Statement/Environmental Impact Report (Draft SEIS/EIR) and recommends the preparation of a Final Environmental Impact Statement/Environmental Impact Report for the project.

Project Description

The U.S. Army Corps of Engineers, in partnership with the Massachusetts Port Authority, are proposing to deepen the Port of Boston to allow deeper draft bulk and container vessels to enter without experiencing tidal delays in order to position the port to effectively meet current and future cargo needs of the shipping industry. The proposal recommends the deepening of the Broad Sound North Entrance Channel, the lower Main Ship Channel through President Roads to the Reserved Channel, the President Roads Anchorage Area, the lower Reserved Channel, and the Reserved Channel Turning Area to -48 feet at mean lower low water (MLLW), with an additional two feet of depth in the Entrance Channel (to -50 feet MLLW). The proposal also includes widening the Main Ship Channel to 900 feet through the reaches between President Roads and Castle Island and to 800 feet above Castle Island to the Reserved Channel; widening the Reserved Channel Turning Area to 1,600 feet; and further widening in the channel bends at Spectacle Island and Castle Island. The Main Ship Channel would be deepened for an additional distance of 2,600 feet above the expanded Reserved Channel Turning Area to -45 feet MLLW; the 9.1-acre, 35-foot channel lane approach to the Medford Street Terminal in the Mystic River would be deepened to -40 feet MLLW; and the 38-foot Chelsea River Channel and Turning Basin would be deepened to -40 feet MLLW, with accompanying widening of the bridge approaches, the bend between the two bridges, and through a new Chelsea Street bridge opening. These improvements would require the removal and disposal of between 6.6 and 14.8 million cubic yards of parent material and between 450,000 and 1.4 million cubic yards of rock.

Project Comments

CZM supports the proposed improvements to Boston Harbor included in the deepening project. Boston is the premier New England port for bulk and container cargoes, and the improvements will increase the ability of the port to attract larger, deeper draft vessels and thus improve the commercial viability of the port. As the project proceeds through the preparation of the Final EIS/EIR, the design phase, and the state permitting process, the proponents should provide additional information and discussion on the issues identified below.

Technical Working group/Technical Advisory Committee

CZM has participated in the Technical Working Group (TWG) for the completed Boston Harbor Navigation Improvement Project (BHNIP) and continues to believe that the ongoing participation of this group is critical to the success of the proposed project. Close cooperation between the project proponents and state and federal agencies during the design phase of the project must be built in to the process to ensure that the final plan both meets the goals of the proponents while avoiding or minimizing the potential environmental impacts. CZM also suggests the establishment of a smaller technical advisory sub-committee, facilitated by an independent, third-party contractor, to manage situations as they arise during the construction phase of the project. This model was employed during the BHNIP and was very successful in allowing the project to proceed with minimal delays.

Comment CZM #1

Outer and Lower Harbor Resources

The information provided on the general abundance and distribution of the American lobster was sufficient to understand the population characteristics of the project area. However, there was little or dated information on the other potentially impacted natural resources such as shellfish, fishes, benthic infauna and epifauna, and other species of decapod crustaceans (e.g. rock crabs). The lack of site-specific data for the blast areas is of particular concern due to the potential impacts to the relatively stable exposed bedrock seafloor habitat. The area to be blasted is largely different than the proposed dredging areas. The seafloor in the inner and lower harbor is largely comprised of relatively mobile soft sediments that support a dynamic community of benthic infauna and epifauna typical of highly disturbed environments. The area to be blasted in the outer harbor is in an area of hard bottom (bedrock and boulders) that is presumably very stable and not highly disturbed, potentially supporting a stable community. A pre- and post blasting/dredging monitoring program of the impacted areas, particularly the areas to be blasted and outer and lower harbor resources would allow for a sufficient description of the baseline characteristics and potential impacts, while facilitating the monitoring of recovery in the area.

Comment CZM #2

Comment CZM #3

The Draft EIS/EIR indicates the presence of scallops in the outer and lower harbor, with areas of coarser-grain material. Scallops are an important commercial resource and indicative of the presence of coarse-sand to cobble substrate. This substrate is also valuable habitat to a number of marine species, including early benthic phases of Atlantic cod and American lobster. The resource characterization and monitoring should include a variety of techniques to assess benthic habitats, as sediment profile imaging (SPI) is only suitable for collecting data on sessile infauna and epifauna in soft sediments. A combination of underwater observations (e.g., diver-based and/or underwater vehicle), benthic grabs, and SPI would be useful to fully describe the resources. Further details on the ecological characteristics of the outer and lower harbor natural resources would better allow an understanding of potential impacts and the development of mitigation measures and strategies.

Comment CZM #4

Environmental Consequences and Blast Plan

A comprehensive blast plan should be developed to better understand not only the impacts and potential recovery of the area, but to allow for any modifications of the plan that may be required as the project proceeds. The blast plan should include details regarding methods and materials to ensure that the minimum blast effect is generated. The blast plan should also include a

Comment CZM #5

detailed fish-startle system description to be developed in consultation with state and federal regulatory agencies. This system should include strict guidelines on implementation and review procedures to ensure the most effective protection to fishes and resources in the project area. An independent third party observer should also be present during the project to ensure that these procedures are followed or modified on a real-time basis with the TWG.

Comment CZM #6

Consideration should also be given to harvesting American lobsters and rock crabs from the blast areas as part of the plan to limit the impact to these valuable commercial fisheries. Substantial concentrations of attached shellfish such as mussels, encountered in the blast area should also be harvested and relocated as appropriate. These harvested resources could be transported to similar nearby habitat, helping to minimize the impacts associated with the removal of this valuable habitat.

Comment CZM #7

In order to make informed decisions regarding the potential impacts to demersal eggs, benthic invertebrates, or fishes, the pattern of sediment settling around the dredge as well as the concentration of total suspended solids in the sediment plume should be modeled. This information may have been already determined using the SSFATE model, however the data and associated maps were not presented. The only modeling presented in the Draft EIS/EIR relates to the increase in harbor currents upon completion of the deepening project.

Project Sequencing

Comment CZM #8

Boston Harbor is habitat to a number of managed and regulated fisheries. Both anadromous and catadromous species pass through the harbor and are species of concern for the project. Winter flounder use the area for both spawning and rearing. The determination of project sequencing should be addressed to avoid or minimize the effects on the species at different times during the year. Sequencing the most disruptive and potentially damaging aspects of the project (e.g. blasting) to avoid sensitive locations during the critical time of year, while continuing to work in less sensitive areas, would allow for a timely completion of the project. This sequencing should be developed with the input of the Massachusetts Division of Marine Fisheries and the National Marine Fisheries Service.

Beneficial Use

Comment CZM #9

A better understanding of the need for a rock reef using blasted rock in Massachusetts Bay is required to make an appropriate judgment on the proposal. In general, there is not a lack of hard bottom in the bay and it is not likely to be the limiting factor for American lobster populations. The creation of the proposed rock reef for the benefit of the American lobster may not be warranted and may simply replace an existing productive habitat with rocky material. Both sites that are proposed (Broad Sound and Massachusetts Bay) were found to support a diverse and abundant benthic community with numbers of organisms on the order of tens of thousands per square meter. The applicant found that these proposed conversion sites were productive habitat for managed species such as winter flounder and red hake. CZM suggests that rather than convert existing, productive soft bottom habitat to hard bottom, the proponent further evaluate the use of rock material as shore protection and for upland use. In previous correspondence, CZM has identified potential locations for the material.

Comment CZM #10

CZM supports the plan to use parent material, primarily composed of Boston blue clay, to cap the Industrial Waste Site in Massachusetts Bay. This project may result in the elimination of hazardous materials being dispersed to the water column or recovered during (illegal) commercial fishing operations. Results of a preliminary capping demonstration using material obtained from the present maintenance project should be reviewed by the TWG and used to design the capping project.

Federal Consistency

The proposed project is subject to CZM federal consistency review and must be found to be consistent with CZM's enforceable program policies. For further information on this process please contact Robert Boeri, Project Review Coordinator, at (617) 626-1050, or visit the CZM web site at www.state.ma.us/czm/fcr.htm. Comment CZM #11

Sincerely,

Leslie-Ann McGee
Director
Massachusetts Office of Coastal Zone Management

LAM/bkc/tc/taw/rlb

cc: Karen Adams, U.S. Army Corps of Engineers
Mike Keegan, U.S. Army Corps of Engineers
Catherine Rogers, U.S. Army Corps of Engineers
Jacquelyn Wilkins, Massachusetts Port Authority
Deb Hadden, Massachusetts Port Authority
Brad Washburn, Massachusetts Office of Coastal Zone Management
Ben Lynch, Massachusetts Department of Environmental Protection
Ken Chin, Massachusetts Department of Environmental Protection
Alex Strysky, Massachusetts Department of Environmental Protection
Rachel Freed, Massachusetts Department of Environmental Protection
Christopher Boelke, National Marine Fisheries Service
Kathryn Ford, Massachusetts Division of Marine Fisheries
Tay Evans, Massachusetts Division of Marine Fisheries
Eileen Feeney, Massachusetts Division of Marine Fisheries
Mark Rousseau, Massachusetts Division of Marine Fisheries
Tim Timmermann, U.S. Environmental Protection Agency
Ed Reiner, U.S. Environmental Protection Agency
Phil Colarusso, U.S. Environmental Protection Agency

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY & ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
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Governor

TIMOTHY P. MURRAY
Lieutenant Governor

IAN A. BOWLES
Secretary

LAURIE BURT
Commissioner

Ian A. Bowles, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street
Boston MA, 02114

RE: Boston Harbor Deep Draft Navigation Improvement Project
EOEA File No. 12958

Attn: MEPA Unit-Deirdre Buckley

Dear Secretary Bowles:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed the Feasibility Report and Draft Supplemental Environmental Impact Report/Environmental Impact Statement (DSEIR/EIS) for the Boston Harbor Deep Draft Navigation Improvement Project proposed by the U.S. Army Corps of Engineers and Massachusetts Port Authority (Massport). The purpose of the project is to allow access to Boston Harbor by deeper draft vessels without delays due to tidal cycles. The proposed project includes the following changes to the Main Channels, which would result in the removal of approximately 953,000 cubic yards (cy) of rock and 11.1 million cy of dredged material: deepening the 40-foot lane of the Broad Sound North Entrance Channel to 50 feet MLLW and widening it to allow turning of larger vessels; widening and deepening the Main Ship Channel from the Main Ship Channel to Reserved Channel to 48 feet MLLW; deepening the President Roads Anchorage to 48 feet MLLW to accommodate two large vessels at anchor; widening and deepening the lower reach of Reserved Channel; and widening and deepening the Reserved Channel Turning Basin. The project also includes: deepening a 2600 foot length the Main Ship Channel above the Reserved Channel Turning Area to 45 feet MLLW, requiring the removal of approximately 246,300 cy of dredged material and 78,400 cy of rock; deepening a 9 acre area of the Mystic River Channel to 40 feet, generating 67,100 cy of dredged material; and deepening and widening the Chelsea River Channel and Turning Basin to 40 feet MLLW, requiring the removal of 342,600 cy of dredged material and 500 cy of rock. Material unsuitable for disposal at the Massachusetts Bay Disposal Site (MBDS) is proposed to be placed in existing and proposed Confined Aquatic Disposal cells in Boston Harbor, or beneficially reused.

MassDEP generally supports the proposed improvements to support the working port areas of Boston Harbor. The project will require a s.401 Water Quality Certificate under 314 CMR 9.00 to ensure that the dredging and in-state disposal activities meet state Surface Water Quality Standards (314 CMR 4.00). In addition, MassDEP, as noted below, MassDEP will perform an Air Quality General Conformity Determination.

Comment DEP #1

Dredging comments

Beneficial Reuse

The DSEIR/EIS proposes to beneficially reuse some of the clay parent material to use as a cap over contaminated material at the Industrial Waste Site (IWS) in Massachusetts Bay. MassDEP recommends that the proponent explore additional options to reuse the material to be generated by this project. Specifically we recommend that the FEIR explore the following:

- The proponents should perform a community outreach effort to provide coastal communities with an opportunity to use the material for projects addressing shoreline erosion, beach renourishment, and other needs. Comment DEP #2
- As sequencing allows, clean material may function as a suitable cap over material to be disposed of in a Confined Aquatic Disposal (CAD) cell. Comment DEP #3
- Rocky material may provide suitable habitat in some instances. MassDEP recommends that the proponents continue to consult with the Division of Marine Fisheries and other resource agencies to develop a suitable habitat enhancement project. Comment DEP #4

Project sequencing:

The FEIR should further develop, to the greatest extent possible, a sequence of the proposed activities. MassDEP believes that appropriate sequencing can serve to minimize or avoid some of the impacts associated with this project. In particular, performing blasting activities should be performed so as to avoid times that may result in impacts to fish spawning.

Comment DEP #5

Refinement of the sequence of project activities may also result in environmental benefits during disposal activities. For example, MassDEP generally recommends that the most contaminated dredged material be placed at the bottom of a CAD cell to maximize the separation of such materials from aquatic habitats. Ideally, dredging of the most contaminated material should occur early so that it will be the first to be disposed of in the CAD cell. Similarly, dredging of suitably clean material at an appropriate time could facilitate its use as a cap over the CAD cell.

Comment DEP #6

Technical Working Group

MassDEP believes that because of the scale and duration of the project, the Technical Working Group (TWG) will play a critical role in the success of the project. For longer-term design issues, the TWG can provide input on minimizing impacts through the use of Best Management

Comment DEP #7

Practices based on Best Available Technology. The proponents should also continue to develop a framework for providing the TWG with regular updates during the construction period, particularly for communicating unexpected occurrences that require a rapid, coordinated response from agency and community representatives. To facilitate the timely response by the TWG, the proponent should provide a third-party contractor that reports to the group. The proponents should also use the TWG to help develop means of communicating with affected users of Boston harbor, particularly fishermen and recreational and commercial boaters.

Air Quality General Conformity Determination

The requirements for General Conformity are contained in section 176(c)(1) of the federal Clean Air Act and in the General Conformity regulations promulgated by EPA in 1993 (40 CFR Part 51, Subpart W, and 40 CFR Part 93). In general, federal actions must support the goals of the State Implementation Plan (SIP) and be shown to <u>not</u>:

- Cause or contribute to new violations of any national ambient air quality standard (NAAQs) in any area;
- Increase the frequency or severity of any existing violation of any NAAQs; or
- Delay timely attainment of any NAAQs or interim emission reductions.

The General Conformity regulations apply to nonattainment areas where the estimated emissions from the action meet or exceed specified emission rates for each NAAQs. Eastern Massachusetts is currently classified as a moderate nonattainment area for the eight-hour ozone standard and, therefore, the emission rates below that are contained in the General Conformity regulations apply to the proposed Boston Harbor Navigation Improvement Project (BHNIP). However, it should be noted that the U.S. Environmental Protection Agency adopted a more stringent eight-hour ozone standard in 2008 of 0.075 ppm. While MassDEP submitted an attainment demonstration to EPA under the eight-hour ozone standard adopted in 1997, additional reductions in ozone precursors may be needed to attain the 2008 standard.

- Volatile organic compounds (VOC) – 50 tons/year
- Nitrogen oxides (NOx)) – 100 tons/year
- Carbon monoxide (CO) – 100 tons/year

In summary, the criteria for determining conformity for <u>ozone</u> nonattainment areas are as follows (see 40 CFR Part 51.858):

- The total of the direct and indirect emissions from the project are included in the SIP;
- The total of the direct and indirect emissions from the project are fully offset within the same nonattainment area through revision to the SIP or a similarly enforceable measure that affects emission reductions so that there is no net increase in emissions of that pollutant;
- The state air agency makes a determination that the total of the direct and indirect emissions from the project would not exceed the emission budgets in the SIP;

- The state air agency makes a commitment to a SIP revision to achieve the necessary reductions prior to the federal action.

The DSEIR/EIS includes a general conformity analysis and presents an emissions analysis for the no action alternative and two additional build alternatives: Alternative 1 – 45 foot deep MLLW navigation channel; and Alternative 2 – 50 foot deep MLLW navigation channel. Both build alternatives show that the emissions would exceed the general conformity deminimus review thresholds. (See Tables 4-4 and 4-7 for Alternatives 1 and 2, respectively.) To address the exceedances and to reduce emissions below the general conformity review thresholds, the DSEIR/EIS proposes two primary emission reduction options for Alternatives 1 and 2 – the replacement of older, higher emitting equipment with newer and cleaner burning equipment in 2011 and beyond and extending the dredging schedule to spread out peak year emissions over the dredging schedule.

Comment DEP #8

MassDEP supports the use of lower emitting nonroad engines for the project and notes that this strategy will significantly reduce ozone precursor emission (VOC and NOx) as well as particulate matter emissions. The proponent should verify how this strategy will be implemented and enforced (e.g., through contract specifications). MassDEP also suggests that the proponent explore whether there are any possible engine retrofit opportunities to further reduce emissions.

The extension of the dredging schedule, while it will reduce yearly emissions, will still result in NOx emissions close to the deminimus level under the general conformity requirements. Without this strategy, the proponent would be required to fully offset the increase in NOx emissions. MassDEP suggest the proponent explore additional mitigation strategies including the use of emission reduction credits to avoid these additional emissions. Finally, the proponent should present more detailed information on the dredging schedule within each year and explore targeting dredging operations in the pre- or post-ozone season. As noted above, additional reductions in ozone precursors may be needed to attain the more protective eight-hour standard adopted by EPA earlier this year.

Sincerely,

Philip Weinberg
Associate Commissioner

Cc: Paul Diodati, DMF
Tim Timmermann, EPA
Bob Boeri, CZM

Commonwealth of Massachusetts
Division of Marine Fisheries
251 Causeway Street, Suite 400
Boston, Massachusetts 02114
(617)626-1520
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Paul J. Diodati
Director

Deval Patrick
Governor
Ian A. Bowles
Secretary
Mary B. Griffin
Commissioner

June 2, 2008

Ian A. Bowles, Secretary
Executive Office of Environmental Affairs
Attention: MEPA Office, Deirdre Buckley
100 Cambridge Street
Boston, MA 02114-2150

Re: The Boston Deep Draft Project, EEA #12958

Dear Secretary Bowles:

The Division of Marine Fisheries has reviewed the Draft Feasibility Report and Draft Supplemental Environmental Impact Statement/Draft Environmental Impact Report (DEIR) prepared by the U.S. Army Corps of Engineers (the Corps) in partnership with the Massachusetts Port Authority (Massport) for additional dredging in Boston Harbor, Mystic River, and Chelsea River. The DEIR builds on two previous documents: the Final EIR prepared in 1995 for dredging to improve navigation in Boston Harbor and the DEIR prepared in 2006 for maintenance dredging that is occurring now. We offer the following comments for your consideration and recommendations for fisheries habitat concerns that should be more specifically addressed in the Final EIR (FEIR).

<u>Background and resource information</u>

This project continues work begun in 1995 dredging for navigation improvements, and continued through the 2007 maintenance dredging efforts. For operational reasons, work has proceeded for nearly this entire period, often during critical periods for fish spawning and passage. We acknowledge that Boston Harbor is an industrial harbor and a Designated Port Area. However, that designation should not devalue the fisheries resources and habitat found at the proposed work sites, particularly since significant efforts have been made to improve water quality in Boston Harbor. The status of some fisheries that use this ecosystem is considered grave or dire,[1] and requires the utmost consideration for management. Comment DMF #1

Since virtually every estuarine waterway in Massachusetts is impacted by dredging, there is considerable concern regarding cumulative impacts on the overall ecosystem. Also, because of continuous dredging, these projects change from a potential acute, short-term impact to the fisheries resources, to an impact that is chronic and considerably different in nature. It is clear by the paucity Comment DMF #2

[1] *MarineFisheries* has banned fishing for river herring due to population concerns. Also, rainbow smelt is listed as a "species of concern" by NMFS.

of impact reports from Boston Harbor and the Providence River that limited lessons have been learned regarding the environmental impacts of previous dredging projects, let alone how a chronic impact would differ from an acute impact.

The wide geographic area of this proposed project supports several species of shellfish and finfish, including lobster (*Homarus americanus*), soft shell clam (*Mya arenaria*), mussels, and winter flounder (*Pseudopleuronectes americanus*). In addition, several diadromous species utilize the area including rainbow smelt (*Osmerus mordax*), Atlantic tomcod (*Microgadus tomcod*), white perch (*Morone americana*), and river herring (*Alosa* spp.) (Chase, 2008). Boston Harbor is classified as Essential Fish Habitat (EFH) for winter flounder by the New England Fisheries Management Council (NEFMC) and the ASMFC classifies spawning areas such as these as Habitat Areas of Particular Concern (HAPCs).

General Comments

Comment DMF #3

This DEIR relies primarily on information collected and examined for previous efforts. This level of information was deemed insufficient in the past, and in many cases did not address the questions being asked. As such, the proponents have not conducted a sufficient impact assessment. Since there is a long history of dredge projects in Boston Harbor, we would anticipate a more directed and comprehensive effort to address specific environmental concerns. Instead, the DEIR provides only a review of previous documents and we are concerned about the precedent this sets.

Comment DMF #4

Many decisions regarding this project are being left to the discretion of the technical working group (TWG) and are promised during the design phase. We commend the open process that Massport and the Corps have established to date. However, given the experience of these proponents in the project location, the significant resources that exist within the Corps to study the impact of dredging on marine habitats, and a recent history of impacts to marine resources resulting from the current and ongoing dredge activities in Boston Harbor, a more concerted effort could have been made to examine potential impacts of this new project.

Direct mortality of fisheries resources

Comment DMF #5

This past year, several fish kills occurred during blasting events in Boston Harbor. This was not addressed in the DEIR. The FEIR should include a full assessment of the reasons behind the fish kills, and a reasoned response to avoid such impacts in the future. A multi-pronged approach is necessary to avoid impact to valuable fisheries resources:

Comment DMF #6

- We recommend the proponents **generate a sequencing plan**. Based on available information, *MarineFisheries* routinely provides recommendations for time-of-year (TOY) work windows to minimize impacts on fisheries resources. However, specific project sequencing should be based on biological surveys (ideally three years) to assess fisheries resources, annual trends, and their use of the affected habitat areas.

Comment DMF #7

- We recommend the proponents **generate a blast plan**. This must include an analysis of the previous fish kills and the efforts being proposed to avoid such impact (e.g. use of additional acoustic fish exclusion devices, standards for their use, consideration of bubble curtains, and adherence to time of year recommendations). Sample plans and standards have already been provided to the proponents, but were not included in the DEIR.

Comment DMF #8

- Since early benthic phase (EBP) lobsters are present year-round in hard bottom habitats (Glenn, 2008), impact to this resource is unavoidable. Therefore, we recommend the proponents **clarify how much hard bottom is impacted, how much is removed, and how much is created by the project within the project site**. The proposed addition of off-site hard bottom habitat as a beneficial use should not be included in this assessment.

Comment DMF #9

- We recommend a specific examination of the recovery time of hard bottom habitats that **includes sampling of EBP lobsters**.

The DEIR notes that softshell clam habitat will be impacted by potential work in the Chelsea River (p. 3-23). *MarineFisheries* expects that the proposed dredging will result in a permanent loss of this habitat by direct removal of shallow water and resulting conversion to an environment that may not support shellfish. The ecosystem function of these shellfish beds, which include softshell clam, razor clam, and blue mussels, may be significant to other fish and invertebrate species foraging in this area. Nevertheless, this habitat impact is not addressed in the DEIR. Therefore, we recommend the following: Comment DMF #10

- The FEIR should include **a clear delineation of the shellfish habitat potentially impacted by dredging and an assessment of the functional loss to other species.**
- We recommend that the applicants coordinate with the State and Federal resource agencies to address **avoidance, minimization and mitigation options for this lost habitat in the FEIR.**

Beneficial use of dredge material

We applaud the Corps continued efforts to explore beneficial uses of dredge material. However, upland reuse and disposal options have not been given due attention.

- We recommend that the proponents **revisit upland disposal options in the FEIR.** Only after upland disposal options have been exhausted should subaqueous habitat conversions be considered. Comment DMF #11
- If a subaqueous disposal is required, we recommend the proponents **revisit the site selection model** for the habitat enhancement in conjunction with the TWG. The currently proposed preferred subaqueous sites, Broad Sound and Massachusetts Bay, already have significant habitat value and substantial hard bottom habitat. Edge habitat and habitat heterogeneity are crucial, so these sites may not be appropriate for disposal of all (or any) of the rock material. We are concerned the proponents are making the assumption that hard bottom habitat is always considered of higher value than supplanted habitat and that artificial reefs have the same ecosystem function as natural reefs. Comment DMF #12
- We encourage the proponents to use the guidance provided by *MarineFisheries*' Artificial Reef Policy for site selection and monitoring. Application of the site selection model used by *MarineFisheries* for creation of the HubLine cobble reef would also improve the evaluation process.

Invasive Species

Dredge barges are in the harbor for many months. They typically travel at low speeds so eliminating hull fouling organisms is not a primary maintenance objective. As such, the barges pose a significant threat to the Boston Harbor environment via the introduction of invasive species. Eradication of marine invasive species has rarely been successful and has been enormously costly,[2] therefore,

- We recommend the **proponents identify measures to prevent the spread of invasive species** in the FEIR. For example, the proponents could require regular inspection of the barges. Such inspection should occur when a barge enters the harbor from use in foreign harbors or those known to have species invasive to New England. The inspection should follow a protocol approved by the technical working group. Comment DMF #13

Monitoring

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[2] The cost of eradicating the seaweed, *Caulerpa taxifolia,* from California lagoons ran over $4 M and monitoring continues (Anderson, 2005). Failed attempts at eradication include the green crab, *Carcinus maenas,* on the west coast (Grosholz, 2000), the tunicate, *Didemnum* from barges and pilings in New Zealand and Washington state (Coutts, 2007), and the sea star, *Asteria amurensis* from a bay in Australia (Thresher, 2001).

Comment DMF #14 As previously mentioned, improvement or maintenance dredging has been occurring since 1998 in Boston Harbor. Improvement dredging, by its very definition, is designed to alter the environment as permanently as possible. It is also inaccurate to identify impacts from maintenance dredging as temporary since they are chronic in nature and will result in permanent functional changes of the habitat. We recommend that the chronic impacts associated with ten plus years of dredging be fully addressed.

- Comment DMF #15 We recommend the proponents **include an environmental monitoring system, specifically designed to evaluate the recovery period of impacted areas** should the project move forward.
- Comment DMF #16 We request a **delineation of areas where habitat conversion will take place** due to dredging and/or blasting activities.
- Comment DMF #17 We request that the applicant **provide an estimate of the time needed for recovery** of all impacted habitats.

Mitigation

Even after appropriate avoidance and minimization measures are applied in the project design and sequencing, the proposed project may still result in unavoidable impacts, including habitat conversion and direct and indirect mortality of fisheries resources.

- Comment DMF #18 We recommend that the applicant begin developing **compensatory mitigation plans** for direct and indirect mortality of fisheries resources, delayed recovery of habitat, and areas of habitat that are permanently lost or altered.

Thank you for considering our comments. If you have any questions about this review or require more information please contact Kathryn Ford in our New Bedford office at (508) 990-2860, ext. 145.

Sincerely,

Paul J. Diodati
Director

Cc: M. Keegan, ACOE
C. Boelke, NMFS
B. Boeri, CZM
P. Colarusso, US EPA
C. Bush, Boston Conservation Commission
K. Chin, DEP
T. Evans, M. Rousseau, E. Feeney, F. Germano, DMF
R. Lehan, DFG

References

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The Commonwealth of Massachusetts
William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

May 5, 2008

Curtis L. Thalken
Colonel, District Engineer
New England District
US Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

RE: Boston Harbor Deep Draft Navigation Improvements Project, Boston, Chelsea, Everett, MA.
MHC #RC.323. **EEA#12958.**

Dear Mr. Thalken:

Thank you for seeking the comments of the Massachusetts Historical Commission, the office of the Massachusetts State Historic Preservation Officer, for the project referenced above, in regards to the filing of a Draft Supplemental Environmental Impact Statement/Report.

Review of MHC's files indicates that the Corps (COE to Massachusetts Board of Underwater Archaeological Resources, 10/4/2007) proposed to conduct additional identification surveys for historic properties that may be affected by the project. Comment MHC #1

MHC looks forward to reviewing the scope of the proposed identification efforts, continuing to consult on the methodology and results, and to review of the Corps determinations in accordance with 36 CFR 800.

These comments are provided to assist in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800) and MEPA (301 CMR 11). Should you have any questions, please feel free to contact Edward L. Bell of my staff.

Sincerely,

Brona Simon
Brona Simon
State Historic Preservation Officer
Executive Director
State Archaeologist
Massachusetts Historical Commission

xc:
Marc Paiva, COE-NED
Jacquelyn I. Wilkins, Massport
Secretary Ian A. Bowles, EEA, Attn. Deirdre Buckley, MEPA Office
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June 2, 2008

Colonel Curtis L. Thalken
U.S. Army Corps of Engineers
696 Virginia Road
Concord, Massachusetts 01742

Re: Boston Harbor Deep Draft Navigational Improvement Project - EOEEA #12958
Feasibility Report and Supplemental Environmental Impact Report

Dear Colonel Thalken:

The Massachusetts Water Resources Authority (MWRA) appreciates the opportunity to review the Draft Feasibility Report and Supplemental Environmental Impact Report on the Boston Harbor Deep Draft Navigational Improvement Project. The Reports prepared by the U.S. Army Corps of Engineers (Corps) in partnership with the Massachusetts Port Authority (Massport) discuss proposed channel and associated navigation feature improvements to the Port of Boston. The Massachusetts Water Resources Authority (MWRA) is represented on the Dredging Technical Working Group created by Massport and the Corps in an effort to stay informed and participate in the review of this project in Boston Harbor.

The purpose of the Boston Harbor Navigation Improvement Study is to identify, formulate, evaluate and screen potential alternatives for channel deepening and related improvements at the Port of Boston. The recommended plan proposes to deepen the harbor's main channels and the lower portion of the Reserved Channel at the Conley Terminal from their existing - 40 foot depth at mean lower low water (MLLW) to a depth of between - 48 and - 50 feet MLLW. Additional minor port improvements in the Mystic and Chelsea Rivers and in the Main Ship Channel above the Reserved Channel are also under consideration. In all areas an overdepth dredging allowance of two feet is required, and in addition, in areas where ledge is encountered, (as is the case in the Reserved Channel) an additional two feet of required rock removal will be performed for vessel safety which would bring the Reserved Channel to a finished depth of not less than -52 feet MLLW. Comment MWRA #1

MWRA's comments are focused upon the need to protect existing infrastructure in the project area, specifically NSTAR's cable in the Reserved Channel, and MWRA water and sewer lines that may be impacted by the project located in the Chelsea River.

Reserved Channel: NSTAR Cable

MWRA commented on the Environmental Notification Form filed (ENF) in 2003, and at that time raised concerns specifically related to the potential impacts to NSTAR's existing cross-harbor electric cable located in the Reserved Channel that provides power to the MWRA's Deer Island Treatment plant serving over 2.5 million people in the metropolitan Boston area. While the cable is owned by Harbor Electric Energy Corp., a wholly owned subsidiary of NSTAR, the cost of construction, operation and maintenance of the cable and associated substations is borne entirely by MWRA and its ratepayers. The cable and substations were installed at a cost of approximately $40 million and provided power for construction of the $3.5 billion federal court-mandated Boston Harbor Project and presently provides power for the operation of the Deer Island Treatment Plant (DITP).

It appears that the proposed limit of this project will seek to achieve channel depths at or deeper than the current location of NSTAR's 115Kv Submarine Power Cable which feeds the MWRA's Treatment Plant. NSTAR's documents indicate that this cable was installed at approximately –50 feet with variations higher and lower along its course, and that the new dredging project proposes to increase the cut from the existing channel depth of – 40 to a new depth of -50 to -52. The permit required the cable to reach a depth of -60 MLLW which, based upon the "as-built" data of NSTAR's contractor, was not achieved. MWRA has the same concerns now as it did when it commented upon the ENF -- the proposed depths of a newly-deepened channel directly threaten the current location of the cable.

Comment MWRA #2

Comment MWRA #3

Comment MWRA #4

MWRA's primary concern is that any blasting and dredging as part of this proposal near the cable in the Reserved Channel cannot help but pose a direct threat of damage to the cable which would result in the long-term loss of a vital energy link to its Deer Island facility and, in the process, cause a release of insulating oil in the cable to the waters of the harbor, the same waters which have seen dramatic improvement in quality precisely because of the contributions of that wastewater treatment facility. The potential for disruption of this primary source of power to the treatment plant servicing over 43 cities and towns in metropolitan Boston would be catastrophic for MWRA over the lengthy period which would be required to replace that cable. It should be noted that even in the short term, any disruption in the use of the cable would require that MWRA depend upon and use its own generating capability which given today's fuel costs, could result in millions of dollars in annual additional expenditures charged to MWRA's ratepayers, whose municipal budgets are already substantially over-burdened. Additionally, should MWRA's sole source of back-up power fail for any reason, the environmental impacts would be disastrous.

Staff at MWRA have attended meetings with the Corps, NSTAR and the US Justice Department over the past several years in response to the Corps' claim raised in 2005 that NSTAR's cable, in certain stretches, was not laid by its contractor as deeply below the channel floor as required by its permit and in response to the Corps' insistence that corrective work be undertaken to bring the cable's location into compliance with that permit. While NSTAR has, over the past several years, identified and examined several alternative protection strategies that it believes would protect its submarine cable, no concrete progress has been made toward finding a solution that will assure that the cable could survive the channel-deepening project. Of the alternatives considered, NSTAR's preferred option for placing protective mats over the cable cannot be expected to work if the cable's current location is already at or above -52 MLLW. Until additional survey work is completed to determine the precise location and depth of the cable, it is impossible to define a protective measure that NSTAR could reliably employ. MWRA does not believe that consensus has been reached which will assure that channel-deepening to the depths desired by the project can be attained while guaranteeing that no damage will be caused to the infrastructure that is critical to MWRA's operations. Comment MWRA #5

MWRA has worked with the proponents to try to assure that MWRA's electric source is not jeopardized and equally as important, to assure that any costs associated with the protection or deepening of NSTAR's cable are not passed on to MWRA ratepayers. It is hoped that a reasonable solution will be realized to satisfy MWRA's operational and economic issues. MWRA, as a co-permittee of the Corps' cable permit, is already one of the entities targeted for litigation by the Justice Department if the permit conditions are not met. MWRA can ill afford to expose its ratepayers to the costs of replacing a damaged cable, which cannot be repaired via splicing, to the magnitude of the diesel fuel costs which will become necessary during the multiple years that will be required to replace the cable, if damaged, or worst of all, to the prospects of operating DITP with only a single source of power when the plant was designed to operate with a back-up source.

Chelsea River: Section 38 Water Main and Three Sewer Crossings

It appears that the proposed dredging may impact MWRA's Section 38, a 36" water main that crosses under the Chelsea River. The proposed dredging plan calls for the deepening and widening of the Chelsea River Channel to - 40 feet. Section 38 is located at an approximate elevation – 44, so any future dredging and/or blasting in this area should be carefully coordinated with MWRA. Comment MWRA #6

In addition to the Section 38 water main, there are three wastewater crossings located under the Chelsea River. These include an abandoned siphon, Section 10, an active deep tunnel Section 101, and an active siphon Section 37.5. Various elevation scales have been used by MDC, MWRA's predecessor, and will need to be researched to assure accuracy prior to dredging. We suggest that the proponent coordinate with MWRA permitting staff to identify specific elevations to determine whether or not there will be an impact to these facilities as an MWRA 8 (m) permit will be required for work in this area. Comment MWRA #7 Comment MWRA #8

Questions regarding 8 (m) water permitting and MWRA's need to protect our water infrastructure should be directed to Ralph Francesconi at 617 305-5827. Permitting issues related to the wastewater crossings should be directed to Kevin McKenna at 617 305-5956.

MWRA understands that the deepening of the Chelsea River beyond the current -38 foot depth is based on the assumption that the Chelsea Street Bridge would be replaced by the Massachusetts Highway Department and that the Keyspan gas siphon would be removed and relocated. MWRA will continue to monitor progress of these projects and work with the Project Proponents to assure that MWRA's infrastructure is protected as all the alternatives are evaluated during the environmental review process. Comment MWRA #9

Please contact me at 617 788-1165 if you have questions, need additional information or agency coordination to review MWRA engineering plans. Thank you for the opportunity to comment.

Yours truly,

Marianne Connolly

Marianne Connolly
Program Manager, Regulatory Compliance

cc: Deb Hadden, Massport
Michael Keegan, US Army Corps of Engineers

C: MEPA12958BosHarEIRcomments.doc

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

OFFICE OF THE
REGIONAL ADMINISTRATOR

May 23, 2008

Curtis L. Thalken, Colonel
District Engineer
ATTN: Programs and Project Management Division (Mr. Michael Keegan)
696 Virginia Road
Concord, Massachusetts 01742-2751

RE: Draft Supplemental Environmental Impact Statement and State Draft Environmental Impact Report (DSEIS/DEIR) for the Boston Harbor Deep Draft Navigation Improvement Dredging, Boston, Massachusetts (CEQ # 20080143)

Dear Colonel Thalken:

In accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, we have reviewed the U. S. Army Corps of Engineers, New England District (Corps) Draft Supplemental Environmental Impact Statement (DSEIS) for the Boston Harbor Deep Draft Navigation Improvement Dredging project proposed in various areas of Boston Harbor.[1] The DSEIS was prepared by the Corps in partnership with the Massachusetts Port Authority (Massport).

The DSEIS details Massport's goal to establish a deeper channel for access to the Conley Container Terminal in South Boston and to make port improvements in the Mystic and Chelsea Rivers and in the Main Ship Channel above the Reserved Channel. The proposed channel deepening is intended to help reduce tidal delays currently experienced by containerships and bulk carriers that use Boston Harbor. Other anticipated improvements beyond the Corps work to deepen the Federal channels would include work by Massport to deepen vessel berths at the Conley and Marine terminals. The project is expected to generate a total of 12.1 million cubic yards of non-rock dredged material (parent material) and 1.2 million cubic yards of rock.

The DSEIS proposes disposal of the majority of the dredged material at the Massachusetts Bay Disposal Site (MBDS)[2] and proposes the use of some of the non-rock dredged material (parent material) as cover at the former Industrial Waste Site.[3] Based

[1] This letter serves as our comment on the DSEIS and the Draft Environmental Impact Report prepared under the Massachusetts Environmental Policy Act.

[2] The MBDS is approximately 17 nautical miles east of the entrance to Boston Harbor adjacent to the Stellwagen Bank National Marine Sanctuary.

[3] The Industrial Waste Site is located 20 miles east of Boston in 300 ft. of water.

on our review of the information contained in the DSEIS, EPA has no objections to use of the MBDS for disposal of the dredged material. Also, EPA has no objection to the use of parent material as cover at the former Industrial Waste Site, and we view the proposed capping plan as an opportunity to further reduce the remaining risk associated with waste barrels that may still exist at the site.

We focused our review of the DSEIS on air quality impacts, removal of rock in the project area by blasting, and the potential for beneficial reuse of rock material to construct rock reefs. Each of these issues is discussed to varying degrees in the DSEIS. These issues are discussed below and in detail in the attachment to this letter.

The DSEIS describes a range of potential impacts to air quality that are directly related to the type of dredging equipment utilized and the duration of the work, and proposes a multi-year dredging/construction schedule in order to keep annual emissions low enough to avoid triggering the offset requirements of the Clean Air Act general conformity regulations. We are concerned that the DSEIS focuses on avoiding the need to offset emissions without a vigorous examination of the possible cost to the marine environment as a result of lengthening construction schedules to reduce annual emissions. We request that the Corps provide a full analysis of the environmental tradeoffs and costs of avoiding triggering the air emission offsets. In addition, this analysis should include developing contract provisions to require the cleanest construction equipment available and fully consider offsets as a means to reduce the in-water construction time/marine impacts of the project. We are also concerned that as currently written, the DSEIS postpones the determination on the use or viability of emission credits/offsets until the design phase after completion of the NEPA process and Record of Decision. We do not support this approach because we believe the issue should be fully vetted for public review as part of the EIS. We recommend that the Corps work closely with EPA and other interested state and federal stakeholders to resolve this issue in advance of the publication of the FEIS. Comment EPA #1

In addition to unresolved air issues the DSEIS lacks information to fully describe the potential impacts associated with proposed rock blasting and the creation of rock reefs--a proposed beneficial use of the dredge material. At a May 19, 2008 interagency meeting the Corps reported that the final extent and amounts of the proposed blasting will not be made known until sometime after the Spring of 2009 when extensive borings will be conducted to characterize the type and quantities of the rock to be removed, and that more specific discussions regarding how the material will be removed will not be possible until that point. Comment EPA #2

We are concerned that there is only limited information in the DSEIS regarding the potential for impacts and whether measures can be implemented to successfully minimize and mitigate blasting impacts, and that the Corps does not intend to fully address this issue until post EIS design and permitting. In addition, we are also concerned that only limited information is included in the DSEIS regarding the establishment of rock reefs, not enough information to inform a decision whether the proposed sites and potential impacts are acceptable. Our comments in the attachment recommend the establishment of two advisory panels comprised of state and federal stakeholders (and others as appropriate) to address these outstanding issues.

EPA appreciates the opportunity to offer comments on the DSEIS and encourages the Corps to work closely with EPA and other interested federal and state agencies and other stakeholders to develop strategies to effectively address the air and marine impacts associated with the proposed project. We have rated the disposal of the dredged material at the MBDS and capping of the Industrial Waste Site LO-1 "Lack of Objections-Adequate", in accordance with EPA's national rating system, a description of which is attached to this letter. Moreover, based on a lack of information relative to the extent and impacts of blasting and the proposal to create rock reefs we have rated those aspects of the EIS EO-2 "Environmental Objections–Insufficient Information." We look forward to working with the Corps to resolve these issues and suggest a meeting to discuss our comments more fully. Please feel free to contact Timothy Timmermann of the Office of Environmental Review at 617/918-1025 to set up a meeting.

Comment EPA #3

Sincerely,

Robert W. Varney
Regional Administrator

Attachment

cc:

MEPA Unit

Summary of Rating Definitions and Follow-up Action

Environmental Impact of the Action

LO--Lack of Objections
The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC–Environmental Concerns
The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO--Environmental Objections
The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU--Environmentally Unsatisfactory
The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potentially unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

Adequacy of the Impact Statement

Category 1--Adequate
EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2--Insufficient Information
The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3–Inadequate
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

Additional Detailed Comments on the Draft Supplemental Environmental Impact Statement and State Draft Environmental Impact Report (DSEIS/DEIR) for the Boston Harbor Deep Draft Navigation Improvement Dredging, Boston, Massachusetts

Marine Issues

Blasting

According to the DSEIS, the project will result in the removal of between 450,000 and 1,400,000 cubic yards of rock through dredging and blasting. The duration and magnitude of blasting described in the DSEIS is of a scope that has the potential for serious and significant impacts to fish and marine mammals. The DSEIS highlights the multiple fish kills that resulted from blasting performed in Boston Harbor last fall despite the implementation of preventative measures. Based on that experience, we view the blasting as the most significant source of risk for impact to marine organisms associated with the project. While we understand the difficulty of quantitatively predicting impacts from blasting, we believe that significant effort will be required to develop an acceptable plan to minimize the impacts of blasting on the wide range of marine organisms in Boston Harbor. We appreciate the Corps' and Massport's commitment in the DSEIS to work with federal and state agencies to develop approaches to minimize impacts from blasting. In order for this project to move forward, we believe that the Corps and Massport should:

Comment EPA #4

- **Continue their work to establish an interagency underwater technical working group.** We recommend that the Corps work closely with the working group to identify, discuss and evaluate measures that could be implemented to minimize blasting impacts. These measures should include, but not necessarily be limited to, technological fixes, sequencing, time-of-year restrictions, and examination of whether or not the limits of the channel could be shifted as a means to avoid the areas of rock. We strongly encourage the Corps to establish the working group immediately so that the group's work can be incorporated into the FEIS. We also note that the Draft Feasibility Report (page 186) explains that it may be possible to rip (remove) the bedrock with a large toothed bucket mounted on an excavator. According to the analysis, the viability of that alternate removal method (and the overall magnitude of impacts expected from the rock removal component of the project) will not be known until the design phase of the project. We believe that the development of this critical information should proceed now and be presented in the FEIS, not delayed to the design phase of the project outside of the NEPA/MEPA review process. If the development of that information is delayed and information regarding the impacts of rock removal will be developed after the current NEPA process, the Corps should explain how the information will be made available to the agencies and public for review and comment through a supplemental NEPA process. We also recommend that the working group be maintained throughout the life of the blasting component of the project to help address any unforeseen developments should they arise. As part of the process we recommend that the working group be convened or informed on a regular basis to gauge success of control measures and review project progress (based on the reported results of the monitoring program described below). Rock removal techniques should be revisited as necessary when additional detailed geologic information becomes available.

Comment EPA #4

- **Commit to an extensive monitoring program spanning the entire project life cycle that will provide real-time information on the impacts of blasting.** The monitoring program should be developed in consultation with the working group and should include reporting protocols to explain the chain of events should large fish kills or marine mammal impacts occur as a result of blasting. EPA looks forward to working with the Corps and participating on the working group to help develop the protocols, including those regarding notification of the group following notable events. The working group in conjunction with the Corps and Massport will then explore options for response actions, operational changes, or additional minimization measures, if they are indicated.

Comment EPA #5

- **Work to make sure that the public is kept fully informed of the blasting program and working group discussions as the project advances.** We recommend that the Corps also consider inviting interested members of the public and industry to join the working group. Transparency in this part of the process will be critical given that the DSEIS does not include complete impact information related to rock removal for the project.

Comment EPA #6

<u>Beneficial Reuse</u>

The DSEIS presents the Massachusetts Bay Disposal Site (MBDS) as the preferred method of disposal for the non-rock dredged material. The DSEIS also provides preliminary information regarding the potential beneficial reuse (disposal) of some or all of the parent material to cap areas of the Industrial Waste Site and use of the blasted rock material to create rock reefs. EPA does not object to the disposal of project generated dredged material at the MBDS. And, in general, we support the Corps and Massport investigation of the potential to beneficially reuse a portion of the dredged material generated by the project.

Comment EPA #7

With respect to the plan to cap areas of the former Industrial Waste Site we note that the risk of a fisherman recovering an intact waste barrel to the surface is fairly remote because the area is technically closed to fishing and many of the barrels have already corroded. Therefore we view the proposed capping plan as an opportunity to further reduce the remaining risk.

Comment EPA #8

Comment EPA #9

With respect to the proposal to establish rock reefs, we support the concept of habitat restoration and enhancement; however, we have concerns about the locations selected for reef development and believe that significantly more information needs to be developed to fully understand the potential for impacts from this use proposal. The DSEIS states that reefs encompassing between 186 and 518 acres could be constructed at the Broad Sound or Massachusetts Bay sites. We have concerns about these particular sites due to the large size of the proposed reefs and the habitat functions these areas now appear to perform. The DSEIS describes the geomorphology of Broad Sound site as 43% gravel and cobble and the Massachusetts Bay site as 50% sand waves. The Corps' recent denial of the proposal to place dredged material at Winthrop Beach due to fisheries concerns (including adverse affects on cod spawning and lobsters) and comments highlighting the value of sand waves for fish in comments recently submitted by the National Marine Fisheries Service on the Minerals Management Service's Cape Wind EIS are relevant to this issue. Both of these instances support our position that the Corps and Massport need to more precisely define the potential for impacts associated with the project. As part of this additional evaluation we believe that the impacts associated with a range of reef sizes for both potential sites should be explored in the FEIS.

EPA strongly recommends that the Corps consider establishing a separate working group comprised of federal and state agencies and other interested stakeholders to address issues associated with rock reef creation. As with the blasting issues detailed above, the results of the working group efforts related to rock reef formation should be incorporated into the FEIS for review and comment. As above, we also believe that the information should be provided during the NEPA process, not later during the design phase of the project. At this point, the DSEIS does not contain sufficient information for EPA to determine whether rock reefs will be an acceptable use of the rock material generated by the project.

Acoustic Monitoring System

Comment EPA #10

The FEIS should evaluate the potential for impacts of blasting on the recently installed buoy listening and monitoring system in the Boston shipping lanes.[4] As you may know, the listening and monitoring system is designed to reduce the likelihood of ships colliding with whales by providing close to real time information to ship captains regarding the presence of whales in the shipping channel. The FEIS should include substantive information, including results of consultation with NOAA, to explain whether any proposed blasting will harm marine mammals and/or the effectiveness of the monitoring system.

In addition, the Corps and Massport should commit to use the data generated by the buoy listening and monitoring system and contract specifications should require that barges and other construction equipment are equipped with the proper communication equipment to receive the updates.

[4] http://www.listenforwhales.org/NetCommunity/Page.aspx?pid=467

Specific comments

DSEIS page 2-25: States that monitoring of the habitat enhancement sites for several years would be important to document colonization rates and provide information for future projects. Yet, there is no commitment in the DSEIS from the Corps or Massport to fund or carry out this monitoring. We believe that if the habitat enhancement (rock reef) efforts advance, the Corps and/or Massport should fund a monitoring plan that is commensurate with the ultimate size of the reefs and is consistent with the input of the working group established to explore this issue (see above).

Comment EPA #11

Comment EPA #12

DSEIS page 3-23: EPA staff have observed European oysters within Boston Harbor along the Winthrop and East Boston shorelines.

DSEIS page 3-83: The DSEIS notes that only transient marine mammals are found in Boston Harbor. We believe that some marine mammals (harbor seals and harbor porpoise) are regular seasonal visitors into the harbor.[5] Harbor porpoise are routinely observed around the Charles River dam in the spring during anadromous fish inward migration. They have also been observed in Chelsea Creek. Harbor seals have been observed year round throughout the harbor.

Comment EPA #13

Comment EPA #14

The FEIS discusses a change in the size and number of vessels projected to come to the port as a result of the development of the project. The FEIS should calculate the change in water usage (for cooling water intake, ballast, etc.) associated with the projected fleet change.

Comment EPA #15

Comment EPA #16

Comment EPA #17

Cumulative Impacts

The FEIS should look at the cumulative impacts of additional barge traffic to MBDS to the risk of vessel collision with whales. Also, this project will cause a conversion of between 1100-1300 acres of soft-bottom to hard substrate. The FEIS should also analyze the cumulative impact to benthic habitat (from both temporary and permanent conversion) from this project and the large number of other projected projects in the harbor.

Air Quality

General Conformity

Comment EPA #18

EPA disagrees with the approach to general conformity described in the DSEIS which leaves the decision on satisfying the Clean Air Act requirements of general conformity to the design phase of the project (see page 4-51 under "Emission Credits" and page 4-75 under "Mitigation"). We believe that under NEPA the Corps has an obligation to include in the EIS the information about how general conformity requirements will be met. The general conformity provisions at 40 CFR 93.150 mandate that the Corps must make a determination that its action conforms prior to engaging in, supporting, providing financial assistance for, licensing or permitting, or approving it. We believe this requires satisfying conformity prior to issuing a Record of Decision for the project. Therefore, we

[5] Dave Wiley, PhD, personal communication, 5-16-2008.

strongly encourage the Corps to work closely with the EPA and other state and federal agencies as appropriate to develop an approach to general conformity, in a fashion that can be presented in the FEIS. We believe that leaving a determination on the use or viability of emission credits until the design phase is inappropriate.

The Corps position on its general conformity obligations presented in the DSEIS is unclear and leads to confusion, as evidenced by the statement on page 5-5 under "Environmental Compliance," which states: "*Clean Air Act, as amended, 42 U.S.C. 7401 et seq*. Compliance: The 'general conformity' requirements of Section 17[6 *sic.*] (c)(1) of the Clean Air Act, 42 U.S.C. 7506(c)(1), will be adhered to by limiting construction and using 'clean' equipment to avoid exceeding air quality standards [general conformity emission applicability thresholds *sic.*] or by purchasing emission credits."

Should the Corps ultimately adopt either Alternative 1 or 2 with Emission Reduction Option 2 (which includes replacement of older equipment with new equipment[6] and increased/spread-out dredging schedule[7]) with enforceable environmental commitments that insure the use of new equipment with more stringent EPA emissions standards, and enforceable dredging schedule, then general conformity would be satisfied by the action falling below emission thresholds. However, should the Corps select not to use equipment with more stringent emission standards and/or shorten the construction schedule, then a general conformity analysis is required. Once project emissions exceed the *de minimis* threshold all emissions of the exceeded pollutant would have to be offset or otherwise accounted for in the state implementation plan.

Should an alternative or construction process be chosen that triggers a general conformity analysis (an alternative without emission reduction option # 2), we point out that a draft conformity analysis must undergo a public review process and a final conformity determination issued by the Corps before issuance of the Record of Decision. We are willing to work closely with the Corps to address these issues.

Comment EPA #18

EPA is concerned that the Corps' has focused more emphasis on efforts to avoid triggering the offset requirements of the general conformity regulations than the need for an analysis of the relative costs and benefits of that avoidance against the other project impacts that may be worsened by stretching the construction schedule out over more years. Those impacts include but are not limited to increased aquatic impacts or

Comment EPA #19

[6] Replace all non-road equipment with newer equipment that would meet EPA Tier 2, 3 and 4 emission standards that would be required for equipment model years 2011 and beyond. (Page 4-50 and 4-51; "This environmental commitment requires replacing all non-road equipment with newer equipment that would meet EPA Tier 3 and 4 emission standards that would be required for equipment model years 2011 and beyond. The clamshell and backhoe engines would need to meet Tier 4 emissions standards and support equipment would need to comply with Tier 3 and Tier 4 emission standards, depending on the equipment category and engine size. Table 4-12 presents the Tier 3 and Tier 4 emission limits based on engine size, in horsepower. In addition, the tugboats would also have to be equipped with engines that meet EPA's Tier 2 marine engine emissions standards presented in Table 4-12."

[7] Alternative One, 45-Foot MLLW Alternative would increase the dredging six months (from 36 to 42 months) while Alternative 2, 50-Foot MLLW Alternative would increase the dredging four years (from 48 months to 73 months over eight calendar years). Air quality shutdown periods would occur every other winter.

Comment EPA #20

increased costs from multiple re-deployments of equipment. EPA requests that the Corps take a hard look at these comparisons before any final decision is made to avoid one impact at the expense of increasing another. With respect to general conformity, EPA notes that offsets for a time-limited project such as this construction may be supplied using time-limited discrete emission reduction credits. The Agency is aware of at least two recent projects that have successfully secured such credits to offset emissions from construction projects. It is possible that such credits may be available in the open market, and it would be important to weigh the cost of such credits against the potential impacts and costs of an extended schedule. In addition, the analysis in Appendix O of the DSEIS does not appear to explore the option of excluding emissions of ozone precursors that occur outside the ozone season from the conformity analysis. The options for a construction schedule presented in Appendix O, Attachment A, Part 4 suggest that a substantial portion of the construction operations will occur during the winter under most of the options. If the project proponent is prepared to accept enforceable commitments that require a portion of its operations to occur outside the ozone season, those emissions attributable to non-ozone season operations may be excluded from the conformity analysis and reduce the emissions subject to the offset requirement.

Comment EPA #21

Emission Reduction and Mitigation

EPA strongly encourages the Corps to require the use of new non-road equipment that would meet EPA Tier 2, 3 and 4 emission standards. As specified in the DSEIS's "Environmental Commitments," section 4.8.4, page 4-50, the clamshell and backhoe engines would meet Tier 4 emissions standards and support equipment would need to comply with Tier 3 and Tier 4 emission standards, depending on the equipment category and engine size. The DSEIS also notes that tugboats would be equipped with engines that meet EPA's Tier 2 marine engine emissions standards.

Comment EPA #22

EPA recommends including an enforceable commitment in the Record of Decision and specifying this environmental commitment in the contract specifications with enforceable provisions to reduce impacts on air quality, consistent with CEQ's NEPA regulations which require that the Record of Decision include mitigation as conditions in the approvals and funding for the project. 40 CFR 1505.3(a) and (b).

National Ambient Air Quality Standard Nonattainment Areas, and Attainment Areas with an Ongoing Maintenance Plan

Comment EPA #23

The DSEIS identifies the project area as located in the Metropolitan Boston Interstate Air Quality Control Region (AQCR), [40 CFR 81.19]. While this is a true statement, it is more relevant in determining applicable Clean Air Act requirements to indicate that the project is in an area that has been designated nonattainment or is subject to a maintenance plan. The relevant areas for the project are the Boston-Lawrence-Worcester (E. Mass), MA moderate eight-hour ozone nonattainment area and the Boston area carbon monoxide attainment area with an associated maintenance plan.

Table 3-11 & Table O-1 Ambient Air Quality Standards

Comment EPA #24

These tables should be updated to reflect recent revisions to the ozone standard. On March 12, 2008, EPA Administrator Stephen L. Johnson signed the final rule revising the National Ambient Air Quality Standards (NAAQSs) for eight-hour ozone to a level of 0.075 parts per million (ppm), specifying the level of the primary standard to the nearest thousandth ppm. EPA also revised the secondary eight-hour ozone standard by making it identical to the revised primary standard. The Federal Register was published March 27, 2008 (73 FR 16436 — 16514) making the revised eight-hour ozone standards effective on May 27, 2008. NAAQSs can be found on EPA's web site at URL address: http://www.epa.gov/air/criteria.html.

Eight-Hour Ozone SIP

Comment EPA #25

Page 3-94 identifies the eight-hour ozone demonstration State Implementation Plan as under development. Please note that the Massachusetts Department of Environmental Protection submitted its eight-hour ozone Reasonable Further Progress (RFP) State Implementation Plan, as well as its eight-hour ozone Attainment Demonstration State Implementation Plan to EPA on January 31, 2008.

General Conformity Regulations

Comment EPA #26

On Tuesday, January 8, 2008, EPA proposed revisions to the general conformity Regulations (73 FR 1402 — 1428). Depending on the timing of the FEIS and the Corps general conformity determination, the Corps may be able to take advantage of the flexibility and benefits offered by a revised final general conformity rule.

CD-ROM disk provided in Attachment B

Comment EPA #27

Page O-11 references a marine vessel MS Excel emissions calculation spreadsheet developed by CDM which was to be included in the CD-ROM disk provided in Attachment B. Our copy of the DSEIS did not include a copy of the CD-ROM. Please submit a copy of the MS Excel spreadsheet for marine vessel emissions to EPA for review.

Page O-14 references a non-road emissions spreadsheet which was to be included in the CD-ROM disk provided in Attachment B. As noted above, our copy of the DSEIS did not include a copy of the CD-ROM. Please submit a copy of the MS Excel spreadsheet for non-road emissions. Page O-14 also references a MS Excel spreadsheet developed by CDM to calculate the on-road annual emissions, which is presented in Attachment A. Please submit a copy of the MS Excel spreadsheet for on-road annual emissions.

Finally, page O-14 references the MOBILE6.2 model input and output files which was to be included on a CD-ROM disk provided in Attachment B. Page O-18 also makes reference to the CD-ROM disk containing MOBILE6.2 input and output files. Because the CD-ROM was not included in our review copy of the DSEIS we respectfully request a copy of all MOBILE6.2 input and output files for review.

We will review the new information contained in the spreadsheets and the CD-ROM and supplement our comments on the DEIS as appropriate based on our review of that information.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
One Blackburn Drive
Gloucester, MA 01930-2298

JUN 2 2008

Colonel Curtis L. Thalken
Attn: Michael Keegan
U.S. Army Corps of Engineers
New England District
696 Virginia Road
Concord, MA 01742-2751

Ian A.Bowles, Secretary
Attn: Deirdre Buckley, MEPA Analyst
Executive Office of Energy and Environmental Affairs
Suite 900
100 Cambridge Street
Boston, MA 02114

Re: Boston Harbor Deep Draft Navigation Improvement Dredging Project, Feasibility Report and Draft Supplemental Environmental Impact Statement; Draft Environmental Impact Report

Dear Colonel Thalken and Secretary Bowles:

The National Marine Fisheries Service (NMFS) has reviewed the Draft Supplemental Environmental Impact Statement (DSEIS) and the Commonwealth of Massachusetts' Draft Environmental Impact Report (DEIR) for the Boston Harbor Deep Draft Navigation Improvement Dredging Project. This project involves the improvement dredging of approximately 12.1 million cubic yards (cy) of material from the Broad Sound entrance channel, the Main Ship channel, the Reserved channel, the Mystic River channel, and the Chelsea River channel. Dredged material from the proposed project will be placed at Massachusetts Bay Disposal Site (MBDS). In addition, approximately 1.2 million cy of rock will be removed from the Broad Sound entrance channel, Main Ship channel, and the Chelsea River channel by blasting.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) and the Fish and Wildlife Coordination Act require federal agencies to consult with one another on projects such as this. Insofar as a project involves essential fish habitat (EFH), as this project does, this process is guided by the requirements of our EFH regulation at 50 CFR 600.905, which mandates the preparation of EFH assessments and generally outlines each agency's obligations in this consultation procedure. While the EFH assessment contained in the DSEIS/DEIR addresses many of the issues associated with this project, specific information necessary to evaluate anticipated impacts has not been received. This information, as described below, is necessary for NMFS to fully evaluate anticipated

Comment NMFS #1

impacts on fishery resources and habitat. Upon receipt of additional information, NMFS will provide specific EFH conservation recommendations, as appropriate.

Comment NMFS #1

Presence of Fishery Resources in Boston Harbor

Boston Harbor provides habitat for a variety of living marine resources, including, but not limited to, the commercially and recreationally important winter flounder (*Pseudopleuronectes americanus*), rainbow smelt (*Osmerus mordax*), alewife (*Alosa pseuodoharengus*), blueback herring (*Alosa aestivalis*), and American lobster (*Homarus americanus*). There is ample evidence that winter flounder utilize the proposed project area for spawning and juvenile development habitat. According to the NOAA Technical Memorandum NMFS-NE-138 (EFH Source Document), winter flounder generally spawn over sand, silt, and mud substrates in nearshore habitats from less than five meters deep, as well as offshore areas at depths of up to 90 meters on Georges Bank (Pereira et al. 1999). With the exception of Georges Bank and Nantucket Shoals populations, mature winter flounder spawn in the shallow waters of inshore bays and estuaries (Pereira et al. 1999). Because winter flounder eggs are demersal and adhesive in nature and larval and young of year winter flounder also prefer shallow inshore waters, spawning, egg development and early juvenile development habitat tend to be close together (Pereira et al. 1999). According to the EFH Source Document, winter flounder eggs and larvae have been collected at temperatures ranging from 0 to about 20.5 degrees Celsius. As such, it is anticipated that winter flounder eggs and larvae would be present within Boston Harbor during the winter, spring, and early summer. In addition, NOAA's Estuarine Living Marine Resources Program has identified winter flounder eggs and larvae as being abundant in Boston Harbor during this portion of the year (US Department of Commerce 1994).

The 2004-2005 final report for the Mystic Power Generating Station along the Mystic River in Everett, Massachusetts contains detailed information regarding the impingement and entrainment of fishery resources as a result of operations. This power station is located upstream of the proposed dredging footprint. As noted within the final report, approximately 16 million winter flounder larvae were entrained into the facility in this 12-month period (Shaw 2006). While this facility is located upstream of the proposed project footprint, this study suggests that inner portions of Boston Harbor are currently being utilized for winter flounder spawning and juvenile development.

The May 1995 Finfish Sampling and Description Report prepared by Normandeau Associates for the Army Corps of Engineers (ACOE) 1995 improvement dredging project of the inner Boston Harbor identified substantial winter flounder presence in the project area. This study included sampling at stations located within the inner and outer harbor. The trawl data identify winter flounder as being the most numerous finfish at each station, and winter flounder catch per unit effort (CPUE) as the highest of all species for all stations combined (Normandeau 1995). In view of these data provided in the reports and publications provided above, NMFS maintains that Boston Harbor and the Mystic and Chelsea Rivers support populations of winter flounder that utilize the area for spawning and juvenile development.

In addition to winter flounder, anadromous rainbow smelt, alewife, and blueback herring currently utilize Boston Harbor, the Mystic River, and the Chelsea River as a migratory pathway between upstream spawning locations and Massachusetts Bay. The 1995 Normandeau study associated with the improvement dredging of Boston Harbor found use of the area by alewife, blueback herring, and rainbow smelt through gill net sampling. Over all stations combined, blueback herring (26%), rainbow smelt (25%), and alewife (15%) were found to be the most abundant species sampled using gill nets (Normandeau 1995). Entrainment studies within the Mystic Station final report for 2004-2005 found that approximately 1.8 million rainbow smelt larvae were entrained in the facility (Shaw 2006). Further, this study found that 497 alewife and 27,379 blueback herring juveniles and adults were subject to impingement resulting from operations (Shaw 2006). As such, NMFS maintains that this area is being utilized by anadromous fish, including blueback herring, rainbow smelt, and alewife. It is important to note that due to the low populations of alewife and blueback herring throughout the Commonwealth of Massachusetts, the Massachusetts Division of Marine Fisheries has prohibited all harvest of these species. In addition, rainbow smelt has been identified as a "species of concern" by NMFS, who is assessing whether the species warrants listing under the Endangered Species Act. These actions underscore the importance of these species in Massachusetts and New England as well as the need for measures which avoid and minimize impacts on anadromous fishery resources.

Comment NMFS #2

The substrate found within the project area also serves as habitat for benthic organisms, such as shellfish and other invertebrates living within and on the surface of the sediment. These organisms contribute to the productivity of the federally managed species as a food source for both juvenile and adult life stages of finfish. The commercially important American lobster has been documented extensively within Boston Harbor by the Massachusetts Division of Marine Fisheries through the 1990-2002 Massachusetts Bay Lobster Trawl Sampling Program.

Issues associated with dredging

The proposed dredging and the resulting suspended sediment and deposition may result in adverse effects to fishery resources and habitats. The EFH Source Document states that winter flounder eggs range in size from 0.74-0.85 mm in diameter, and are demersal and adhesive (Pereira et al. 1999). The eggs have been shown to be adversely affected by minimal levels of sediment deposition. Research conducted at the NMFS Northeast Fisheries Science Center's Milford Lab found that sediment deposition at depths of ½ the egg diameter (~0.5 mm) resulted in reduction in hatch of eggs (David Nelson, personal communication, 2003). In addition, a recent study found that deposition of suspended sediments can have adverse effects on winter flounder eggs at approximately 1.0 mm (Walter Berry, personal communication, 2006). While this study found that deposition at greater than 3mm reduced hatch significantly, there was also a reduction in hatching success (approximately 60 percent down to 35 percent) at deposition levels of 0.5mm-1.0mm (Berry et al. 2006). It is important to note that this study dealt solely with total hatch success, and did not deal with sublethal effects, such as developmental deformities, which may result from burial. There is also evidence that egg burial of approximately 1.0 mm results in increased time for winter flounder eggs to hatch, which results in a greater

Comment NMFS #3

risk of predation (Berry et al. 2006). Furthermore, it has been indicated that larval stages of winter flounder may be susceptible to impacts from suspended sediment due to abrasion (Walter Berry, personal communication, 2006).

As stated above, Boston Harbor, Mystic River, and Chelsea River serve as habitat for a number of anadromous fishery resources. These anadromous fishery resources serve as prey for a number of federally managed species and are considered a component of EFH pursuant to the MSA. In addition, these are NOAA trust resources that are covered under the Fish and Wildlife Coordination Act. NMFS remains concerned that dredging activities and associated plumes of contaminated sediment have the potential to impair migration of anadromous species. Chiasson (1993) found an increase in swimming activity of rainbow smelt when suspended sediments were present. Such alarm reactions have been found to disrupt schooling behavior of fishes (Wildish and Power 1985). In a laboratory study, Wildish and Power (1985) found that rainbow smelt avoided suspended sediment when concentrations were in excess of 20 Mg/L. Furthermore, sublethal effects to estuarine fishes can include decreased feeding, impacts from lowered oxygen levels, as well as impacts on gills and associated respiratory impacts (Wilber and Clarke 2001).

Comment NMFS #4

Comment NMFS #5

The DSEIS/DEIR states that the sediment plume from the dredging is expected to be contained within the vicinity of the proposed dredge area. The primary means for this determination was the use of the SSFATE model for the 2004-2005 Outer Boston Harbor maintenance dredging project, as well as the plume tracking performed for the construction of the CAD cell within Boston Harbor during the previous improvement dredging project in 1998-2002. During the review of the Boston Harbor Inner Harbor Maintenance Dredging project in 2006, NMFS raised concerns regarding the applicability of the SSFATE model used in the suspended sediment dispersion analysis, as described in our May 12, 2006 letter to the ACOE. In a letter dated February 22, 2007, the ACOE developed a water quality monitoring plan for the inner harbor maintenance dredging project to be performed in 2008. This plan includes a real-time dredge plume tracking effort in order to identify the extent of suspended sediment dispersion resulting from dredge operations. Results of this effort should be utilized, in part, to develop a dredge sequencing plan to avoid and minimize adverse effects to fishery resources in certain areas and times when they would be most susceptible to adverse impacts.

Comment NMFS #6

Issues associated with blasting

The DSEIS/DEIR contains limited information regarding anticipated effects resulting from the proposed blasting. Specifically, the DSEIS/ DEIR and EFH assessment does not include an analysis of the location, timing, and methods of the proposed blasting and the anticipated impacts on living marine resources. NMFS acknowledges the need to advance the project, however, this blasting impact information is important in order to fully anticipate adverse effects to fishery resources and to identify suitable minimization techniques. This detailed assessment of impacts should be incorporated into the proposed blasting plan.

Comment NMFS #7

The recent blasting events associated with the Boston Harbor Maintenance Dredging project resulted in a series of fish kills. As noted in the DSEIS/ DEIR, the ACOE is currently in the process of preparing an "after action report" to provide information and determine what lessons can be learned from the 2007 fish kill events, and to identify corrective measures that can be used to avoid and minimize impacts on fishery resources during the proposed deep draft improvement project. This "after action report" should be incorporated into the recommended blasting plan.

The DSEIS/DEIR discusses the formation of an interagency underwater blasting technical working group in order to discuss construction sequencing and potential constraints as well as operational procedures and equipment for the proposed blasting. NMFS believes that this can be an effective approach in the development of a comprehensive blasting plan. In addition to an assessment of impacts, the blast plan should address potential operational impact minimization measures, sequencing options, impact thresholds, and an adaptive management protocol. This blasting plan should be developed and approved by the interagency technical working group prior to any blast operations. Comment NMFS #8

Beneficial uses of rock as artificial reefs

According to the DSEIS/DEIR, the ACOE is considering the utilization of the blasted rock to create artificial reefs over an area of approximately 220-530 acres of soft bottom habitat within Broad Sound. The DSEIS/DEIR discuss three alternatives considered as beneficial reuse, including the use of rock for upland construction purposes, use for ongoing shore protection projects, and use of rock as artificial reefs. The document states that upland alternatives and shore protection alternatives were eliminated from consideration due to uncertainty. Due to recent discussions with MassPort regarding the potential use of the Marine Terminal as a transfer facility, NMFS maintains that the upland alternatives should be more fully explored. Comment NMFS #9

In the context of the beneficial reuse of blasted rock for creating artificial reefs, the DSEIS/DEIR assumes that hard bottomed habitat is preferable to soft bottom habitat. Although less structurally complex, soft bottom habitats serve as habitat for a variety of resources. As noted in the DSEIS/DEIR, soft bottom areas of the Broad Sound preferred reef site are utilized by benthic invertebrates, lobster, and fishery resources such as flounder, red hake, and sculpin. As the Broad Sound reef site contains areas of both hard and soft substrates, the FSEIS/FEIR should consider the loss of soft bottom habitats as a result of the creation of artificial reefs relative to the overall ecosystem functions and values. Comment NMFS #10

Capping of the former Industrial Waste Site

As noted in the DSEIS/DEIR, the ACOE is considering the use of dredged material to cover potential hazardous and radioactive waste located within the former Industrial Waste Site (IWS) located adjacent to the MBDS. In order to test a methodology for capping of the IWS, a demonstration project is planned for the dredged material disposal in the MBDS associated with the upcoming Boston Harbor Maintenance Dredging project. While the results of the demonstration project will be unavailable for the FSEIS/FEIR, information should be presented to federal and state resource agencies in order to determine if this method is acceptable for use for the IWS capping project. Comment NMFS #11

Essential Fish Habitat Assessment

As noted in the EFH assessment included in the DSEIS/DEIR, this portion of Boston Harbor serves as EFH for 23 federally managed species, including, but not limited to, Atlantic cod, haddock, pollock, whiting, red hake, white hake, winter founder, yellowtail flounder, windowpane flounder, American plaice, ocean pout, Atlantic mackerel, and summer flounder. As noted above, our ability to assess potential impacts on EFH and associated marine resources was complicated by insufficient information in the document. Section 305(b)(2) of the MSA requires all federal agencies to consult with NMFS on any action authorized, funded, or undertaken by that agency that may adversely affect EFH. Included in this consultation process is the preparation of a complete and appropriate EFH assessment to provide necessary information on which to consult. NMFS recommends that the following additional information regarding project impacts and issues relative to fishery resources and habitats be provided in order for us to fully assess the adverse effects of the proposed project. Upon receipt of this information, NMFS will provide specific EFH conservation recommendations, as appropriate.

1) A sequencing plan should be developed for dredging activities. This plan should avoid and minimize adverse impacts on winter flounder and anadromous fish resulting from increased levels of suspended sediment and deposition. This sequencing plan should be coordinated with federal and state resource agencies.

2) A comprehensive blasting plan should be developed by an interagency underwater blasting technical working group. As noted above, this plan should have a detailed discussion of anticipated impacts on fishery resources, and should address potential operational impact minimization measures, sequencing options, impact thresholds, and an adaptive management protocol. This blasting plan should be approved by the interagency technical working group.

3) Alternative beneficial reuse options that avoid and minimize adverse impacts on biologically productive soft bottom habitats should be evaluated more fully within the FSEIS/FEIR.

4) In order to assess potential impacts resulting from the proposed capping at the IWS, the results of the upcoming demonstration capping project within MBDS should be presented to federal and state resource agencies.

Comment NMFS #12

Endangered Species Act

Three species of federally threatened or endangered sea turtles and three species of endangered whales may be found in Massachusetts waters. The sea turtles in Massachusetts nearshore waters are typically small juveniles with the most abundant being the federally threatened loggerhead (*Caretta caretta*), followed by the federally endangered Kemp's ridley (*Lepidochelys kempi*). Loggerheads and Kemp's ridleys have been documented in waters as cold as 11°C, but generally migrate northward when water temperatures exceed 16°C. These species are typically present in Massachusetts waters from June through November. Federally endangered leatherback sea turtles (*Dermochelys coriacea*) are located in New England waters during the warmer months as well. While leatherbacks are predominantly pelagic, they may occur close to shore, especially when pursuing their preferred jellyfish prey. Green sea turtles *(Chelonia mydas)* may also occur sporadically in New England waters, and any occurrence in Massachusetts waters is likely to be rare. Sea turtles are known to occur on Stellwagen Bank and in Massachusetts Bay. While no surveys for sea turtles have been conducted in Boston Harbor, suitable forage and habitat exists in this area and it is likely that sea turtles occasionally are present in Boston Harbor.

Federally endangered North Atlantic right whales (*Eubalaena glacialis*) and humpback whales (*Megaptera novaeangliae*) are also found seasonally in Massachusetts waters. North Atlantic right whales have been documented in the nearshore waters of Massachusetts from December through June. Humpback whales feed during the spring, summer, and fall over a range that encompasses the eastern coast of the United States, including Massachusetts Bay. While these whale species are not considered residents of the Boston Harbor area, transients occasionally enter the area as they complete seasonal migrations in nearby Massachusetts Bay. For example, in April 1996 a right whale was documented in Boston Harbor, and in the fall of 2000, a humpback whale was documented in Boston Harbor. Fin (*Balaenoptera physalus*), Sei (*Balaenoptera borealis*), and Sperm (*Physter macrocephalus*) whales are also seasonally present in New England waters, but are typically found in deeper offshore waters and are not likely to occur in Boston Harbor.

Comment NMFS #13

The ACOE requested consultation pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended, regarding the Boston Harbor Deep Draft Navigation Improvement Project in 2005. In a letter dated September 6, 2005, NMFS concurred with the ACOE's determination that the project was not likely to adversely affect listed species. However, at that time, the ACOE had indicated that the removal of 2-6 million cy of material was likely and the ACOE did not indicate to NMFS that blasting would be necessary. As such, the consultation only considered the effects of dredging 2-6 million cy of material, as opposed to the 12.1 million cy currently proposed for removal, and did not contemplate the effects of the currently proposed blasting operations.

Reinitiation of consultation is required and shall be requested by the federal agency or by the Service, where discretionary federal involvement or control over the action has been retained or is authorized by law, and: (a) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in the consultation; (b) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the consultation; or (c) if a new species is listed or critical habitat designated that may be affected by the identified action. As the action has been modified from the action considered by NMFS in the September 6, 2005 letter, reinitiation of consultation is necessary. As such, the ACOE will need to provide NMFS with a determination of effects to listed species that analyzes the potential for impacts of the

Comment NMFS #14

additional dredging as well as from the proposed blasting. In order to determine the likely effects of blasting on listed species, additional information on the underwater noise resulting from the project as well as information on timing, sequencing, and monitoring is necessary. Should you have any questions about these comments, or the reinitiation of consultation, please contact Julie Crocker in NMFS' Protected Resources Division at (978) 281-9300 ext. 6530, or by e-mail (Julie.Crocker@Noaa.gov).

Comment NMFS #15

Conclusion

In summary, NMFS requests additional information be provided in order to fully evaluate potential impacts on listed species, fishery resources, and habitats. Specifically, we recommend that a dredging sequencing and comprehensive blasting plan be developed for this project. Further, we recommend that alternative beneficial reuse options for blasted rock be explored. Finally, NMFS recommends that further coordination regarding the capping demonstration project and proposed capping at the IWS should occur. Upon receipt of this information, NMFS will provide specific EFH conservation recommendations, as appropriate. Additionally, as noted above, section 7 consultation must be reinitiated to consider the effects of the additional dredging as well as the effects of blasting on listed species. Should you have any questions regarding these comments, please contact Christopher Boelke of my staff at (978) 281-9131.

Sincerely,

Peter Colosi

Peter D. Colosi
Assistant Regional Administrator
for Habitat Conservation

cc: US ACOE - Michael Keegan, Cathy Rodgers
US EPA - Robert Varney, Phil Colarusso
US FWS – Vern Lang, Maria Tur
MA DMF - Paul Diodati, Kathryn Ford
MA CZM - Leslie Ann McGee, Bob Boeri
MA DEP - Lealdon Langley, Ken Chin
MassPort Maritime Department - Deb Hadden
MEPA - Deerin Babb-Brott
Boston Conservation Commission – Chris Busch
NOA/PPI – Steve Kokkinakis

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CITY OF BOSTON
THE ENVIRONMENT DEPARTMENT

Boston City Hall, Room 805 • Boston, MA 02201 • 617/635-3850 • FAX: 617/635-3435

June 2, 2008

Ian A Bowles, Secretary
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, 9th Floor
Boston, MA 02114
Attention: Deirdre Buckley, MEPA

Colonel Curtis L. Thalken, District Engineer
United States Army Corps of Engineers, New England District
696 Virginia Road
Concord, MA 01742-2751
Attention: Michael Keegan, Project Management Division

Re: Boston Harbor Deep Draft Navigation Improvement Project - Draft Feasibility Report and Supplemental Environmental Impact Statement/Environmental Impact Report

Dear Secretary Bowles and Colonel Thalken:

The City of Boston Environment Department and staff of the City of Boston Conservation Commission have reviewed the Draft Feasibility Report (DFR) and joint Draft Supplemental Environmental Impact Statement/Environmental Impact Report (DSEIS/EIR) for the Boston Harbor Deep Draft Navigation Improvement Project (Deep Draft Project) and offers the following comments.

The U.S. Army Corps of Engineers (ACOE) and the Massachusetts Port Authority (Massport) have proposed the Deep Draft Project which will include increased navigation access to Massport's Conley Container Terminal on the Reserved Channel in South Boston by dredging to a depth of at least -45 feet mean lower low water (MLLW) and improvement dredging in the Mystic and Chelsea Rivers, Main Ship Channel, the Presidents Roads Anchorage and the Broad Sound North Entrance Channel. The project proponents note that the Deep Draft Project is necessary due to existing delays to container ships and bulk carriers caused by insufficient tidal depths; the light loading of vessels, or partial loading or unloading of vessel cargo to meet tidal windows; and the bypassing the Port of Boston by carriers to meet arrival schedules at other East Coast Ports. Other stated reasons for the project include carriers that add larger vessels to their fleets may not include Boston on their itineraries, and recent shipping trends indicating cargo being shifted increasingly from the Port of New York/New Jersey to Boston Harbor.

The Department supports the project and is aware of the need for the proposed improvement dredging due to the limitations that existing drafts place upon current and future vessel traffic, and the importance of Port of Boston's shipping activity to the local and regional economy. Given the size and scope of this project, and the disruptive nature of dredging upon marine habitat, and impacts on water and air quality, the project environmental mitigation requirements should be thoroughly detailed in the Final SEIS/EIR. The proponents should also continue to work with state and local resource conservation agencies in the development and implementation of mitigation measures and protocols to ensure the protection of the harbor's environmental resources. Comment COB #1

The Deep Draft Project will be one of the most significant dredging projects in Boston Harbor, involving the dredging of between 6.6 and 14.8 million CY of parent material and between 450,000 and 1.4 million CY of rock, affecting over 1,140 acres of harbor bottom. Parent material will either be placed at the Massachusetts Bay Disposal Site (MBDS), and/or utilized for beneficial uses such as the capping of the Industrial Waste Site overlapping MBDS. Beneficial uses or dredged rock may include creation of hard bottom habitat in Massachusetts Bay and Broad Sound (and the armoring of seashore areas within Boston Harbor with problematic coastal erosion). Some unsuitable dredge material may be disposed of in existing or previously permitted Confined Aquatic Disposal (CAD) cells within the harbor. Comment COB #2

The blasting of rock is of particular concern given the four fish-kill events that occurred in the fall of 2007, associated with the Boston Inner Harbor Maintenance Dredge Project (BIHMDP). These events have illustrated the limitations of the blasting mitigation measures, which included insert delays, shock wave attenuation measures, a fish startle system, side scan sonar, and a fisheries observer. A complete review of the adequacy of these measures should be addressed in the ACOE "after action report" on the fish kill events, and discussed with the interagency blasting technical working group, once it is convened. The findings of this report, the mitigation measures used to date and potential new mitigation technologies must be reviewed prior to the completion of the development of a blasting plan for the Deep Draft Project. The project blast plan should require a stoppage of blasting in the event of a fish kill and assessment of possible causes and changes to blast methodology prior to re-commencement of blast activities. The blasting technical working group should also be informed and consulted on all marine mammal or fish kill event. Non-blasting options should also be discussed such as a closed dredge bucket, impact devices, or a large tooth bucket on an excavator, which have been previously employed for ledge removal. The non-blast methodologies should be assessed for the types of impacts they may have on marine species and whether they are viable methods of removing the different types of rock and ledge material found in the harbor. Comment COB #3

The Beneficial Use Alternatives section of the DSEIS/EIR notes several possible applications of dredged parent material, including the capping of the Industrial Waste Site (IWS) in Massachusetts Bay and creation of new rock reef habitat in Broad Sound and Massachusetts Bay. It is our understating that a pilot study is to be conducted with parent material from the BIHMDP to assess the feasibility of using such material to cap the IWS. The findings of this study should be provided and utilized to inform the Deep Draft Project final design. If unsuitable silt material needs to be disposed of into CAD cells within the harbor, disposal activities should not delay the capping of cells utilized for the BIHMDP. Comment COB #4 Comment COB #5

The DSEIS/EIR states that Broad Sound and Mass Bay are the most suitable sites for creation of hard bottom habitat after assessing and ranking five possible habitat enhancement sites. Comment COB #6

However, the site ranking and Hard Bottom Habitat Report rate the Mass Bay site as fourth, it ranks last in benthic habitat quality. The DSEIS/EIR references depth and location constraints as the rationale for selecting Mass Bay. Given the extent of disturbance the project will cause to marine habitat, the beneficial use sites must be selected based upon locations where the greatest enhancement of bottom habitat will occur. The proponent should further substantiate the rationale for not selecting the Magnolia site as a preferred enhancement location. Whether all or a portion of the rock will be used for beneficial use, as well as the size and type of rock most appropriate for bottom habitat should also be addressed. Additionally, the final design should be coordinated with state and federal resource agencies to ensure that the rock is suitable and its placement is properly configured and located in areas where existing rock and cobble habitat is not currently present.

As noted in the DSEIS/EIR, multi-year monitoring of the habitat creation sites is necessary to determine if colonization occurs and if such rock disposal options serve as a beneficial use. The Department is also aware of the need for armoring stone for several coastal areas within Boston Harbor and the Harbor Islands. Use of removed rock for shoreline protection should be discussed further as it may serve to benefit the project proponent as well as state and local landowners within the harbor.

Comment COB #7

The Environmental Consequences section (4.0) should include a discussion of possible impacts of dredge material transport and disposal at the IWS and MBDS upon the adjacent Stellwagen Bank National Marine Sanctuary. With the recent issuance of a Draft Management Plan for the sanctuary, there has been renewed focus on the lack of effective management of the ecosystem, resulting in serious decline of the sanctuary's marine life. The transport of dredge spoil and its disposal must be reviewed to ensure that such activities are not contributing to a decline in viability of sanctuary and the numerous marine species that inhabit the area.

Comment COB #8

Turbidity from dredge activities has the potential of affecting harbor water quality in the vicinity of dredge equipment and adversely impacting important life stages of fish and shellfish. The DSEIS/EIR notes that the means by which the dredge equipment is operated can have an impact upon suspension of sediments and turbidity than the type of bucket used. The proponent should discuss how operational techniques and parameters such as dredge cycle-time, and practices such as scow washing, will be managed to limit turbidity. The document also references prior field monitoring results of dredge buckets and associated turbidity levels, noting greater turbidity associated with conventional buckets, and less with Cable Arm and environmental buckets. The proponent should employ to the greatest extent practicable the use of Cable Arm or environmental dredge buckets during the project to minimize water quality impacts. Closed buckets should be used for dredging of all silty material. Turbidity is problematic for eelgrass beds in particular, which provide important habitat to finfish and shellfish. The Biological Environment section (3.3.1) references eelgrass beds only located in small areas within Hull and Hingham Bay. The Final SEIS/EIR should update the section to include eelgrass beds located along the northwest shoreline of Long Island which have been established as part of the MA Department of Marine Fisheries Eelgrass Restoration Project.

Comment COB #9

Comment COB #10

The Biological Resource Impacts section of the DSEIS/EIR notes that benthic communities within the navigation channel will be destroyed as a result of dredging and blasting, and that such communities are expected to recover and return to pre-dredge conditions within a short period of time after the project, citing a 1977 Oregon study. The document also states that if significant areas of blue clay are exposed through dredging the number and type of organisms may be reduced. Given the scope of impacts the project will have on benthic habitat, the lack of specific study information on Boston Harbor benthic communities and uncertainty over such communities' ability to reestablish, a biological monitoring program should be developed to adequately assess whether benthic species actually re-colonize in dredged areas within Boston Harbor, and if so, to what extent. Such results can better inform project mitigation measures and provide more accurate information on the environmental impacts of dredge projects in Boston Harbor. Comment COB #11

As with prior and current dredging projects, prior to the start of dredging operations and barge transport of dredged materials, work areas and barge routes should be coordinated with the Boston Harbor Lobstermen's Cooperative and the Massachusetts Lobstermen's Association. To facilitate coordination the contractor should prepare a weekly schedule of dredging and disposal activities and forward it to these organizations at least 48 hours prior to the scheduled work. Comment COB #12

The Air Quality section (4.8), notes that mitigation measures will need to implemented during the project to avoid exceeding annual air quality emissions thresholds for Carbon Monoxide (CO), Nitrogen Oxide (NOx), and Volatile Organic Compound (VOC) emissions. Specifically, utilizing newer, cleaner burning off-road equipment (model year 2011 and beyond), and extending the three year dredge schedule. The shut down periods are proposed to occur in six month periods every two years from October to March. As NOx and VOC's are pre-cursers to ozone, an air pollutant most problematic during the summer months, the proponents should provide more detail as to why dredging is not occurring during the winter months. Comment COB #13

The proponent should ensure that the Technical Working Group continues to meet regularly throughout the duration of the dredge project to review and address any problems and operational changes that may be suggested by the dredge contractor. Comment COB #14

Thank you for the opportunity to offer comment.

Sincerely,

Bryan Glascock
Director

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The Boston Harbor Association
for a clean, alive and accessible Boston Harbor

2 June 2008

Colonel Curtis Thalken
District Engineer
U.S. Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751
ATT: Programs and Project Management

RE: Feasibility Report and Draft Supplemental Environmental Impact Statement, Boston Harbor Deep Draft Navigation Improvement Project

Dear Colonel Thalken:

The Boston Harbor Association is a non-profit, public interest organization founded in 1973 by the League of Women Voters and the Boston Shipping Association to promote a clean, alive, and accessible Boston Harbor. We have reviewed the April, 2008 Feasibility Report and Draft Supplemental Environmental Impact Statement for the Boston Harbor Deep Draft Navigation Improvement Project submitted by the Massachusetts Port Authority and the U.S. Army Corps of Engineers.

The Boston Harbor Association is a member of the proposed project's Technical Working Group, comprised of environmental representatives, scientists, city, state and federal representatives, and local stakeholders, and has

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been kept apprised of the project as well as the results of the prior maintenance dredging project.

Based on a review of the Draft Supplemental Environmental Impact Statement and briefings for the Technical Working Group, The Boston Harbor Association strongly supports the preferred alternative of the Deep Draft Navigation Improvement Project, which calls for deepening the Broad Sound North Entrance Channel of the Harbor to 50 feet, and the Main Ship Channel up to the Reserved Channel, the President Roads Anchorage, the Reserved Channel and its Turning Area to 48 feet.

The proposed alternative, known as Plan B, would allow existing companies calling on Conley Terminal in South Boston to use larger ships, and could potentially help attract additional container lines. During the past decade, the trend has continued where Boston is no longer a significant manufacturing center, but rather, a major distribution center for goods to the Northeast region. The Port of Boston will in the foreseeable future continue to receive extensive tonnage of imports (particularly from Asia) for distribution in the region, with some exports of raw materials such as scrap metal, paper, wood products, and some finished products.

Implementation of Plan B will allow deeper draft vessels into the Port of Boston. Two types of ships were modeled in the Draft Supplemental Environmental Impact Statement: a 4,700 TEU (twenty-foot equivalent unit, the measurement size for cargo containers) Panamax ship that shippers believe will most likely call on the Port of Boston if deepened, and a larger 5,600 TEU ship which potentially may be used by existing companies if the channel is deepened (page 135, Draft SEIS). According to the Draft SEIS, a fully-loaded Panamax vessel requires 48 feet of water depth in the harbor channels and 50 feet of water depth in the entrance channel (page 135).

In addition, the Draft SEIS (page 71) examined the planned use of the Massport Marine Terminal in South Boston by larger ships. Expanded use of the Marine Terminal would be for bulk carriers with cement, salt, gypsum, frozen seafood, and/or manufactured goods, with larger vessels eventually requiring 45 feet depths (main ship channel deepening above the Reserved Channel Turning Area).

As the project proponents continue to secure the necessary environmental permits, we ask that the following issues be further addressed:

Beneficial Re-use of Dredged Materials: We highly commend Massport and the U.S. Army Corps of Engineers for including a detailed analysis of the potential beneficial re-use of the dredged materials to be generated by this project.

According to the DEIR, two types of the dredged materials may potentially be suitable for re-use. In the first instance, blasted ledge, cobble, gravel, and other stony materials may be suitable for creation of hard bottom habitat favored by lobsters and other species in Boston Harbor and/or Massachusetts Bay (page 170 of Draft SEIS). Algonquin's Hubline project, for example, re-used some of its materials to create hard-bottom habitat, although on a much smaller scale than proposed for this project.

As indicated in the Draft SEIS, further evaluation needs to occur regarding two potential sites for hard-bottom habitat creation, and a plan needs to be developed for the placement of materials on the ocean floor. In addition, the final Environmental Impact Statement should detail an evaluation and monitoring program to determine how successful the habitat creation and colonization efforts are. Comment BHA #1

In the second instance, Boston Blue Clay, a stiff impervious clay, will be removed from the President Roads Anchorage and upper channel reaches. The Boston Blue Clay and other unconsolidated materials may potentially be suitable for capping the former Industrial Waste Site in Massachusetts Bay.

The former Industrial Waste Site overlaps and extends north of the current Massachusetts Bay Disposal Site in the Stellwagen Basin, and was used for the disposal of chemical, medical, and radiological wastes from the 1940s to the 1970s (page 174 of the Draft Supplemental Environmental Impact Statement). The waters around the Site were also used for disposal of construction waste, demolition debris, and derelict vessels.

The area in and around the former Industrial Waste Site is currently trawled by fishermen, and capping of the Site would reduce the potential of catching the debris, some of which is quite contaminated, in fishing nets. We strongly support a proposed demonstration project suggested by the project proponents, with care taken to ensure that ambient sediment does not become re-suspended during the disposal process. Comment BHA #2

Minimizing Impacts to Marine Life: In the past five years, thanks to the efforts of the Massachusetts Water Resources Authority, Boston Water and Sewer Commission, Department of Environmental Protection, City of Boston, and many others, Boston Harbor is cleaner than ever. A number of shellfish beds have re-opened near Logan Airport and Winthrop, and there are many more lobster traps in Boston Harbor.

Consistent with environmental mitigation requirements imposed upon the Algonquin Hubline project, we ask that a communications system be established with the fishing and lobstering communities regarding construction activities and timing to avoid impacts to lobster gear, and/or a monetary fund to compensate lobstermen in the event of damage to lobster traps located outside of the federal navigation channel from dredging or mobilization activities. In the case of the Algonquin project, a $50,000 fund was established for damage to lobster gear outside of the federal navigation channel, which ultimately was not fully Comment BHA #3 utilized due to limited impact upon lobster traps from that project.

The Draft SEIS notes that four fish mortality events occurred in fall, 2007 during the ledge pinnacle removal project of the Boston Harbor maintenance dredging project. Subsequent to the first mortality event, the Army Corps of Engineers met with its contractor to identify ways to prevent other mortality events. In spite of these measures, three other mortality events occurred during blasting events by the contractor.

We are concerned about the inability of the contractor to prevent fish mortality events during the Harbor maintenance dredging activities last year, and urge the permitting agencies to impose strict requirements upon the project proponents and their contractors to prevent any fish mortality events as part of this project.

Comment BHA #4

<u>Other Environmental Mitigation Measures</u>: Because of adverse environmental impacts from the Algonquin Hubline project, the state permitting agency required, amongst other conditions, a $5 million contribution to the not-for-profit Island Alliance organization to support use of the Harbor Islands.

In the event that adverse environmental impacts are identified with this proposed project, we ask that consideration be given to requiring, amongst other conditions, a monetary contribution to support water transportation in Boston Harbor and Massachusetts Bay if water transportation service

Comment BHA #5

is impacted from construction activities of this project.

On-going Environmental Oversight: In additional to local, state, and federal regulatory oversight of this project, we ask that a Technical Advisory Group continue to meet regularly to review progress of the project, any monitoring data with the project's independent environmental observer, and to discuss prevention measures in the unlikely event of fish mortality events or other environmental incidences.

Comment BHA #6

Thank you for your consideration. We look forward to timely approval of this much-needed project.

Sincerely,

Vivien Li
Executive Director
The Boston Harbor Association

Save the Harbor
Save the Bay

For Everyone

June 2, 2008

Colonel Curtis L. Thalken
District Engineer
U.S. Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Attn: Michael Keegan, Programs and Project Management Division

Re: Boston Harbor Deep Draft Navigation Improvement Project

Dear Colonel Thalken:

As you know, Save the Harbor / Save the Bay supports efforts such as dredging to keep the Port of Boston competitive provided that appropriate safeguards are in place to protect the environment.

I am writing to you today with two serious concerns about the proposed Boston Harbor Deep Draft Navigation Improvement Project that we hope you will address as you consider the feasibility of the proposed project.

Our first concern is air quality: Based on what we have seen, the Corps of Engineers apparently believes that it is simply not feasible to proceed with this project as described and meet air quality standards on a daily basis. Rather than look for a real solution to reduce daily emissions to an acceptabl level and protect the public health and the environment, they appear to have chosen to "game" the numbers.

Comment STH/B #1

It is disingenuous to propose to "work dirty" for 9 months, then suspend work on the project for three or six months, and then average the numbers to artificially meet "annual" air quality standards. There has to be a better- or at least more honest –way.

We are also concerned about the impact of the extensive blasting that this project would require on forage fish such as herring, alewife, rainbow smelt, and menhaden, as well as on the lobster, striped bass, codfish, tautog, pollack and flounder that are so important to our region's fisherman.

Comment STH/B #2

As you may recall, last year the Boston Globe reported that more than 2,00(fish were killed in four separate incidents related to blasting associated with routine maintenance dredging of the Harbor. To date, the Corps has yet to release a final report on the incidents.

Boston Fish Pier, 212 Northern Avenue, Suite 304 West, Boston, Massachusetts 02210
Phone: (617) 451-2860 Fax: (617) 451-0496 www.savetheharbor.org

As a result, we remain concerned that measures presently in place are insufficient to protect these and other marine species during even a "routine" project, and are clearly insufficient to protect the resource during the 18 months or more of daily blasting that the proposed project would require.

Boston Harbor and the Port of Boston are both remarkable resources. We hope that you will work with us to make certain that improvements to the port do not come at the expense of the health of the public, or of our $4.5 billion dollar investment in the harbor we have worked so hard to restore and protect.

Sincerely,

E. Bruce Berman, Jr.
Director of Strategy and Communications
Save the Harbor/Save the Bay

cc: I. Bowles/EOEEA
J. Wilkins/Massport

Boston Fish Pier, 212 Northern Avenue, Suite 304 West, Boston, Massachusetts 02210
Phone: (617) 451-2860 Fax: (617) 451-0496 www.savetheharbor.org

TOWN OF WINTHROP
TOWN COUNCIL

Town Hall
1 Metcalf Square
Winthrop, Massachusetts 02152

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Thomas E. Reilly

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Precinct 6:
Linda J. Calla

Carla Vitale
Council Clerk

May 30, 2008

Dear Mr. Keegan,

Attached is a report sent to the Town of Winthrop by a concerned constituent. Please accept it as our comments on the Boston Harbor Deep Draft Navigation Improvement Project. The Town of Winthrop is extremely concerned that the Army Corps of Engineers inappropriately denied the long anticipated and critically necessary share protection on Winthrop Shore Drive.

If the rationale utilized in its Winthrop Beach decision is consistently applied, then the Boston Harbor project should also be denied. If the Boston Harbor project is approved, then we expect that the Army Corps of Engineers will reconsider and reverse its denial of the Winthrop Beach project.

Comment
TOW #1

Very truly yours,

Thomas E. Reilly
Council President

May 7, 2008

U.S. Army Corps of Engineers – New England District
District Engineer
696 Virginia Road
Concord, MA 01742-2751
ATTN: Programs and Project Management Division (Mr. Michael Keegan)

and

Secretary Ian A. Bowles
EOEA, Attn: MEPA Office
[Deirdre Buckley], EOEA No.12958
100 Cambridge Street, Suite 900
Boston MA 02114

RE: Comments on the DSEIS/DEIR for the Boston Harbor Deep Draft Navigation Improvement Project

Dear Secretary Bowles:

The Town of Winthrop is very concerned about the substantial adverse environmental impacts associated with the proposed Boston Harbor deepening project. Specifically, a large portion of Broad Sound and the North Channel areas are designated Essential Fish Habitat (EFH) for cod and American lobster. This designation is based on the oceanographic conditions (basically, water temperature in this case), bottom type, and presence/absence data used by the National Marine Fisheries Service (NMFS) in accordance Magnuson-Stevens Fishery Conservation and Management Act. Comment TOW #2

As described in detail below, the NMFS will be required to determine that the seaward portion of the proposed Boston Harbor Deep Draft Navigation Improvement Project is an Aquatic Resource of National Importance (ARNI) to be consistent with their conservation recommendations for identical bottom type and EFH concerns at the proposed NOMES Site I borrow site (8 miles offshore of Boston Harbor). Moreover, the SDEIS/DEIR acknowledges that the proposed Boston Harbor project will cause a change in bottom substrate, resulting in a permanent impact to EFH and the associated ARNI. In an attempt to ensure consistent regulatory assessment, we request that both the "technical" personnel responsible for the ARNI determination from the U.S. Army Corps of Engineers and the NMFS be required to perform a scientifically-defensible comparison of EFH impacts associated with the outer harbor dredging and the NOMES Site I dredging prior to the preparation of a FEIS/FEIR. Once reviewed by qualified outside technical experts, this assessment should serve as the basis for EFH conservation

Comment TOW #3

Comment TOW #4

recommendations and hopefully ensure consistent regulatory decision-making for projects impacting cod and American lobster EFH in Massachusetts Bay.

In a recent decision, the U.S. Army Corps of Engineers recently denied the long anticipated shore protection project along Winthrop Shore Drive. The project was denied primarily because of one agency's (the National Marine Fisheries Service or NMFS) opinion regarding the value of offshore sand and gravel habitat to the "sustainability" of the cod population throughout the Northeastern U.S. In a letter from Louis A. Chiarella of NMFS to Christine Godfrey of the U.S. Army Corps New England District (NED) dated December 7, 2006,

NMFS maintain[ed] that gravel and cobble habitats (2mm - 256 mm) are an Aquatic Resource of National Importance [ARNI] due to its role in providing habitat essential to the sustainability of Northeast fisheries..

It is clear from this statement that the NMFS has determined that all gravel and cobble habitats in the Northeast U.S. are in an ARNI and this determination is not restricted to a 100-acre area 8 miles offshore of Boston Harbor. Areas designated as an ARNI prohibit activities that would impact the habitat such as dredging (including the proposed Boston Harbor navigation improvements), cable laying, and port development, but apparently not the equally damaging fishing-related impacts (e.g. bottom trawling and scallop dredging).

A review headed by Dr. Douglas Clarke of the U.S. Army Engineer Research and Development Center in Vicksburg, Mississippi indicated that "the NMFS case is primarily based on previous existing knowledge, presence/absence data, and assessments of critical habitat functions." They concluded that the sand, gravel, and cobble "habitat in question is of sufficient rarity with adequate evidence of significance to justify a high threshold of protection." The U.S. Army Corps North Atlantic Division (NAD) utilized this opinion as confirmation of the NMFS position and denied the use of NOMES Site I as a borrow source for Winthrop Beach.

Since the NMFS conclusions and the Army Corps denial were based strictly on the sediment comprising the ocean floor and whether the area was designated as an Essential Fish Habitat (presence/absence data), an area within Massachusetts Bay that has identical bottom habitat and EFH concerns should be afforded identical treatment and protection by the U.S. Army Corps of Engineers.

The geotechnical data presented in the Draft EIR for the Boston Harbor Deep draft Navigation Improvement Project clearly determined that the "sediments consist mostly of sand, gravel, and rock [cobble and boulder]" within the outer harbor. This information from the DEIR indicates that the sediments within the Boston outer harbor are as coarse as or coarser than the sediments at NOMES Site I. In addition, the DEIR acknowledges that the outer channel is EFH for most of the same species as NOMES Site I, most notably cod and American lobster.

One possible difference is the water depth at NOMES Site I, where the proposed borrow site is located at depths in excess of 80 ft MLLW that likely make it unsuitable for early benthic phase lobster (as proven by the extensive benthic sampling). However, the Boston outer harbor area where deepening is proposed consists of water depths that are highly conducive to early benthic phase lobsters and, therefore should receive a higher level of protection than the NOMES Site I habitat.

As described above, the NMFS has already designated gravel and cobble habitats within the Northeast as an ARNI, based upon EFH and bottom type considerations. Since this ARNI by default includes the Boston outer harbor channel (it has the same bottom type and EFH concerns as NOMES Site I), it will not be possible for the U.S. Army Corps of Engineers to issue a permit on the proposed dredging of the outer harbor channel.

To ensure consistency with recent previous habitat evaluations that have impacted regulatory decisions, the Town of Winthrop requests the following:

- The NMFS and DMF should be required to provide an analysis of the EFH and bottom type of the outer harbor channel relative to NOMES Site I and portions of the approved Hubline that crossed similar habitat. Using objective scientifically-defensible criteria, NMFS and DMF should be asked to develop fisheries conservation recommendations for the Boston outer harbor channel, supported by a clear concise reasoning for these recommendations in relation to the concerns they raised for NOMES Site I.
- Dr. Clarke's team at the Army Corps should review this NMFS/DMF analysis to determine whether they still agree with the ARNI designation for NOMES Site I and, if so, whether it is appropriate to impact one portion of the ARNI (the Boston outer harbor channel) and mandate protection of a different portion (NOMES Site I). This Army Corps team should justify their opinion with sound scientific arguments.
- An independent outside technical review of the analysis and Army Corps review should be performed to corroborate the conclusions and/or results of these other analyses. If this objective outside review should indicate that there is not clear scientific evidence supporting differences between the EFH, as well as bottom type, of NOMES Site I and the Boston outer harbor channel, the Army Corps should adopt this opinion as part of their regulatory decision and deny this portion of the harbor deepening project to protect the ARNI.

All of these analyses and reviews should be funded by the project proponent that has proposed the Boston Harbor deepening. In addition, the Town of Winthrop should be allowed to select the consultant to perform the independent technical review, subject to Army Corps approval based on the consultant's qualifications.

Comment TOW #5

Regardless of the ARNI concerns for the Boston outer harbor, the DEIR lacks the level of geotechnical investigation appropriate for a project of this magnitude. For example, the NMFS indicated that 15 cores at NOMES Site I was not sufficient to characterize the post-dredging substrate of an approximate 100-acre site (~1 core per 7 acres of dredged area). However, the density of coring performed for the Boston Harbor deepening project is not nearly as dense as the NOMES Site I project. This is especially concerning, since the DEIR acknowledges a high variability in bottom sediments throughout the project footprint. This level of sampling may be sufficient for a dredging contractor to perform the work, but clearly (according to NMFS) is inadequate to characterize the fisheries and benthic habitat that will exist once the deepening project is completed. In addition to these geotechnical concerns, we have the following specific comments regarding the DEIR:

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- The DEIR does not indicate that the proposed project is within the DMF designated "Cod Conservation Zone". According to the recent Army Corps denial of the Winthrop Beach project, the importance of the "Cod Conservation Zone" to the sustainability of the cod population in the northeast was an important consideration. Since the proposed dredging activities will have a substantial spatial and water quality (turbidity) impact on the "Cod Conservation Zone", the FEIR, Feasibility Report, and FEIS should provide a full assessment of these impacts. Winter flounder may be the primary concern within the upper portion of the Boston Harbor estuary; however, the outer portion of the system is prime American lobster and cod habitat. Turbidity impacts to EFH near the dredge footprint, any proposed mitigation sites, and at the offshore or nearshore dump sites should be included in this analysis. According to the recent Winthrop Beach decision, the discharge of dredged material was deemed to "cause or contribute to substantial degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic and economic values." The FEIR and FEIS needs to show how the proposed dredging activities, as well as any disposal activities, will not degrade the waters of the U.S. in a similar fashion, especially considering that many of the dredge-related activities will be performed within areas with the same EFH concerns and the disposal areas will create suspended sediment that will directly impact or migrate into areas of gravel and cobble bottom that have been designated an ARNI by the NMFS.

Comment TOW #6

Comment TOW #7

- The FEIR should clearly delineate areas that have previously been dredged versus areas of proposed new dredging/mining (including increased channel area associated with side slopes). In addition, maps clearly indicating bottom type within each of these areas, as well as EFH concerns. Although the DSEIS and DEIR indicate that two very different benthic environments exist within the project footprint, the document does not adequately evaluate these areas as distinct habitats relative to potential impacts associated with the proposed deepening project. For clarity, it would be more appropriate to evaluate the "soft bottom" and "hard bottom" benthic communities and fisheries resources in separate sections. For example cod is an important species of concern for the "hard bottom" associated with the outer harbor channel (Broad Sound and North

Comment TOW #8

Comment TOW #9

Channel); however, the Feasibility Study does not even mention the species as a primary interest. The evaluation of the "hard bottom" habitat, its importance to the fisheries of the Northeast U.S., and the impacts to this habitat associated with the proposed improvement dredging need to be evaluated in significantly more detail.

- The DMF and the NMFS required an intensive one-year fish trawl and benthic survey to evaluate the resources at Since Figure 3-33 clearly indicates that no fisheries data exist within the project area, the fisheries analysis contained within the DSEIS and DEIR is incomplete. We recommend that the project proponent seek guidance from the DCR and or the Sconset Beach Preservation Fund to develop an adequate fisheries evaluation plan. This requirement would be consistent with other recent dredging proposals in Massachusetts state waters, since dredging improvement projects are regulated using the same guidelines as sand/gravel mining. Comment TOW #10
- The DEIR and DSEIS acknowledge that early benthic phase lobsters presently are (a) prevalent in the project area, primarily adjacent to the existing channel, and (b) would lose substantial habitat if the outer channel footprint is increased as proposed. Presumably this destruction of habitat would have similar impacts to the early life stages of the cod population that utilize similar habitat. The FEIR needs to assess the direct impacts associated with this loss of habitat. Unlike the recently denied Winthrop Beach project, it is highly unlikely that this area of "hard bottom" will recover, since it will be within the channel footprint and, therefore maintenance dredging will be allowed to continuously damage the habitat. Due to this concern, compensatory mitigation will be required for this loss of habitat functions and values. Since the Winthrop Beach project was denied because of the "concern" over potential for permanent impacts to identical habitat, it is unclear how the regulatory agencies are going to permit an acknowledged permanent impact to this same habitat. Comment TOW #11

In addition to the fisheries concerns, the Town of Winthrop is very concerned about the proposed dredging project relative to potential changes to wave energy and/or wave direction that could impact the shoreline.The historic navigation channel significantly deepened an area offshore of Winthrop and Yirrell Beaches likely leading to a significant increase in wave energy and the associated alteration of sediment transport patterns. These alterations have directly led to increased erosion at Winthrop Beach and the existing public safety hazard to the residents of Winthrop. Therefore, as part of the environmental review process for the proposed Boston Harbor deepening project, we request that the Army Corps evaluate the long-term impacts of the present North Channel on coastal sediment transport patterns relative to the pre-channel conditions (Figure 2). In addition, this analysis should include an evaluation of the wave climate associated with the proposed channel improvements relative to existing conditions. Comment TOW #12

Due to the inherent bias and/or conflict of interest of the Corps in this situation, we further request that the Corps fund an independent external technical review of this effort by appropriate consultants selected by the Town of Winthrop. As the Army Corps is well aware, independent technical reviews have been performed to address concerns related to Comment TOW #13 other controversial projects (e.g. Canaveral Inlet in Florida). In these cases, the technical experts are selected by the affected party (in this case, the Town of Winthrop). If the historical or proposed navigation improvements cause any alteration in nearshore wave climate to the Winthrop shoreline, the Town will seek damages from the Army Corps in the form of beach nourishment and/or structural improvements as compensatory mitigation. Comment TOW #14

. In our view, it is not possible for the Army Corps to issue the needed 404 permit based on their recent denial of the NOMES borrow site. Unfortunately, there does not appear to be consistent leadership at the Corps decision-making level(s), which is likely one of the primary reasons for the needless delay and costs associated with the Winthrop Beach project. To be consistent with the NOMES decision, the proposed dredging of the outer channel should be denied with prejudice by the U.S. Army Corps of Engineers.

Very Truly Yours,

PART 3

SECRETARY’S CERTIFICATION
OF THE
ENVIRONMENTAL NOTIFICTION FORM
INCLUDING EIR SCOPING REQUIREMENTS

MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND
ENVIRONMENTAL AFFAIRS

WITH ATTACHMENTS

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
251 Causeway Street, Suite 900
Boston, MA 02114-2119

MITT ROMNEY
GOVERNOR

KERRY HEALEY
LIEUTENANT GOVERNOR

ELLEN ROY HERZFELDER
SECRETARY

Tel. (617) 626-1000
Fax (617) 626-1181
http://www.mass.gov/envir

March 10, 2003

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME	: Boston Harbor Deep Draft Navigation Improvement Project
PROJECT MUNICIPALITY	: Boston, Chelsea and Revere
PROJECT WATERSHED	: Boston Harbor
EOEA NUMBER	: 12958
PROJECT PROPONENT	: Massport
DATE NOTICED IN MONITOR	: February 8, 2003

Pursuant to the Massachusetts Environmental Policy Act (G. L. c. 30, ss. 61-62H) and Section 11.03 of the MEPA regulations (301 CMR 11.00), I hereby determine that this project **requires** the preparation of an Environmental Impact Report (EIR).

Project Description

As described in the Environmental Notification Form (ENF), the project consists of a feasibility study of potential deep-draft navigation channel improvements within Boston Harbor. The US Army Corps of Engineers (ACOE), in partnership with the Massachusetts Port Authority (Massport), is conducting the feasibility study. It will examine the Port of Boston's current and future role in maritime commerce and identify potential levels of future vessel traffic and commerce. The study will explore options for accommodating increased deep draft vessel traffic in Boston Harbor, including no action and channel deepening at a range of depths. The study will explore deepening the Entrance Channel, Main Anchorage and Main Ship Channel from -40 feet up to -50 feet mean lower low water (MLLW), the Mystic River Channel from -35 feet up to -40 feet MLLW and the Chelsea River Channel from -38 up to -40 feet MLLW. Channel deepening will be conducted with a mechanical bucket dredge and could generate approximately 6 million cubic yards (cy) of dredged spoils. Resource areas affected by the project include approximately 1,140 acres of Land Under Ocean and Fish Runs located within a Designated Port Area (DPA).

While the full range of disposal options will be addressed in the EIR, Massport has indicated that the majority of the dredged material will be natural clay and till (and to a lesser extent ledge) that is suitable for disposal at the Massachusetts Bay Disposal Site (MBDS). The remaining material is likely to be disposed of in one of the previously permitted Confined Aquatic Disposal (CAD) Cells developed as part of the Boston Harbor Navigation Improvement Project (BHNIP).

Permits and Jurisdiction

The project is undergoing MEPA review and requires the preparation of an EIR pursuant to Section 11.03 (a)(1)(a) because it requires a state permit and will alter more than ten acres of wetlands. The project requires a 401 Water Quality Certification from the Department of Environmental Protection (DEP), an Order of Conditions from the Boston, Chelsea and Revere Conservation Commissions, and Coastal Zone Management (CZM) Federal Consistency review.

Also, the project requires an Environmental Impact Statement (EIS) pursuant to the requirements of the National Environmental Policy Act (NEPA). Both MEPA and NEPA regulations allow (and encourage) joint review documents. Massport has indicated that the federal EIS and state EIR will be submitted as a single document that addresses the requirements of both review processes. The EIS/EIR should fully address both the federal and state scopes although I will ultimately issue a determination of adequacy only for those portions of the document required in the state scope.

Because the proponent is a state agency and is funding half of the project costs, MEPA jurisdiction extends to all aspects of the project that may cause significant Damage to the

Environment including air quality, water quality, threatened and endangered species, marine habitat, and fisheries.

Boston Harbor Navigation Improvement and Berth Dredging Project (#8695)

The planning and permitting process for the BHNIP addressed a number of issues that are directly relevant to the design and implementation of this project. The BHNIP was the first major dredging project in Boston Harbor in thirty years and was unique in terms of size, design, process and construction techniques. It included the maintenance and improvement dredging of the main shipping channels and berths within Boston's Inner Harbor. Over 784,850 cubic yards of dredged material deemed unsuitable for open-water disposal was placed within nine CAD cells constructed within the dredging footprint of navigation channels.

The overall size of the project and the amount of contaminated material (containing elevated levels of metals and organic compounds) raised a number of environmental issues and concerns related to dredging and the disposal of dredged materials. These issues and concerns were outlined in related environmental filings and addressed through project design and permitting. A Technical Advisory Committee (TAC), consisting of resource agencies, environmental advocates, scientists and others, was formed to help advise the proponent and was instrumental to the success of this project through the design, permitting and construction phases. The TAC helped evaluate a wide range of disposal alternatives, develop conditions for the Water Quality Certification, and modify construction and monitoring techniques as necessary.

The BHNIP, which was completed in late 2001, has provided a framework for creating an environmentally acceptable dredging and disposal plan. It furthered our understanding of dredging operations and techniques, provided valuable information about baseline conditions within Boston Harbor, and resulted in the development of guidelines for permitting and constructing CADs to minimize impacts. I expect that the recommendations included in the feasibility study for this proposed project will be MEPA.1
informed by the experience developed during the BHNIP and I encourage the proponent to include a summary of lessons learned in the EIR to facilitate understanding of the proposed design and mitigation. In particular, an evaluation of the utility of water quality monitoring methodology, the geographical behavior

of the CAD cells and data related to marine habitat will be useful.

SCOPE

The EIR should follow Section 11.07 of the MEPA regulations for outline and content, as modified by this scope. It should include a copy of this Certificate and of each comment received. The proponent should address the comments to the extent that MEPA.2 they are within this scope. The proponent should circulate the EIR to those who commented on the ENF, and to any state agencies from which the proponent will potentially seek permits or approvals.

The draft scope provided by the proponent within the ENF addresses most of the issues that should be included in the EIR including a No Action scenario to establish a baseline and a number of additional alternatives including alternatives for disposal of the dredged material.

Project Description

The EIR should clearly identify where this project and its MEPA.3 alternatives overlap with previous improvement and/or maintenance dredging. While Massport is the proponent of this project in terms of MEPA review, it is my understanding that the ACOE will conduct most of the actual dredging and related mitigation while Massport may implement discrete elements of it. The EIR should identify who is responsible for what elements of the project and its related mitigation and whether or not that responsibility shifts depending on the alternative selected. MEPA.4

Environmental Impacts

The EIR will include a section on environmental impacts of dredging and dredged material disposal including water quality, biological resources, threatened and endangered species, MEPA.5 historic and archaeological resources, noise and odor. This section should indicate which impacts are temporary and which are permanent. The EIR should identify wetland resource areas present within the project boundaries on a reasonably scaled plan and it should indicate the significance of the resources. MEPA.6

The environmental impacts section should include the secondary impacts of the deepening project such as increased ship traffic and an increase in the size of ships entering the harbor. The EIR should examine the impact of these changes to fishing, marine mammals, water quality, air quality and harbor uses. MEPA.7

Cumulative Impacts

A number of comments have suggested that the EIR should address the cumulative impacts of a number of ongoing and planned projects within Boston Harbor and Massachusetts Bay. As noted, a number of small and large scale projects with potential short and long term impacts to marine resources are planned within these areas. These projects are set against a background of impacts to coastal resources from a range of human activities, including use of existing disposal sites, shipping, commercial and recreational fishing, and long term climate changes. I believe these comments emerge from a concern that planning for appropriate activities and uses within our ocean resources are being permitted in the absence of a proactive management and planning framework and highlight the relevance of such an approach. EOEA agencies responsible for coastal planning permitting and decision-making can successfully address this issue over time in a comprehensive manner that could not be demanded of a single project proponent.

However, to assist the permitting agencies in their evaluation of the potential impacts of this project, the EIR MEPA.8 should describe ongoing and planned projects within Boston Harbor and Massachusetts Bay to include, at a minimum, the Hub Line gas pipeline project and the proposed Everett Extension, the ACOE maintenance dredging, and the use of an offshore borrow site (NOMES I) by the MDC as a sand source for the Winthrop Shores Reservation and Restoration Project. The description should include a summary of the projects' impacts, individually and cumulatively, including the size of the impacted area, the resources impacted by the projects, and the duration of the impacts. The description should also include a timeline that shows when the projects are planned to occur in relation to the dredging project. Coordination with agencies/organizations regarding existing infrastructure.

Alternatives

A number of project design alternatives will be included in the EIR that vary, incrementally, in the depth and areas of dredging. Dredged material disposal options and sites will be summarized. A preferred design and disposal alternative will be identified. This section should include a discussion of project MEPA.9 phasing. Will dredging be conducted only in one area at one time or will multiple areas be dredged at once? What are the volumes of material that will be dredged and disposed of over what time period? It should explore the comparative impacts to the substrate and water column of several smaller deepening efforts as opposed to one larger one and this information should be incorporated into the ACOE cost/benefit analysis. Finally, MEAP.10 it should include a discussion of the types of dredges that can be used for this project and compare the benefits and/or drawbacks of each.

The EIR should include a discussion of maintenance needs, MEAP.11 indicate how often maintenance dredging will be required and how associated dredged materials will be disposed.

Coordination with Proposed Projects

As noted previously, a number of projects have been proposed within the general vicinity of this one. The DEIR MEPA.12 should lay out a process for coordination with the agencies and organizations responsible for these projects to minimize conflicts and environmental damage.

The Massachusetts Water Resources Authority, NSTAR and the Central Artery/Tunnel Project have requested that the proponent address construction period impacts on existing harbor infrastructure such as utility crossings and the Ted Williams Tunnel, respectively. Impacts to one or more of the buried utilities, particularly the cross harbor electric power cable that is the primary source of power to the Deer Island Treatment plant, could result in very significant adverse effects. The cable construction, operation and maintenance and associated substations is borne entirely by the MWRA and its ratepayers.

The DEIR should lay out a clear process for coordination between parties, indicate who is responsible for identifying MEPA.13 actual locations and depths of existing infrastructure that could be directly affected by the project's construction, who is responsible for related costs, and, should include a contingency plan in the event that a problem occurs. Because the range of dredging depths being considered could result in little or no buffer between the utility cable and the ocean floor, the DEIR should explore the feasibility and cost of relocating the cable.

Technical Working Group (TWG)

As noted earlier, the ongoing participation of technical advisors for the BHNIP was critical to its success. I applaud the proponent's inclusion of a TWG for this project and expect the TWG will help refine the monitoring and mitigation requirements as the project is designed and developed. MEPA.14

Mitigation

The mitigation section should correspond with the areas of impact outlined in previous sections of the proponent's draft scope. Mitigation should address temporary, short-term and long-term impacts. MEPA.15

The proponent should indicate how it will minimize turbidity and migration of dredged sediments during dredging and disposal. MEPA.16 The proponent should identify dredging windows and related monitoring activities to minimize and mitigate impacts to fishery resources in, and adjacent to, the dredging and disposal activities. MEPA.17 In addition, the proponent should consider beneficial reuse of ledge material to provide benthic habitat and/or shore protection. MEPA.18 The state Water Quality Certification, issued by DEP, will be the vehicle for solidifying most mitigation requirements.

The EIR should include a summary of all mitigation measures to which the proponent has committed, including mitigation for construction period impacts. MEPA.19 The EIR should also include Proposed Section 61 Findings for use by the state permitting agencies.

March 10, 2003
Date

James W. Hunt for
Ellen Roy Herzfelder

Comments received:

02/27/03	Department of Environmental Protection (DEP)
02/27/03	Division of Marine Fisheries (DMF)
02/27/03	Coastal Zone Management (CZM)
02/28/03	Massachusetts Water Resources Authority (MWRA)
02/27/03	Massachusetts Turnpike Authority(MTA)/CA/T Project
02/28/03	City of Boston/The Environment Department
02/28/03	The Boston Harbor Association (TBHA)
02/28/03	NSTAR

ERH/CDB/cdb

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

DB

MITT ROMNEY
Governor

KERRY HEALEY
Lieutenant Governor

ELLEN ROY HERZFELDER
Secretary

EDWARD P. KUNCE
Acting Commissioner

RECEIVED
FEB 28 2003
MEPA

February 27, 2003

Ellen Roy Herzfelder, Secretary
Executive Office of Environmental Affairs
251 Causeway Street, 9th floor
Boston, Massachusetts 02114

Re: EOEA # 12958
Environmental Notification Form
Boston Harbor Deep Draft
Navigation Improvement Project

Attention: Deirdre Buckley

Dear Ms. Herzfelder:

The Department of Environmental Protection (DEP) has reviewed the Environmental Notification Form (ENF) published in the February 8, 2003, *Environmental Monitor* for a Feasibility Study (Boston Harbor Deep Draft Navigation Improvement Project [BHDDNIP]) of potential navigation channel improvements to the Port of Boston and this correspondence includes DEP's consolidated comments.

Project Description

The U.S. Army Corps of Engineers (ACOE), in partnership with Massport as the non-federal sponsor, plans to conduct a Feasibility Study of potential deep draft navigation channel improvements to Boston Harbor. The study will examine the Port of Boston's current and likely future levels of future navigation traffic and commerce through the port. The study will specifically investigate alternatives for accommodating increased deep draft vessel traffic in Boston Harbor, including channel deepening, cargo diversion, and no action to identify whether improvements are warranted. Environmental documentation as required under the Massachusetts Environmental Policy Act (MEPA) and under the National Environmental Policy Act (NEPA) will be conducted as part of the Feasibility Study. DEP notes that this project is categorically required to prepare an EIR.

Background Information

As MEPA is aware, in addition to the BHDDNIP, two additional navigational dredging projects for the Port of Boston have either recently been completed or planned to be performed in the near future; (1) the now-completed Boston Harbor Navigation Improvement and Berth Dredging Project (BHNIP), and (2) a federal maintenance dredging project of the main shipping channel to be undertaken solely by ACOE, proposed to begin the summer of 2003. In late 2001, ACOE/Massport completed the dredging and sediment management for the BHNIP (EOEA # 8695), which resulted in deepening of key tributaries and portions of the main shipping channel to 40 feet and related berths to depth ranging from 35 to 45 feet. The ACOE project will consist of maintenance dredging of the federal channels up to the CA/T Ted Williams Tunnel.

Comments

1. In addition to the above referenced navigation dredging projects, there are a number of ongoing and/or planned projects within the Boston Harbor environs which should be considered in the scooping of the BHDDNIP EIR. Those projects include, but are not limited to; (1) ongoing Maritimes and Northeast Pipeline/Algonquin Gas Transmission Company Hubline Project (EOEA # 12355); (2) proposed Everett Extension Pipeline Project (extension/modification to Hubline Project); (3) Massachusetts Water Resources Authority (MWRA) ongoing implementation of the Boston Harbor Cleanup; (4) MDC's Back-to-the-Beaches Program; (5) ongoing Central Artery/Tunnel Project, including opening of the Spectacle Island Park (EOEA # 4325); and the numerous shore-side development projects (including Portside @ Pier One/Boston Harbor Shipyard and Marina (EOEA # 12623), Pier 4 (EOEA # 12433), and Fan Pier (EOEA # 12083). DEP.1

   At the February 25th MEPA Scoping Session the issue of cumulative impacts and/or "overlapping" projects, was specifically raised as a significant concern. DEP agrees that this issue should be considered in the development of the EIR Scope.

2. DEP has agreed to actively participate in the BHDDNIP Technical Working Group (TWG). Yvonne Unger (Bureau of Resource Protection/Dredging Program) will be the DEP-designee on the TWG. DEP staff actively participated in the TWG for the previous BHNIP, an activity which was critical to getting consensus on that project. DEP expects that the discussions which will occur as part of the BHDDNIP TWG will be as successful. DEP.2

3. According to the ENF, and as discussed at the Scoping Session, the overwhelming majority of the approximate 6 million of cubic yards of material to be dredged and/or removed will be natural clay and till (and to a lesser extent ledge) which are planned to be barged to the MBDS, but ACOE anticipates that there will be some volume of silt materials that will probably not be allowed to be placed at the MBDS. The Feasibility Study will consider options for the management of this material, including; placement into one or more In-Channel CAD Cells that were permitted as part of the BHNIP, and upland disposition. At the Scoping Session the ACOE spokesperson stated that there currently is extensive capacity in various permitted, but unused, CAD Cells and that ACOE and Massport are likely to propose to place the silts into one or more of these cells. DEP.3

   During the environmental review, permitting, implementation and post-dredging monitoring of the BHNIDP, DEP staff have been directly involved in the consideration and assessment of the CAD Cell disposal activities. In this regard, DEP staff recently performed a review of the "One-Year Monitoring Plan for the Boston Harbor CAD Cells - Summary 2001" document prepared and submitted as a condition of the Water Quality Certification. Based on a review of this report and prior information, DEP is of the opinion that the CAD Cells are functioning properly and that DEP would therefore look favorably at a proposal by ACOE/Massport to utilize one or more of the unused (or partially filled) cells for disposal of the silty sediment from the BHDDNIP.

DEP would like to also indicate that based on its experiences working on the BHNIDP, CA/T and Hubline Projects, that an upland management option for significant volumes of silty sediment from Boston Harbor will be problematic.

4. At the Scoping Session concerns were raised by representatives from NSTAR and MWRA DEP.4
regarding impacts to utilities (particularly buried power cables) located in areas of the Harbor which would overlap with the proposed dredging footprint. According to the NSTAR representative, there were significant problems during the BHNIDP. Impacts to one or more of the buried utilities, particularly the power cable running down Reserved Channel to Deer Island, could result in very significant adverse effects, therefore DEP strongly recommends that the EIR scope fully address this issue.

5. It will be important for the proponent to closely coordinate with relevant local, state and federal resource agencies relative to minimizing and mitigation impacts to fishery resources in, and DEP.5
adjacent to, the dredging and sediment disposal activities. A key element will be defining allowable "dredging windows" and monitoring activities. DEP staff will need to be involved in all such discussions in that the WQC will be the state-permitting vehicle for defining the monitoring requirements, contingency measures, allowable dredging periods, etc. ACOE and Massport should carefully review the WQCs that have been issued by DEP for the BHNIDP, CA/T Ted William Tunnel and Hubline Projects as guides to the activities and conditions that are likely to be included in the BHDDNIP.

Feel free to contact Yvonne Unger at 617-292-5893 or me at 617-292-5698 if you have any questions regarding this correspondence.

Very truly yours,

Steven G. Lipman, P.E.
Special Projects Coordinator
Commissioner's Office

Cc: Mike Keagan (ACOE)
Deb Hadden and Jacki Wilkins (Massport)
Deerin Babb-Brott (CZM)
Vin Malkoski (DMF)
Dave Shakespeare, Yvonne Unger, Jim Sprague, Eric Worrall, Lealdon Langley (DEP)

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
251 Causeway Street, Suite 900, Boston, MA 02114-2136
(617) 626-12100 fax: (617) 626-1240

MEMORANDUM

TO:	Ellen Roy Herzfelder, Secretary, EOEA
ATTN:	Deirdre Buckley, MEPA Unit
FROM:	Tom Skinner, Director, CZM
DATE:	February 27, 2003
RE:	EOEA #12958 – Boston Harbor Deep Draft Navigation Improvement Project

The Massachusetts Office of Coastal Zone Management (CZM) has completed its review of the above-referenced Environmental Notification Form (ENF) noticed in the Environmental Monitor dated February 8, 2003. CZM understands that this project categorically requires the preparation of an Environmental Impact Report (EIR).

Project Description

The US Army Corps of Engineers (Corps), in partnership with the Massachusetts Port Authority (Massport), has initiated a feasibility study of potential deep-draft navigation channel improvements to the Boston Harbor. The study will examine the Port of Boston's current and future role in the maritime commerce of the nation, and identify likely levels of future vessel traffic and commerce through the Port. In addition, the study will investigate options for accommodating increased deep draft vessel traffic at Boston Harbor, including channel deepening, cargo diversion, and no action. The costs of implementing alternative options will be measured against estimated benefits to improving commercial transportation costs in order to identify whether improvements are warranted consistent with Corps policies. Plans for channel improvements will result in the deepening of the entrance channel and main anchorage (from –40 feet to up to –50 feet mean lower-low water (MLLW)), the main ship channel (from -40 feet to up to –50 feet MLLW), the Mystic River Channel (from –35 feet to –40 feet MLLW), and the Chelsea River Channel (from –38 to –40 feet MLLW).

Comments

CZM participated in the technical working group for the recently completed Boston Harbor Navigation Improvement Project (BHNIP), which deepened the Harbor to –40 feet MLLW, and looks forward to participating in a similar process for the Boston Harbor Deep Draft Navigation Improvement Project (BHDDNIP). CZM.1

Confined Aquatic Disposal, Water Quality, Fisheries Impacts

As part of the recently completed BHNIP project, the Corps used in-channel confined aquatic disposal (CAD) cells as a method of disposing of dredged sediment deemed unsuitable for disposal at the state approved ocean disposal site. At the MEPA scoping meeting, the Corps indicated its intention to consider use of the unused BHNIP CAD cells (approved under the

BHNIP) for the placement of contaminated dredged material from the currently proposed deepening effort. CZM supports the assessment of the previously approved CAD cells for this purpose. In the EIR, CZM requests that the Corps summarize the "lessons learned" from the recently completed BHNIP with regard to this method of sediment disposal, in addition to recommended changes for the upcoming dredging project based on that information. In particular, an evaluation of the utility of the water quality monitoring methodology, the geographical behavior of the CAD cells, and any other available data related to impacts to marine habitat will be useful for the evaluation of the proposed dredging project. CZM.2

Cost/Benefit Analysis

CZM understands that the Corps must perform a cost/benefit analysis of any project it proposes to construct using federal funds. It is our understanding that this analysis will be performed incrementally for the BHDDNIP project, i.e., the cost/benefit model will be applied to a project that deepens to -42 feet MLLW, -44 feet MLLW, -46 MLLW, etc., up to -50 feet MLLW, and the depth selected will be that which provides the most benefit for the least cost, in accordance with Corps regulations.

The Corps' cost/benefit analysis often leads to the selection of a depth that most parties recognize will not be sufficient to meet even the mid-term needs of the shipping industry. As is often the case, the need for channel depths in excess of the BHNIP selected depth of -40 feet was recognized prior to the completion of that project. With this in mind, CZM requests that the Corps consider, as part of the cost/benefit analysis, the environmental impacts of disturbing the substrate and impacting the water column with several smaller deepening efforts as opposed to one larger one. CZM.3

Coordination With Utility Providers, Other Projects

During the scoping session, concerns were raised by N-Star and the MWRA regarding the respective agencies cables and pipelines which run under Boston Harbor. CZM suggests that the EIR lay out a clear process for coordination between any parties with utilities in the area of the proposed dredging project. The EIR should discuss a similar process for coordination between the other multiple projects taking place in and around Boston Harbor during a similar timeframe. CZM.4

Proposed Outline

The ENF contains a proposed outline for the BHDDNIP draft EIR/SEIS. Except as requested above, the outline appears to cover most of the relevant issues associated with the proposed deepening project. CZM looks forward to seeing the information referenced in the draft outline, and will comment in detail on its findings when the EIR/SEIS becomes available.

Additional Review

As stated in the ENF, this project will be subject to CZM federal consistency. The project must be found to be consistent with CZM's enforceable program policies. For further information on this process, please contact Jane W. Mead, Project Review Coordinator, at 617-626-1219 or visit the CZM web site at www.state.ma.us/czm/fcr.htm. CZM.5

TWS/MG

Cc: Deerin Babb-Brott, Assistant Director
Massachusetts Office of Coastal Zone Management
James Sprague, Section Chief
Northeast Regional Office, MA DEP
Deb Hadden, Deputy Director of Maritime
Massport
Vin Malkoski, Fisheries Biologist
Division of Marine Fisheries

D3

Commonwealth of Massachusetts

Division of Marine Fisheries

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Paul J. Diodati
Director

February 27, 2003

Ellen Roy Herzfelder, Secretary
EOEA, Attention: MEPA Office
Deirdre Buckley, EOEA No. 12958
251 Causeway Street, Suite 900
Boston, MA 02114-2150

Dear Secretary Roy Herzfelder:

The Division of Marine Fisheries has reviewed the Environmental Notification Form (EOEA #12958) for the Boston Harbor Deep Draft Navigation Improvement Project with respect to its effect on the marine fisheries resources of the Commonwealth. We offer the following comments for your consideration.

The proposed Scope of Work for the DEIR/DEIS prepared by the Army Corps of Engineers appears to have identified the major resource questions that must be addressed. It is our understanding that the specific data sets and techniques to be used in this evaluation will be identified and defined by the Technical Working Group. In addition, there are several issues not included in the DEIR Scope of Work that need to be addressed:

1. The Corps should identify opportunities for beneficial reuse of dredged materials such as rock and cobble. In some areas, there may be an environmental benefit to leaving the unconsolidated material in place to provide benthic habitat. Other uses would include shore protection or redeployment in another area to enhance benthic habitat. DMF.1

2. The DEIR should include discussion of how this dredging project will contribute to the overall cumulative impact to marine resources and habitat caused by on-going projects in this portion of Massachusetts Bay. At this time, installation of the Hubline gas pipeline is altering nearly 30 square miles of bottom, the Corps is proposing to perform maintenance dredging that will remove approximately 250 acres of sand, cobble, and gravel from Broad Sound, and the MDC is proposing to remove 1 million cubic yards of cobble and gravel (approximately 100 acres) from nearby Massachusetts Bay. Alteration of these habitat areas will result in direct and indirect impacts to fisheries and the loss of habitat functions and value during recovery. For example, cobble and ledge habitat (critical habitat for juvenile cod and lobster) may take upwards of 10 years to recover from radical alterations and may never fully recover. DMF.2

3. Relative to the direct loss of habitat and temporal loss of function, creation of a comprehensive recovery monitoring and mitigation plan will be needed to compensate for these losses. This effort should be guided by the Technical Working Group and the plan included as a condition of project permits. DMF.3

Thank you for the opportunity to comment on this proposal and we look forward to working with the Army Corps and Massport on this project as part of the Technical Working Group. If you have any questions about this review, please contact Vin Malkoski in our Pocasset office at (508) 563-1779, ext. 119.

Sincerely,

Paul Diodati

Paul J. Diodati
Director

Cc: Timothy Famulare, Boston Conservation Commission
Michael Keegan, ACOE
Mike Johnson & David MacDuffee, NMFS Gloucester
Timothy Timmerman, US EPA
Deerin Babb-Brott & Jane Mead, MCZM
Steve Lipman, MA DEP
Yvonne Unger, MA DEP
Cunningham, Estrella, Kennedy, & Pierce, MDMF

DB

MASSACHUSETTS WATER RESOURCES AUTHORITY
Charlestown Navy Yard
100 First Avenue
Boston, Massachusetts 02129

Telephone: (617) 242-6000
Facsimile: (617) 788-4899

Frederick A. Laskey
Executive Director

February 28, 2003

Ms. Ellen Roy Herzfelder, Secretary
Executive Office of Environmental Affairs
MEPA Unit
251 Causeway Street, Suite 900
Boston, MA 02114

RECEIVED FEB 28 2003 MEPA

Attn: Dierdre Buckley, EOEA No. 12958

Re: Massport's Boston Harbor Deep Draft Navigational Improvement Project - EOEA #12958

Dear Secretary Roy Herzfelder:

Staff at the Massachusetts Water Resources Authority (MWRA) have reviewed the Environmental Notification Form (ENF) for Massport's Boston Harbor Deep Draft Navigational Improvement Project and attended the scoping session held on Tuesday, February 25, 2003 at the Black Falcon Terminal. Massport and the U.S Army Corps of Engineers (Corps) plan to conduct a feasibility study of potential deep draft navigation channel improvements in Boston Harbor. The study will examine the Port of Boston's current and likely future role in the maritime commerce of the nation and identify likely levels of future navigation traffic and commerce through the port. The costs of implementing alternative options will be measured against estimated benefits in reduced transportation costs in order to identify whether improvements are warranted consistent with Corps policies.

MWRA's comments and concerns are specifically related to the impacts to the existing cross-harbor electric cable that provides power to the Deer Island Treatment plant, the second largest treatment plant in the country. While the cable is owned by Harbor Electric Energy Corp. (a wholly owned subsidiary of Nstar), the cost of construction, operation and maintenance of the cable and associated substations is borne entirely by the MWRA and its ratepayers. The cable and substations were installed at a cost of approximately $40 million as part of the $3.5 billion Federal court mandated Boston Harbor Project.

The proposed limit of this project partially coincides with the current location of Nstar's 115Kv Submarine Power Cable which feeds the MWRA's Treatment Plant. As indicated in the ENF, there appears to be an overlap in the proposed deep draft dredging of the Reserve Channel and adjacent entrance to the Reserve Channel and the "as-installed" location of the Submarine Cable. Nstar documents indicate that this cable was installed at –50 feet and that the new dredging project proposes to increase the cut from the existing depth of –40 to the new depth of –42 to –50. It should be noted that the dredging process might result in areas being deepened an additional two feet beyond what is actually proposed.

Therefore, the dredging in the immediate area of the 115Kv Submarine Cable to the new proposed depths may lead to possible damage to the cable, resulting in the release of the insulating oil in the cable to the waters of the harbor and the potential long term disruption of the primary source of power to the treatment plant servicing over 43 cities and towns in metropolitan Boston. MWRA.1

Staff at MWRA need to have serious discussions with the Project Proponents on identifying and examining alternatives to dredging at the Reserve Channel so that impacts to the submarine cable are avoided. In addition, MWRA requests that the EIR/S identify the cost/benefits of moving the cable, if necessary, determine who pays for this undertaking, and include a contingency plan in the event of damaging the cable (loss of power to the treatment plant as well as water quality impacts with the release of oil contained in the cable.) MWRA cannot over emphasize the importance of the electric cable in the daily operation of the treatment plant, which services over 2.5 million people. MWRA looks forward to working with the proponents to assure that MWRA's electric source is not jeopardized and to assure that any costs associated with the project are not passed on to MWRA ratepayers. MWRA.2 MWRA.3

Thank you for the opportunity to comment.

Yours truly,

Marianne Connolly

Marianne Connolly
Program Manager, Regulatory Compliance

cc: Senator Robert Travaglini
Representative Robert A. DeLeo
Maggie Debbie, MWRA
David Finlay, MWRA
Jeff McLaughlin, MWRA

C: MEPA12958BosHarDredging

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Massachusetts Turnpike Authority
Central Artery/Tunnel Project

MAR 3 2003
MEPA

February 27, 2003

Secretary Ellen Roy Herzfelder
Executive Office of Environmental Affairs
Attention: MEPA Office
Ms. Deirdre Buckley, EOEA #12958
251 Causeway Street, Suite 900
Boston, MA 02114

Subject: Boston Deep Draft Navigation Improvement Project
Environmental Notification Form (ENF)

Dear Secretary Roy Herzfelder:

The Central Artery/Tunnel (CA/T) Project staff has reviewed the subject document. The proposed Navigation Improvement Project is located adjacent to the CA/T Project's Ted Williams Tunnel and our Excavated Materials Handling Site at Subara Pier.

The ENF notes that the Ted Williams Tunnel limits channel depths above the Tunnel to the 40 feet now provided; however, our design allows for accommodation of an approximately 600-foot wide, 45-foot deep channel over the Tunnel. In the future, if the channel depth is proposed to be deepened over the Tunnel, these dimensions should be verified.

Our only concern with the proposed dredging project is the deepening next to the Tunnel, MTA.1
especially any blasting in the vicinity of the Tunnel. We request documentation and close coordination with our Project and the MTA to ensure that the channel deepening and any associated construction activities such as blasting will not effect the Ted Williams Tunnel.

Massport officials have maintained a cooperative relationship over the years with the CA/T Project and the Massachusetts Turnpike Authority. We anticipate this ongoing cooperative relationship effort will continue during the design review, permitting, and construction processes for the Navigation Improvement Project.

185 Kneeland Street • Boston • Massachusetts • 02111 • Phone 617-951-6000 • Fax 617-457-8198

If you have any questions, please contact Ronald Killian, Manager of Environmental Permits and Procedures, at (617) 556-2453.

Sincerely,

MASSACHUSETTS TURNPIKE AUTHORITY

Paul A. Stakutis
Director of Environmental Affairs

PAS/AR/mal

cc: Mr. Michael A. Leone, Massport
Mr. James F. Cashman, MTA

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AL-1.2

CITY OF BOSTON
THE ENVIRONMENT DEPARTMENT

Boston City Hall, Room 805 • Boston, MA 02201 • 617/635-3850 • FAX: 617/635-3435

nB

February 28, 2003

Ellen Roy Herzfelder, Secretary
Executive Office of Environmental Affairs
251 Causeway Street, 9th Floor
Boston, MA 02114
Attention: Deirdre Buckley, MEPA Office

RECEIVED
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MEPA

Re: Boston Harbor Deep Draft Navigation Improvement Project, Environmental Notification Form, EOEA #12958

Dear Secretary Roy Herzfelder:

The City of Boston Environment Department has reviewed the Environmental Notification Form (ENF). We hereby submit the following comments to promote the use of proven environmental strategies and technologies in fulfilling environmental requirements.

PROJECT DESCRIPTION

The U.S. Army Corps of Engineers, and the Massachusetts Port Authority (Massport) propose to conduct a feasibility study of potential deep draft navigation channel improvements to Boston Harbor, known as the Boston Harbor Deep Draft Navigation Improvement Project ("BHDDNIP"). This study will include an examination of the current and likely future role of the Port of Boston in national maritime commerce and identify likely levels of maritime traffic. The study will also investigate alternatives for accommodating increased deep draft vessel traffic and a cost-benefit analysis of these alternatives to include channel deepening, cargo diversion, and no action.

RESPONSE

This Department supports the proposed study to assess the needs of the Port of Boston to accommodate increased maritime commerce. This project will require Orders of Conditions issued by the Boston Conservation Commission ("BCC") pursuant to the Massachusetts Wetlands Protection Act, M.G.L. Ch. 131, s. 40 ("the Act"). The involvement of BCC staff on the Technical Working Group ("TWG") for the recently completed Boston harbor Navigation BOS.1
Improvement Project proved very useful in designing the project to conform with performance

standards set by the Act and it s regulations; the Executive Secretary of the BCC has accepted the proponent's invitation to join the TWG for the BHDDNIP.

Several utility crossings were damaged or destroyed during dredging operations of the BHNIP. Repair efforts sometimes involved alteration of wetlands resources protected by the Act. The applicants should work with all affected utility owners to identify the location and depth of utility crossings to prevent unnecessary damage to them during the BHDDNIP. BOS.2

In the past decade, the land under Boston Harbor, which provides habitat to a diverse community of fish and marine invertebrates, some of which are commercially viable species, has been frequently disturbed by major projects, including the construction of the Ted Williams Tunnel crossing, the BHNIP, and the Algonquin Gas Hubline Project. The environmental documentation required under the Massachusetts Environmental Policy Act and the National Environmental Policy Act should carefully assess the cumulative effects of these disruptive BOS.3 projects and consider appropriate mitigation for destruction of marine species habitat that would occur as a result of the BHDDNIP.

Thank you for the opportunity to offer comment.

Sincerely,

Bryan Glascock
Acting Director

BHDDNIP.doc.DBG:TJF.tjf/03.02.010

The Boston Harbor Association

for a clean, alive and accessible Boston Harbor

DB

28 February 2003

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MAR 6 2003

MEPA

Secretary Ellen Roy Herzfelder
Executive Office of Environmental Affairs
251 Causeway Street, Suite 900
Boston, MA 02114
Att: MEPA Office

RE: Environmental Notification Form, Boston Harbor Deep Draft Navigation Improvement Project, Boston

Dear Secretary Herzfelder:

The Boston Harbor Association, a non-profit, public interest organization founded in 1973 by the League of Women Voters and the Boston Shipping Association, strongly supports the Massachusetts Port Authority and the U.S. Army Corps of Engineers' efforts to conduct a feasibility study of potential deep-draft navigation channel improvements to Boston Harbor.

The Boston Harbor Association was an active participant in the environmental oversight and planning for the Boston Harbor Navigation Improvement Project completed in 2001. That project deepened the main shipping channel to 40 feet and the associated berths to depths of 35 to 40 feet. Since completion of that project, however, the continued silting of the main shipping channel in other portions of the Harbor now require maintenance dredging to restore the shipping channel to a minimum 40 feet depth.

The economics and efficiencies of cargo transport currently and in the coming decade require the use of larger, state-of-the-art vessels. The Massachusetts Port Authority has done an excellent job of attracting new service to the Port of Boston, most recently, direct outbound ocean service to Asia. In order to be able to continue to attract and keep such cargo service coming to the Port of Boston, however, the shipping channel must be deepened to accommodate larger vessels.

The proposed feasibility study is a much-needed and welcomed step towards deepening of Boston Harbor. We have reviewed the Environmental

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Notification Form, including the attached outline of the feasibility study, and offer the following comments:

Project schedule: The estimated commencement date for the deepening is 2009, with completion in 2011. While we understand that the study will require more than a year to complete, followed by the need for budget appropriations, it is our hope that commencement of the deepening can occur before 2009 if the study supports such action and if funding is available. Any delay beyond then will adversely impact the viability of the Port of Boston. BHA.1

Study introduction: The outline for the feasibility study suggests a section on the "Historical Importance of the Port of Boston" within the chapter on "Project Purpose and Need". We believe that only minimal attention should be given the role of the Port in the 18th, 19th, or even early 20th centuries, and that this section on project purpose and need should focus on the future of the Port of Boston, and the measures that need to be taken to sustain it.. A more crucial discussion is why the region needs to have a Port of Boston, and the economic impacts to the region as a whole without a viable Port. We believe that this section is important in helping to justify the need for funding of the project, and should be written with sufficient facts and details to support the project. BHA.2

We would also suggest that "Discussion of Previous Dredging Projects in the Port of Boston" be moved from the section on Project Purpose and Need to the section on History or Summary of Major Changes from the 1995 EIR/S for the previous project.

Sediment Disposal: Regarding the disposal of dredged sediments, we assume that disposal methods used for the previous dredging projects will be considered, in addition to other ocean or land disposal sites. BHA.3

Environmental Consequences: Regarding environmental consequences of dredging, we urge that short-term impacts from dredging be identified, as well as the longer-term impacts.

During the previous dredging project, a Technical Advisory Group (TAG) was convened to regularly review the monitoring data with the project's independent environmental observer. We have recently been asked to participate on a similar Advisory Group for this project, and would BHA.4

anticipate that such a group will meet regularly and be an active participant in the environmental oversight of this project, similar to the past TAG.

Coordination with other projects: We urge close coordination between the Algonquin HubLine Project- Everett Extension and this project, in the event that the timing of the projects should overlap. A Notice of Project Change for the Everett Extension of the HubLine Project was recently filed with the Massachusetts MEPA Program and a filing was submitted to the U.S. Federal Energy Regulatory Commission, and it is not clear how long the federal and state regulatory review processes will take before construction of the Extension Project could begin. BHA.5

Coordination with other projects during the time of the project (currently estimated to be 2009 to 2011) should also occur, to minimize any adverse impacts.

Thank you for your consideration.

Sincerely,

Vivien Li
Executive Director

VL: pr

PART 4

COMMENTS AND RESPONSES
TO THE
ENVIRONMENTAL NOTIFICTION FORM

RESPONSE TO COMMENTS ON ENVIRONMENTAL NOTIFICATION FORM			
Comment Reference	**Comment Summary**	**Response**	**"At A Glance" Quick Section Reference**
MEPA.1	Proponent should include a summary of lessons learned in the EIR to facilitate understanding of the proposed design and mitigation. In particular, evaluate the utility of water quality monitoring methodology, the geographical behavior of the CAD cells and data related to marine habitat.	Experience from the BHNIP has guided development of the dredging and disposal program for the Deep Draft Project. The lessons learned as a result of the extensive environmental monitoring conducted during construction of Phase I and Phase 2 of the BHNIP will be implemented, where applicable, to reduce potential Deep Draft project impacts. Also, fish kills were observed during underwater blasting in the fall of 2007 in Boston Harbor for maintenance dredging in spite of the use of measures such as side scan sonar, fish observers and fish startle systems suggested by resource and permitting agencies to minimize potential impact to fish. An interagency working group has been convened to look at potential measures to further reduce this potential impact. See the Executive Summary Section 1.2 for a detailed summary of BHNIP "lessons learned." Section 4.2.1 *Physical Impacts in Boston Harbor*.	SEIS/EIR Executive Summary Section 1.2 Section 4.2.1
MEPA.2	Circulate the EIR to those who commented on the ENF and to any state agencies from which proponent will seek permits or approvals.	This DSEIS/EIR has been circulated to those who commented on the ENF and to state agencies responsible for issuing permits/authorizations for the project. See Section 10 *Distribution List for DSEIS/EIR*.	Section 10
MEPA.3	The EIR should identify the overlap between this project and previous improvement/maintenance dredging projects.	The relationship between the Deep Draft Project and previous improvement/maintenance projects is discussed in Section 1.2 *Summary of Major Changes*, Section 4.2.1 *Physical Impacts in Boston Harbor*, and Section 4.11 *Cumulative Impacts*; Section 4.2 also contains a figure showing the area boundaries of each dredging project.	Section 1.2 Section 4.2.1 Section 4.11 Figure 4.2

MEPA.4	The EIR should identify responsibilities of Massport and the Corps and whether responsibility shifts based on the alternative selected.	Section 1.1.3 *Congressional Authorization* outlines the Corps and Massport Feasibility Cost-Sharing Agreement (FCSA) for this project. Generally, the Corps is the lead agency for the construction regardless of alternatives selected, and Massport in its role as the non federal sponsor shares in the cost of the construction according to federal dredging cost sharing formulas.	Section 1.1.3
MEPA.5	The EIR section on impacts of dredging and dredged material disposal (water quality, biological resources, threatened and endangered species, historic and archaeological resources, noise and odor) should indicate which impacts are temporary and which are permanent.	This issue is discussed in the sections pertaining to Lessons Learned (see response to Comment MEPA.1) and then reviewed extensively throughout Section 4 *Environmental Consequences*. Generally speaking, the majority of impacts associated with dredging operations are temporary impacts. Temporary environmental impacts include turbidity impacts from deepening the channels, disruption of benthic habitat in the navigation channels as well as habitat disruption of lobster habitat in the channels and potential impacts to fish during dredging operations. Impacts from underwater blasting will be minimized by convening an interagency working group to identify practicable measures to reduce fish kills. In terms of dredge disposal operations, Section 4.4 *Disposal Impacts at the Massachusetts Bay Disposal Site* (MBDS) and Section 4.5 *Disposal Impacts at the Industrial Waste Site* (IWS) discuss short term impacts associated with the dredged material disposal plume (several hours), and note the longer term (18 months to 5 years) required for benthic recolonization and community succession to occur with full ecosystem recovery. Permanent impacts associated with this project are primarily associated with dredge disposal in that depositing the material will create mounds, thus altering the seafloor elevation. If dredged material is disposed of at the Industrial Waste Site, a permanent impact is the covering of the concentrated areas of barrels and surrounding sediment, thus reducing the risk to fishermen by isolating potentially contaminated areas from the environment. Another potential permanent benefit of the Deep Draft Project is	Executive Summary Section 4

		the placement of blasted rock in a shallow area with low productivity to provide critical habitat for several stages of commercial important species such as American lobsters. This is discussed in Section 4.3 *Benefits and Impacts at the Potential Habitat Enhancement* Sites.	
MEPA.6	Identify the boundaries and significance of wetland resources in the project area on reasonably scaled plans.	Wetland Resource Areas, as defined under the Massachusetts Wetlands Protection Act, affected by the project are Land Under the Ocean, Fish Runs and Designated Port Areas (DPAs). A plan outlining the overall project boundaries is presented in Figure 1-1. The project area is described in Section 3.2 *Physical Environment*. The discussion encompasses the physical oceanography, water temperature and salinity, water column turbidity, dissolved oxygen, nutrients, and sediment characteristics of Boston Harbor, the Habitat Enhancement Sites, the MBDS, and the IWS. Section 3.3 *Biological Environment* describes the submerged aquatic vegetation, benthic invertebrates, shellfish, lobster, fish, marine and coastal birds, and marine mammals and reptiles in the project area. Designated Port Areas are designated by Massachusetts Coastal Zone Management (CZM) under the provisions of 301 CMR 25.00. DPAs are designated areas in developed ports for the purposes of promoting and protecting marine industrial activities and certain supporting uses. Additional information on DPAs can be found at the CZM website http://www.mass.gov/czm. DPAs affected by the project are Chelsea, South Boston and Mystic River, with the bulk of the work occurring in South Boston. Pursuant to the Wetlands Protection Act, MA General Laws, Chapter 131, Section 40, Notices of Intent will be filed with the Boston, Chelsea and Revere Conservation Commissions when the project is in the design phase.	Figure 1-1 Section 3.2 Section 3.3
MEPA.7	Include secondary impacts of the deepening project such as increased ship	Section 4.12 *Secondary Impacts* generally assesses the landside secondary impacts likely associated with the Deep Draft Project,	Section 4.12 Section 4.8

	traffic and an increase in the size of ships entering the harbor in light of potential impacts to fishing, marine mammals, water quality, air quality and harbor uses.	focusing on ground transportation. The Final SEIS/EIR will expand this discussion. Section 4.8 *Air Quality* incorporates post-construction estimates of ship traffic emissions that consider the number of ship calls, the type, size and age of the ships (the latter especially relevant because newer ships operate more efficiently). Generally, the project would permit more cargo to be transported in fewer, newer ships whose calls would not need to be delayed by high tide cycles as currently occurs. The analysis of indirect emission presented in Section 4.8.3 *Air Emissions Modeling Results* indicates that the Deep Draft Project would reduce pollutant emissions due to changes in fleet mix for all shipping operations (i.e., fewer but larger ships), reduced anchoring activities for petroleum ships and less time for ships to move in and out of the harbor. The decrease would be only slightly offset by a small increase in pollutant emissions from cargo trucking changes that would occur as a result of the project. The secondary impacts noted in the air quality section (i.e., fewer (but larger) ships, no petroleum ship anchoring activities and less time for ships to move in and out of the harbor) are also likely to translate to secondary benefits to marine mammals, water quality, recreational boating, harbor uses and fishing.	Section 4.8.3
MEPA.8	Describe ongoing and planned projects within Boston Harbor and Massachusetts Bay, including a summary of the project's impacts, individually and cumulatively, including the size of the impacted area, the resources impacted by the projects, and the duration of the impacts. Include a timeline showing when the projects are planned to occur in relation to the dredging project.	Section 4.11 *Cumulative Impacts* evaluates the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. The Secretary's Certificate on the ENF required that a number of specific projects be included in the cumulative impacts section, thus the analysis includes major infrastructure projects as well as private projects in or adjacent to Boston Harbor planned to be undertaken within the timeframe of the Deep Draft Project.	Section 4.11
MEPA.9	In the alternatives assessment include a discussion of project phasing, exploring the comparative impacts to the substrate and	The feasibility investigation examined various deepening alternatives in one foot increments. Federal policy requires that the alternative that provides the highest net annual benefit	

	water column of several smaller deepening efforts as opposed to one large effort. Incorporate information into the cost/benefit analysis.	(annual project benefits minus annual project cost) be recommended if Federal funds are to be invested in the project. From a cost/benefit analysis the recommendation of the project with the highest net benefit represents the best investment of public funds. From a viewpoint of the water column and the substrate, deepening in incremental projects would have a detrimental affect on both. After dredging, the channel bottom is soon repopulated with benthic organisms. Coming in a short period of time later to do additional dredging to further deepen the channel would again displace the benthic organisms and again add suspended sediment into the water column.	
MEPA.10	Discuss the types of dredges that can be used for this project and compare the benefits and drawbacks of each.	Section 2.4 *Alternative Dredging Methods* describes the types of dredges that can be used to remove material from deep draft navigation channels, then assesses which types are suitable given the nature of the material being dredged under the Deep Draft Project (i.e., rock, till, other hard materials, and consolidated clay). A mechanical clamshell bucket dredge is proposed; a clamshell bucket will be used to remove the parent material for the deepening activities.	Section 2.4
MEPA.11	Present maintenance needs, how often maintenance dredging will be required and how associated dredged materials will be disposed.	Boston Harbor has historically had slow shoaling rates. Project features at Boston typically require maintenance on only a 16 to 40 year dredging frequency. There is a complete discussion of the anticipated shoaling rates and maintenance cycles of the various project components located in the Design and Cost Estimate Appendix D-2. As discussed in the Dredged Material Disposal Alternatives section of the feasibility report, less than half of the CAD Cell locations permitted for the 1998-2001 construction were used and the remaining locations will provide a long-term low cost method of disposal for unsuitable dredged materials through at least the next major maintenance cycle in the 2035 timeframe.	
MEPA.12	Coordinate with agencies and organizations responsible for proposed projects: lay out a process for coordination with agencies and	Section 5 *Agency Coordination and Compliance* outlines interagency cooperation. Section 6.3 *Technical Working Group* notes that the TWG is comprised of representatives from	Section 5 Section 6.3 Section 4.11.3

	organizations responsible for other projects to minimize conflicts and environmental damage.	Federal, State, and local resources agencies, environmental advocates, scientists and Port-of-Boston stakeholders. In terms of coordination with projects that may result in cumulative impacts, the analysis in Section 4.11.3 *Summary of Cumulative* Impacts concludes that based on the summary of the cumulative impact of the projects previously presented and the timing, location and magnitude of the projects analyzed, the Deep Draft Project is unlikely to result in significant cumulative impacts to water quality with respect to temperature and salinity, dissolved oxygen concentrations or nutrient concentrations. Temporary cumulative local increases in water column turbidity would result from dredging operations, and the impacts could be more pronounced if one or more of the proposed development projects are being constructed at the same time and in the vicinity of the dredging activities for the Deep Draft Project. Given that many of the projects are subject to obtaining necessary permits and approvals, it is not possible to determine whether some of these projects will occur at the same time as the Deep Draft Project. Implementation of the proposed mitigation measures for dredging and dredged material disposal activities will minimize potential increases to temporary turbidity and biological resources impacts. Positive impacts to subtidal habitat will result from the disposal of dredged rock for rocky bottom habitat enhancement activities within the harbor. Overall, the cumulative impacts of the Deep Draft Project are projected to be insignificant and temporary in nature. The proposed project will primarily deepen only previously disturbed areas in Boston Harbor, and the proposed habitat enhancement will be a positive impact.	
MEPA.13	Address the issues associated with MWRA, CA/T and NSTAR infrastructure by establishing a clear process for coordination between parties, clearly	Section 3.8 *Harbor Infrastructure* identifies the harbor tunnel crossings, sewer tunnel crossings and utility crossings associated with the Deep Draft Project. Section 4.10 assesses potential project impacts to the facilities. No impacts to harbor tunnels or	Section 3.8 Section 4.10 Section 6.3

	designating responsibilities for tasks and cost. Establish a contingency plan. Explore option of relocating utility cable.	sewer tunnel crossings are anticipated. The issue of the MWRA utility crossing is addressed in Section 4.10.3 *Utility Crossings*. A 1989 Corps permit issued to MWRA, Boston Edison (NSTAR's predecessor in interest), and Harbor Energy Electric Company ("HEEC," a wholly-owned subsidiary of Boston Edison) for the NSTAR lines required that they be buried to at least 25 feet below the mud line (or to a minimum –60 feet MLW). At that elevation the lines could be left in place, without modification, under a 45-foot to 50-foot channel improvement. The Corps learned in 2003, however, that the permittees did not comply with the permit requirements for minimum embedded depth for these lines during installation. The Corps engaged in extensive discussions from 2003 to 2004 with NSTAR and the MWRA in an attempt to resolve the permit noncompliance issues. These discussions did not lead to resolution of the issues, and in late 2004 the Corps referred the matter to the U.S. Attorney's office as an enforcement action. The U.S. Attorney's office has engaged in negotiations with NSTAR and MWRA to resolve the issues in a manner that will ensure that the NSTAR cable will not impact the current project. The negotiations have been productive and are ongoing. However, should the matter fail to be resolved through a negotiated settlement, the Corps would recommend that a permit enforcement action be filed in federal District Court, since, as noted above, if the relevant conditions had been satisfied at the time of installation, the cable would be located well below the proposed depths of the current improvement project. This DSEIS/EIR will be available for public review and mailed to utility companies for additional review.	
MEPA.14	Continue the inclusion of the Technical Working Group to help refine the monitoring and mitigation requirements as the project is designed and developed.	Section 6.3 *Technical Working* Group summarizes the meetings of the TWG during the preparation of the DSEIS/EIR. TWG meetings will continue to be held during the design and construction phases as warranted.	Section 6.3
MEPA.15	Mitigation should address temporary,	Section 4.13 *Mitigation* describes mitigation measures to be	Section 4.13

	short-term and long-term impacts.	included in the design of the project to reduce or eliminate impacts from dredging, blasting and dredge materials disposal. Mitigation efforts focus on impacts to air quality, natural resources and commercial lobster operations. As noted in the response to MEPA.5, the majority of project impacts are temporary in nature, thus related mitigation measures will also be implemented over the short-term.	
MEPA.16	Indicate the measures to be employed to minimize turbidity and migration of dredged sediments during dredging and disposal.	Section 4.2.1 *Physical Impacts in Boston Harbor* presents an extensive discussion of turbidity and concludes that a turbidity plume can be produced during dredging but is generally limited to the immediate vicinity of the dredge. The Deep Draft Project will be dredging primarily Boston blue clay and glacial till material, which have substantially less turbidity characteristics than silt, and use of a clamshell bucket will minimize impacts.	Section 4.2.1 Section 4.4
MEPA.17	Identify dredging windows and related monitoring activities to minimize and mitigate impacts to fishery resources in, and adjacent to, the dredging and disposal activities.	Section 4.13 presents the mitigation measures and monitoring activities to minimize impacts to fisheries resources in and adjacent to, dredging and disposal activities. Potential dredging windows for particular areas of the harbor and blasting windows as well as sequencing of project efforts will be discussed further with the resource agencies.	Section 4.13 Section 4.2.4
MEPA.18	Consider the beneficial reuse of ledge material to provide benthic habitat and/or shore protection.	Section 2.7 *Beneficial Use Alternatives* and Sections 2.8.3 and 2.8.4, *Industrial Waste Site* and *Habitat Enhancement Sites*, respectively, present the alternatives considered for beneficial use in this DSEIS/EIR. Also relevant are Section 4.3 *Benefits and Impacts at the Potential Habitat Enhancement Sites* and Section 4.5 *Disposal Impacts at the Industrial Waste Site.*	Section 2.7 Section 2.8.3 Section 2.8.4 Section 4.3 Section 4.5
MEPA.19	Include a summary of all mitigation measures to which the proponent has committed, including mitigation for construction period impacts. Include Proposed Section 61 Findings for use by the state permitting agencies.	See Section 4.13 *Mitigation Measures*. The Draft Section 61 Finding will be presented in the FSEIS/EIR, based in part on public review of this DSEIS/EIR.	Section 4.13

DEP.1	Consider the issue of cumulative impacts and/or "overlapping" projects.	See response to MEPA.8 comment.	Section 4.11
DEP.2	Continue the utilization of the Technical Working Group.	See response to MEPA.14 comment.	Section 6.3
DEP.3	Consider the use of one or more of the unused (or partially filled) In-Channel CAD Cells for disposal of silty sediment rather than employing an upland management option.	Section 2.8.1 *Confined Aquatic Disposal Cells* notes that there is no expected need for creation of additional confined aquatic disposal (CAD) cells in Boston Harbor for the Deep Draft Project. However, by the time the project is authorized, approved and funded for construction, some minor maintenance dredging of adjacent channel areas not maintained in the operations conducted between 1998 and 2009 may be found necessary. If so, construction of one or more smaller CAD cells from the population of previously approved but unconstructed sites may be required to properly dispose of that material. That will be an action separate and distinct from the Deep Draft Project covered by this SDEIS/EIR. If the Chelsea Street Bridge is replaced before or during construction of this Deep Draft Project, then approximately 120,000 cy of material would be removed to deepen and widen that section of the Chelsea River navigation channel. Some of the material would be disposed into the previously constructed CAD cell C12 or in the permitted IHMDP CAD cells. At this juncture no upland disposal options are under consideration for the Deep Draft Project.	Section 2.8.1
DEP.4	Fully address impacts to utilities (particularly buried power cables) located in areas of the Harbor which would overlap with the proposed dredging footprint.	See response to MEPA.13 comment.	Section 3.8 Section 4.10 Section 6.3
DEP.5	Closely coordinate with relevant local, state and federal resource agencies relative to minimizing and mitigation impacts to	As noted in the Executive Summary and Section 1.2 *Summary of Major Changes from the 1995 Final Environmental Impact Report/Statement*, experience from the BHNIP has guided	Executive Summary Section 1.2

	fishery resources in, and adjacent to, the dredging and sediment disposal activities, define allowable “dredging windows” and monitoring activities, and review previously issued WQCs as guides to likely activities and conditions.	development of the dredging and disposal program for this Deep Draft Project. The lessons learned as a result of the extensive environmental monitoring conducted during construction of Phase 1 and Phase 2 of the BHNIP, will be implemented, where applicable, to reduce potential Deep Draft Project impacts. Environmental monitoring required as part of the BHNIP WQC included: ➢ silt plume tracking during dredging of and after disposal into CAD cells; ➢ water quality testing after disposal into the CAD cells; ➢ biological testing; ➢ dissolved oxygen (DO) testing within and outside the CAD cells; and ➢ fisheries monitoring during blasting operations. Additional investigations, outside the scope of the WQC, were performed during BHNIP construction to address concerns raised by the Technical Advisory Committee or to address potential impacts from changes in operations suggested by the dredging contractor. These additional investigations included: ➢ water quality monitoring of disposal at low tide; ➢ monitoring turbidity while using the Contractor’s enclosed bucket; ➢ monitoring turbidity during vessel passage over an uncapped and capped CAD cell; ➢ bathymetric measurements; and ➢ lobster monitoring. Results of the monitoring showed no water quality violations or significant environmental impacts from construction of the project. Little or no silty maintenance material will be removed during the Deep Draft Project. Any unsuitable maintenance material would be disposed into a CAD cell.	

		Additional turbidity studies will be conducted during construction of the Boston Harbor Inner Harbor Maintenance Dredging Project. Monitoring of the turbidity plume from dredging and disposal into the CAD cell will be conducted to confirm SSFATE modeling results and that the plume will not violate water quality standards or impact winter flounder spawning habitat. The results of the monitoring will be available for review upon completion	
DMF.1	Identify opportunities for beneficial reuse of dredged materials, such as for benthic habitat (both in-place or redeployed to another area) or shore protection.	See response to MEPA.18 comment.	Section 2.7 Section 2.8.3 Section 2.8.4 Section 4.3 Section 4.5
DMF.2	Include discussion of how the project will contribute to the overall cumulative impact to marine resources and habitat caused by projects in this portion of Mass. Bay.	See response to MEPA.8	Section 4.11
DMF.3	Create a comprehensive recovery monitoring and mitigation plan to compensate for direct loss of habitat and temporal loss of function, with the guidance of the Technical Working Group.	There will be no permanent loss of habitat from construction of the Deep Draft Project. There will be a benefit if the rock reef in Massachusetts Bay is approved. Lower productive soft bottom habitat will be converted to hard bottom habitat. Mitigation measures will be in place to limit impacts to biological resources in the project area.	
CZM.1	Continue the utilization of the Technical Working Group.	See response to MEPA.14 comment.	Section 6.3
CZM.2	Consider the use of existing CAD Cells for placement of contaminated dredged material, and provide an evaluation of the utility of the water quality monitoring methodology, the geographical behavior of the CAD cells, and any other available data	See response to DEP.3 comment regarding CAD cells. The water quality lessons learned from previous projects, including water quality monitoring data, methodology, etc. has been incorporated into the proposed Deep Draft Project. Lessons learned are highlighted in the Executive Summary, Section 1.2 *Summary of Major Changes form the 1995 Final Environmental*	Section 2.8.1 Executive Summary Section 1.2 Section 4.2

	related to impacts to marine habitat.	*Impact Report/Statement*, and Section 4.2 *General Impacts of Dredging in Boston Harbor.*	
CZM.3	As part of the Corps cost/benefit analysis, consider the environmental impacts of disturbing the substrate and impacting the water column with several smaller deepening efforts as opposed to one larger one.	See Response to MEPA 9 comment	
CZM.4	Lay out a clear process for coordination between any parties with utilities in the area of the proposed dredging project.	See response to MEPA.13 comment.	Section 3.8 Section 4.1 Section 6.3
CZM.5	As stated in the ENF, this project will be subject to federal consistency. The project must be found to be consistent with CZM's enforceable program policies.	Section 5.4 presents the CZM program policies that are applicable to the proposed dredging project and the project's consistency with those policies.	Section 5.4
MWRA.1	Dredging in the immediate area of the 115Kv Submarine Cable to the new proposed depths may lead to possible damage to the cable, resulting in the release of the insulating oil in the cable to the waters of the harbor and the potential long-term disruption of the primary source of power to the (MWRA) treatment plant.	As previously noted, see response to MEPA 13 comment, this cable is the subject of an enforcement referral to the U.S. Attorney's office. The U.S. Attorney's office has engaged in negotiations with NSTAR and MWRA to resolve the issues in a manner that will ensure that the NSTAR cable will not impact the current project. The negotiations have been productive and are ongoing, and in that context MWRA has raised its concerns relating to the NSTAR, and will presumably continue to do so.	Section 3.8 Section 4.10 Section 6.3
MWRA.2	Discussions should occur between the project proponents and MWRA staff to identify and examine alternatives to dredging at the Reserve Channel so that impacts to the submarine cable are avoided.	See response to MWRA.1 comment.	Section 3.8 Section 4.10 Section 6.3
MWRA.3	Identify the costs/benefits of moving the cable, if necessary, determine who pays for	See response to MWRA.1 comment.	Section 3.8 Section 4.10

	such an undertaking, and include a contingency plan in the event of damaging the cable.		Section 6.3
MTA.1	Coordinate with the MTA and provide documentation that the channel deepening and any associated construction activities such as blasting will not affect the Ted Williams Tunnel.	Section 4.2.5 *Blasting Impacts* notes that similar construction techniques used in previous Boston Harbor dredging and blasting projects did not result in any observed damage to piers, bulkheads, tunnels or bridge foundations. Because the same techniques will be used for the Deep Draft Project, it is unlikely that permanent damage to these structures will occur.	Section 4.2.5
BOS.1	Continue the utilization of the Technical Working Group.	See response to MEPA.14 comment.	Section 6.3
BOS.2	Work with all affected utility owners to identify the location and depth of utility crossings to prevent unnecessary damage to wetlands.	See response to MEPA.13 comment.	Section 3.8 Section 4.10 Section 6.3
BOS.3	Assess the cumulative impacts of all projects and consider appropriate mitigation for impacts to marine species habitat.	See response to MEPA.8 comment regarding cumulative impacts assessment. See response to MEPA.15, MEPA.16, and MEPA.19 regarding mitigation measures.	Section 4.11 Section 4.2.1 Section 4.4
BHA.1	Consider the earliest commencement of the deepening to minimize adverse impacts to the viability of the Port of Boston.	The proposed Deep Draft Project will commence as soon as practicable, given the lengthy process required obtain project authorization, approval and funding necessary for construction.	Section 2.8.1
BHA.2	Highlight the current and future economic impacts of the Port of Boston to the region as part of the Purpose and Need Statement, rather than historic impacts.	Section 1 *Introduction* and Section 1.1 *Project Need and Purpose* both touch on the economic forces that make this project critical to the future success of the Boston Harbor ports. The Economic Feasibility Study undertaken by the Corps provides extensive economic analysis on the current and future	Section 1.1

		economic impacts to the ports in relation to the proposed project.	
BHA.3	Consider disposal methods for previous dredging projects for disposal of dredged sediments, in addition to ocean or land disposal options.	This issues associated with dredge material disposal are presented and assessed in Section 2.5 *Disposal Alternatives-Site Selection Process*; Section 2.6 *Disposal Alternatives Identified in the BHNIP FEIR/S*; Section 2.7 *Beneficial Use Alternatives*; and Section 2.8 *Disposal Site Alternatives Evaluated*. Essentially, the disposal sites evaluated in this DSEIS/EIR are confined aquatic disposal cells, MBDS, IWS and the habitat enhancement site. In accordance with Section 2.9.2 *Summary*, beneficial use options will be investigated further with the State Sponsor and EPA during project design.	Section 2.5 Section 2.6 Section 2.7 Section 2.8 Section 2.9.3
BHA.4	Identify short-term as well as long-term dredging impacts.	See response to MEPA.5 comment.	
BHA.5	Coordinate with Algonquin HubLine Project-Everett Extension should the timing of the projects overlap.	Not applicable. Available information indicates that the Everett Extension will not be undertaken by Algonquin Gas.	Section 4.11

NSTAR.1	Our as-built drawings show that the (115kV) cable is located approximately 53 feet below mean low water (MLW) in the Reserve Channel and 63 feet below MLW in the Main Ship channel….If Massport and the Corps dredge the Reserve Channel below the -40 ft. MLW, there will be inadequate cover to protect the cable from cruise ship anchors, etc.	See responses to MEPA.13 comment and MWRA.1 comment.	Section 3.8.3 Section 4.10.3
NSTAR.2	We request that the Corps be required to fund the process of locating and documenting the precise location of the cable.	See response to NSTAR.1 comment.	Section 4.10.3
NSTAR.3	We request that MEPA not allow for additional dredging in the Reserved Channel. We also request that the In-Channel Disposal Cells be made available to private parties to minimize disposal cost of contaminated sediment that is now prohibitively expensive.	Dredging in the Reserved Channel to provide deeper access to Conley Container Terminal/South Boston DPA is absolutely necessary for the successful implementation of this critical project. The Corps is not authorized to construct Confined Aquatic Disposal cells for the use of private parties. Federal law only allows Federal funds to be used for construction of General Navigation Features (GNF) necessary for maintenance of the authorized Federal Channel. Federal Law further requires that a local sponsor provide a cost sharing match for the development of CAD cells required for Federal maintenance activities. Although the Corps could expand the CAD cells for the future use by others it would require that all costs associated with that expansion be provided to the Corps up front prior to the expansion being undertaken. In the case of Boston, the Corps intends to reserve the limited future in-channel CAD cell capacity for the future maintenance requirements of Federal and related State harbor dredging projects.	Section 1.1.2

PART 5

MASSACHUSETTS
ENVIRONMENTAL NOTIFICTION FORM
AND ATTACHMENTS

AS FILED BY
MASSPORT

massport

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January 31, 2003

Ms. Ellen Roy Herzfelder, Secretary
Executive Office of Environmental Affairs
Attn: MEPA Office
251 Causeway Street, Suite 900
Boston, MA 02114

RE: Boston Harbor Deep Draft Navigation Improvement Project
Environmental Notification Form Submittal

Dear Secretary Roy Herzfelder:

On behalf of the Massachusetts Port Authority (Massport), I am pleased to submit two (2) complete copies of an Environmental Notification Form (ENF) for the Boston Harbor Deep Draft Navigation Improvement Project (BHDDNIP), and a third copy of the first three pages, for inclusion in the *Environmental Monitor* to be published on February 8, 2003. The project is needed to accommodate larger cargo vessels that currently utilize Massport's Conley Container Terminal and that are anticipated to call at the Port of Boston in the future.

Project Description

The U.S. Army Corps of Engineers (Corps), in partnership with Massport as the non-federal sponsor, plans to conduct a feasibility study of potential deep draft navigation channel improvements to the Boston Harbor. The study will examine the Port of Boston's current and likely future role in the maritime commerce of the nation, and identify likely levels of future navigation traffic and commerce through the port. In addition, the study will investigate alternatives for accommodating increased deep draft vessel traffic at Boston Harbor, including channel deepening, cargo diversion, and no action. The costs of implementing alternative options will be measured against estimated benefits to improving commercial transportation costs in order to identify whether improvements are warranted consistent with Corps policies. Environmental documentation as required under the Massachusetts Environmental Policy Act (MEPA) and under the National Environmental Policy Act (NEPA) will be conducted as part of the feasibility study.

Project Need

Cargo vessels frequenting the Port of Boston have grown larger such that many of the vessels that now call at Conley Terminal require more than 40 feet of water, the current authorized depth for the Main Shipping Channel. Although these vessels can "ride the tide" into the terminal since the berths were dredged to 45 feet as part of a prior dredging project described below, the need to wait for a high tide to move to and from the terminal results in costly delays and in some cases vessels have ceased container loading operations in order to depart before the tide changed. In addition to the need for deeper water to Conley Terminal, the December 2002 Massport Marine Terminal (MMT) Development Issues and Alternatives Analysis indicates that bulk cargo vessels expected to call at MMT/North Jetty will benefit from 45-foot deep channels and berthing areas.

Background Information

In addition to the BHDDNIP which is the subject of this ENF, two additional dredging projects are worth noting for clarification: the now-completed Boston Harbor Navigation Improvement Project and Berth Dredging Project (BHNIP), and a federal maintenance dredging project of the main shipping channel to be undertaken solely by the Corps beginning this summer (2003). Massport has no role in the maintenance dredging project. A brief background discussion may provide useful context concerning the latter two projects.

In late 2001, the Corps completed dredging for the BHNIP. Massport was an active co-sponsor for this project (EOEA# 8695), which resulted in deepening of key tributaries and portions of the main shipping channel to 40 feet[1] and related berths to depths ranging from 35 to 45 feet.

While the planning, permitting, design and construction process for the BHNIP was underway, the main shipping channel into Boston Harbor continued to silt in such that it now needs maintenance dredging to restore it to 40 feet. The Corps is actively moving forward with the maintenance dredging of the federal channels up to the Ted Williams Tunnel Crossing and plans to begin construction in 2003. The proposed maintenance work is a fully federal activity with no associated dredging of berths or other local navigation features. Because all of the material to be removed has been found by the Corps and approved by the EPA to be suitable for ocean disposal, the proposed Boston Harbor maintenance dredging project will involve the disposal of dredged material into ocean waters outside the three-mile limit of the territorial sea. The Corps is currently preparing an Environmental Assessment (EA) for this project.

Coordinated Review Requested

The BHDDNIP is categorically included for the preparation of an Environmental Impact Report (EIR) under MEPA pursuant to Regulation 11.03(3)(a)b, in that it involves dredging greater than ten acres of non-vegetated wetlands. It also will be the subject of an Environmental Impact Statement (EIS) under NEPA. The Corps will be conducting the NEPA review as a Supplement (SEIS) to the EIS prepared for the BHNIP. It is our intent to satisfy both state and federal environmental impact review concurrently, as was done for

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[1] Chelsea Creek was only deepened to 38 feet due to certain utility crossings that could not cost-effectively be relocated to a deeper elevation.

the now-completed BHNIP. To that end, we have included a proposed scope and outline for the DEIR/DSEIS as an attachment to the ENF. Further, through early coordination with the MEPA Director and his staff, we were able to schedule a scoping meeting ahead of time as follows:

Date:	Tuesday, February 25, 2003
Location:	Massport Black Falcon Terminal
Time:	11 AM

Technical Working Group

As was done with the BHNIP, we intend to establish a Technical Working Group (TWG), comprised of representatives from the regulatory and Port-of-Boston stakeholders, to assist in the planning and review of the EIR/EIS for the BHDDNIP. A list of the organizations invited to participate on the TWG is enclosed.

Please feel free to contact Deb Hadden (617) 946-4435, or Jacki Wilkins (617) 568- 3558, if you have any questions regarding this filing. For copies of the ENF, please call Cheryl Washington at (617) 568-3525.

Sincerely,

Michael A. Leone
Port Director

Enclosures
ENF Distribution List
TWG List

For Office Use Only Executive Office of Environmental Affairs
EOEA No.: MEPA Analyst: Phone: 617-626-

Commonwealth of Massachusetts

ENF

Executive Office of Environmental Affairs ■ MEPA Office

Environmental Notification Form

The information requested on this form must be completed to begin MEPA Review in accordance with the provisions of the Massachusetts Environmental Policy Act, 301 CMR 11.00.

Project Name: *Boston Harbor Deep Draft Navigation Improvement Project*		
Street: *N/A*		
Municipality: *Boston, Chelsea*	Watershed: *Boston Harbor*	
Universal Tranverse Mercator Coordinates:	Latitude: *42° 20' N* Longitude: *70° 59' W*	
Estimated commencement date: *2009*	Estimated completion date: *2011*	
Approximate cost: *$40-80M*	Status of project design: *5* %complete	
Proponent: *Michael A. Leone, Massport Port Director*		
Street: *One Harborside Drive Suite 200S*		
Municipality: *Boston*	State: *MA*	Zip Code: *02128*
Name of Contact Person From Whom Copies of this ENF May Be Obtained: *Cheryl Washington*		
Firm/Agency: *Massachusetts Port Authority*	Street: *One Harborside Drive*	
Municipality: *East Boston*	State: *MA*	Zip Code: *02128*
Phone: *(617) 568-3525*	Fax: *(617) 568-3515*	E-mail: *cwashington@massport.com*

Does this project meet or exceed a mandatory EIR threshold (see 301 CMR 11.03)?
☒ Yes ☐ No

Has this project been filed with MEPA before?
☐ Yes (EOEA No.__________) ☒ No

Has any project on this site been filed with MEPA before?
☒ Yes (EOEA No. *8695*) ☐ No

Is this an Expanded ENF (see 301 CMR 11.05(7)) requesting:

- a Single EIR? (see 301 CMR 11.06(8)) ☐ Yes ☒ No
- a Special Review Procedure? (see 301CMR 11.09) ☐ Yes ☒ No
- a Waiver of mandatory EIR? (see 301 CMR 11.11) ☐ Yes ☒ No
- a Phase I Waiver? (see 301 CMR 11.11) ☐ Yes ☒ No

Identify any financial assistance or land transfer from an agency of the Commonwealth, including the agency name and the amount of funding or land area (in acres): ***Massachusetts Port Authority will provide 50% of the funding to the US Army Corps of Engineers for the feasibility study, as well as a portion of the construction costs (to be determined).***

Are you requesting coordinated review with any other federal, state, regional, or local agency?
☒ Yes (Specify: ***National Environmental Policy Act (NEPA) Review***) ☐ No

List Local or Federal Permits and Approvals: ***Orders of Conditions from Boston, Revere and Chelsea Conservation Commissions; NEPA; coordination under Clean Water Act; Clean Air***

Act; Endangered Species Act; Marine Protection Research and Sanctuaries Act of 1973; Essential Fish Habitat: Magnuson- Stevens Fisheries Conservation and Management Act; Fish and Wildlife Coordination Act; and the Preservation of Historic and Archaeological Data Act of 1974.

Which ENF or EIR review threshold(s) does the project meet or exceed (see 301 CMR 11.03):

☐ Land	☐ Rare Species	☒ Wetlands, Waterways, & Tidelands
☐ Water	☐ Wastewater	☐ Transportation
☐ Energy	☐ Air	☐ Solid & Hazardous Waste
☐ ACEC	☐ Regulations	☐ Historical & Archaeological * Resources

Summary of Project Size & Environmental Impacts	Existing	Change	Total	State Permits & Approvals
LAND				☒ Order of Conditions ☐ Superseding Order of Conditions ☐ Chapter 91 License ☒ 401 Water Quality Certification ☐ MHD or MDC Access Permit ☐ Water Management Act Permit ☐ New Source Approval ☐ DEP or MWRA Sewer Connection/ Extension Permit ☒ Other Permits (including Legislative Approvals) – Specify: ***MCZM Consistency***
Total site acreage	***~1,140***			
New acres of land altered		***N/A***		
Acres of impervious area	***N/A***	***N/A***	***N/A***	
Square feet of new bordering vegetated wetlands alteration		***N/A***		
Square feet of new other wetland alteration		***N/A***		
Acres of new non-water dependent use of tidelands or waterways		***N/A***		
STRUCTURES				
Gross square footage	***N/A***	***N/A***	***N/A***	
Number of housing units	***N/A***	***N/A***	***N/A***	
Maximum height (in feet)	***N/A***	***N/A***	***N/A***	
TRANSPORTATION				
Vehicle trips per day	***N/A***	***N/A***	***N/A***	
Parking spaces	***N/A***	***N/A***	***N/A***	
WATER/WASTEWATER				
Gallons/day (GPD) of water use	***N/A***	***N/A***	***N/A***	
GPD water withdrawal	***N/A***	***N/A***	***N/A***	
GPD wastewater generation/ treatment	***N/A***	***N/A***	***N/A***	
Length of water/sewer mains (in miles)	***N/A***	***N/A***	***N/A***	

CONSERVATION LAND: Will the project involve the conversion of public parkland or other Article 97 public natural resources to any purpose not in accordance with Article 97?

☐Yes (Specify___________________________________) ☒ No

Will it involve the release of any conservation restriction, preservation restriction, agricultural preservation restriction, or watershed preservation restriction?

☐Yes (Specify___________________________________) ☒ No

RARE SPECIES: Does the project site include Estimated Habitat of Rare Species, Vernal Pools, Priority Sites of Rare Species, or Exemplary Natural Communities?

☐Yes (Specify___________________________________) ☒ No

HISTORICAL /ARCHAEOLOGICAL RESOURCES: Does the project site include any structure, site or district listed in the State Register of Historic Place or the inventory of Historic and Archaeological Assets of the Commonwealth?

☐Yes (Specify________________________________) ☐No

To be determined as part of the Draft EIR/SEIS preparation.

If yes, does the project involve any demolition or destruction of any listed or inventoried historic or archaeological resources?

☐Yes (Specify________________________________) ☐ No

To be determined as part of the Draft EIR/SEIS preparation.

AREAS OF CRITICAL ENVIRONMENTAL CONCERN: Is the project in or adjacent to an Area of Critical Environmental Concern?

☐Yes (Specify________________________________) ☒ No

PROJECT DESCRIPTION: The project description should include (a) a description of the project site, (b) a description of both on-site and off-site alternatives and the impacts associated with each alternative, and (c) potential on-site and off-site mitigation measures for each alternative (You may attach one additional page, if necessary.)

The US Army Corps of Engineers (Corps), in partnership with the Massachusetts Port Authority (Massport) has initiated a feasibility study of potential deep-draft navigation channel improvements to the Boston Harbor. The study will examine the Port of Boston's current and likely future role in the maritime commerce of the nation, and identify likely levels of future vessel traffic and commerce through the port. In addition, the study will investigate options for accommodating increased deep draft vessel traffic at Boston Harbor, including channel deepening, cargo diversion, and no action. The costs of implementing alternative options will be measured against estimated benefits to improving commercial transportation costs in order to identify whether improvements are warranted consistent with Corps policies.

(a) Description of the Project Site

Boston Harbor, the largest port in New England, is located on the eastern shore of Massachusetts on Massachusetts Bay. The study area includes the developed port areas of the Cities of Boston and Chelsea, the transportation systems, and navigation facilities providing access to the port.

Existing Conditions (Shown on Figure 1)

Entrance Channels and Main Anchorage: Currently the main entrance channel, the Broad Sound North Channel, is 40 feet deep at mean lower low water (mllw) and 900 feet wide (1,100 feet wide in the turn entrance). The channel also has a northern 35-foot deep and 600-foot wide lane. The 40-foot channel widens to 1,200 feet at the outer confluence of the other two entrance channels to the harbor as it passes south of and alongside the 40-foot anchorage at President Roads.

Main Ship Channel: The Main Ship Channel, between President Roads and the inner confluence generally consists of two lanes, one 40 feet deep and the other 35 feet deep, each 600 feet wide. Below the Ted Williams Tunnel (I-90), the Main Ship Channel's 40-foot lane is located along the southern side of the channel, abreast of the developed industrial waterfront of South Boston. The South Boston Reserved Channel extends westerly off the Main Ship Channel about two miles above the President Roads Anchorage.

Mystic River Channel: The majority of the Mystic River channel above the Inner Confluence and the Tobin Bridge (US-1) was deepened to 40 feet as part of the recent improvement project. The southwestern portion of the channel along the Charlestown shore was left at 35 feet.

Chelsea River Channel: The Chelsea River Channel above the Inner Confluence and the McArdle Bridge was deepened to 38 feet as part of the recent improvement project.

The Ted Williams Tunnel (I-90) crosses beneath the Main Ship Channel at the upstream end of the South

Chelsea River Channel: The Chelsea River Channel above the Inner Confluence and the McArdle Bridge was deepened to 38 feet as part of the recent improvement project.

The Ted Williams Tunnel (I-90) crosses beneath the Main Ship Channel at the upstream end of the South Boston Marine Industrial Park and limits channel depths above this point to the 40 feet now provided. This effectively confines future port development that would require depths greater than 40 feet to areas seaward of the tunnel crossing.

There are several marine cargo facilities located along the lower Main Ship Channel and the Reserved Channel:

- The Conley Container Terminal that is owned and operated by Massport is located at the confluence of the Reserved Channel and the Main Ship Channel.
- The Coastal Oil Terminal is located immediately upstream of the Conley Terminal.
- The Black Falcon Cruise Terminal that is owned and operated by Massport occupies most of the northern bulkhead of the Reserved Channel along the 35-foot reach and upper end of the 40-foot reach.
- The 40-foot dry dock and the Coastal Cement Terminal are located off the 40 foot Federal dry-dock approach channel, immediately upstream of the Reserved Channel.
- The Massport Marine Terminal is located along the Main Ship Channel between the Drydock Channel and the Ted Williams Tunnel.

(b) A description of both on-site and off-site alternatives and the impacts associated with each alternative.

Plans for Channel Improvements (Shown on Figure 2)

Entrance Channel and Main Anchorage: The Broad Sound North Entrance Channel, from the Massachusetts Bay to President Roads and the President Roads Anchorage will be examined for deepening from their current 40-foot depth to up to 50 feet.

Main Ship Channel: The Main Ship Channel reaches from the President Roads Anchorage to the Ted Williams Tunnel, the I-90 tunnel, will be examined for deepening beyond 40 feet to depths as great as 50 feet.

Mystic River Channel: The eastern portion of this 35-foot area will be examined under this study for deepening to 40 feet such that the 40-foot navigation channel abuts the recently deepened 40-foot berth at Massport's Medford Street Terminal in Charlestown.

Chelsea River Channel: The Chelsea River Channel will be examined for deepening to 40 feet. This is now possible because there are plans underway to replace the Chelsea Street Bridge and to replace the natural gas siphon that crosses beneath the channel, neither of which were underway when the feasibility of deepening beyond 38 feet was studied as part of the previous Boston Harbor Navigation Improvement Project.

Each potential project improvement will be evaluated at various alternative depths (i.e., 42 to 50 feet) and will be compared to the No Action Alternative.

In general, because all of these areas are existing navigation channels and anchorage areas that have been dredged in the past, most associated environmental impacts will be temporary in nature.

(c) Potential on-site and off-site mitigation measures for each alternative.

Once the project impacts have been identified as part of the Draft Environmental Impact Report (EIR)/Supplemental Environmental Impact Statement (SEIS) measures to mitigate these impacts will be evaluated and appropriate mitigation will be proposed.

A proposed Draft EIR/SEIS outline is appended to this ENF (Attachment 1).

LAND SECTION – all proponents must fill out this section

I. Thresholds / Permits

A. Does the project meet or exceed any review thresholds related to land (see 301 CMR 11.03(1) ___ Yes _X_ No; if yes, specify each threshold

II. Impacts and Permits

A. Describe, in acres, the current and proposed character of the project site, as follows:

	Existing	Change	Total
Footprint of buildings	*N/A*	*N/A*	*N/A*
Roadways, parking, and other paved areas	*N/A*	*N/A*	*N/A*
Other altered areas (describe) *	*~1,140*	*0*	*~1,140*
Undeveloped areas	*N/A*	*N/A*	*N/A*

**** There will be no change in project site acreage. Approximately 1,140 acres of Land Under Water will be dredged***

B. Has any part of the project site been in active agricultural use in the last three years? ___ Yes _X_ No; if yes, how many acres of land in agricultural use (with agricultural soils) will be converted to nonagricultural use?

C. Is any part of the project site currently or proposed to be in active forestry use? ___ Yes _X_ No; if yes, please describe current and proposed forestry activities and indicate whether any part of the site is the subject of a DEM-approved forest management plan:

D. Does any part of the project involve conversion of land held for natural resources purposes in accordance with Article 97 of the Amendments to the Constitution of the Commonwealth to any purpose not in accordance with Article 97? ___ Yes _X_ No; if yes, describe:

E. Is any part of the project site currently subject to a conservation restriction, preservation restriction, agricultural preservation restriction or watershed preservation restriction? ___ Yes _X_ No; if yes, does the project involve the release or modification of such restriction? ___ Yes _X_ No; if yes, describe:

F. Does the project require approval of a new urban redevelopment project or a fundamental change in an existing urban redevelopment project under M.G.L.c.121A? ___ Yes _X_ No; if yes, describe:

G. Does the project require approval of a new urban renewal plan or a major modification of an existing urban renewal plan under M.G.L.c.121B? Yes ___ No _X_; if yes, describe:

H. Describe the project's stormwater impacts and, if applicable, measures that the project will take to comply with the standards found in DEP's Stormwater Management Policy: ***There will be no addition of impervious surface, therefore the Stormwater Policy is not applicable.***

I. Is the project site currently being regulated under M.G.L.c.21E or the Massachusetts Contingency Plan? Yes ___ No _X_ if yes, what is the Release Tracking Number (RTN)?

J. If the project is site is within the Chicopee or Nashua watershed, is it within the Quabbin, Ware, or Wachusett subwatershed? ___ Yes _X_ No; if yes, is the project site subject to regulation under the Watershed Protection Act? ___ Yes _X_ No

K. Describe the project's other impacts on land: ***Based on testing conducted, by the Army Corps of Engineers under a plan approved by the Environmental Protection Agency, to date it is assumed that most or all of the dredged material will be suitable for open-water disposal at the Massachusetts Bay Disposal Site (MBDS). If any of the material is found unsuitable for MBDS disposal, appropriate disposal alternatives will be identified and evaluated in the Draft EIR/SEIS. It is possible that unsuitable sediments could be disposed of in confined aquatic disposal (CAD) cells beneath sections of the Main Ship Channel, Inner Confluence Area, Mystic River and Chelsea River, similar to what was***

done in the recently completely Boston Harbor Navigation Improvements Project. Therefore no impacts to land are anticipated.

III. Consistency

A. Identify the current municipal comprehensive land use plan and the open space plan and describe the consistency of the project and its impacts with that plan(s): ***The project is consistent with several recent Port Plans. The Port of Boston Competitive Task Force Final Report (December 1998, Vickerman, Zachary & Miller) recommends a series of action items that are necessary to ensure the continued growth and success of the Port of Boston. One of the critical action items states that "Massport should work closely with the Army Corps of Engineers to assess the feasibility of further deepening key portions of the main channel." The supporting text further clarifies that "in order for New England companies to remain competitive by receiving containerized cargo by direct ocean-going service, the channels accessing Conley Terminal must be dredged to at least 45 feet." The proposed project directly fulfills this action item.***

B. Identify the current Regional Policy Plan of the applicable Regional Planning Agency and describe the consistency of the project and its impacts with that plan: ***The project is consistent with applicable policies of the "Boston Region MPO Transportation Plan 2000-2025" regarding other objectives, improved safety and mobility and infrastructure modernization.***

C. Will the project require any approvals under the local zoning by-law or ordinance (i.e. text or map amendment, special permit, or variance)? Yes ___ No _X_ if yes, describe:

D. Will the project require local site plan or project impact review? ___ Yes _X_ No; if yes, describe:

RARE SPECIES SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to rare species or habitat (see 301 CMR 11.03(2))? ___ Yes _X_ No ***(according to the 2000/2001 Natural Heritage Atlas)***; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to rare species or habitat? ___ Yes _X_ No

C. If you answered "No" to both questions A and B, proceed to the Wetlands, Waterways, and Tidelands Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Rare Species section below.

II. Impacts and Permits

A. Does the project site fall within Priority or Estimated Habitat in the current Massachusetts Natural Heritage Atlas (attach relevant page)? ___ Yes ___ No. If yes,

1. Which rare species are known to occur within the Priority or Estimated Habitat (contact: Environmental Review, Natural Heritage and Endangered Species Program, Route 135, Westborough, MA 01581, allowing 30 days for receipt of information):
2. Have you surveyed the site for rare species? ___ Yes ___ No; if yes, please include the results of your survey.
3. If your project is within Estimated Habitat, have you filed a Notice of Intent or received an Order of Conditions for this project? ___ Yes ___ No; if yes, did you send a copy of the Notice of Intent to the Natural Heritage and Endangered Species Program, in accordance with the Wetlands Protection Act regulations? ___ Yes ___ No

Not Applicable

B. Will the project "take" an endangered, threatened, and/or species of special concern in accordance with M.G.L. c.131A (see also 321 CMR 10.04)? ___ Yes ___ No; if yes, describe:

C. Will the project alter "significant habitat" as designated by the Massachusetts Division of Fisheries and Wildlife in accordance with M.G.L. c.131A (see also 321 CMR 10.30)? ___ Yes ___ No; if yes, describe:

D. Describe the project's other impacts on rare species including indirect impacts (for example, stormwater runoff into a wetland known to contain rare species or lighting impacts on rare moth habitat):

WETLANDS, WATERWAYS, AND TIDELANDS SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to wetlands, waterways, and tidelands (see 301 CMR 11.03(3))? _X_ Yes ___ No; if yes, specify, in quantitative terms: ***Dredging of approximately 6 million cubic yards from Land Under the Ocean, Designated Port Area and Fish Runs.***

B. Does the project require any state permits (or a local Order of Conditions) related to wetlands, waterways, or tidelands? _X_ Yes ___ No; if yes, specify which permit: ***Orders of Conditions, 401 Water Quality Certification***

C. If you answered "No" to both questions A and B, proceed to the Water Supply Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Wetlands, Waterways, and Tidelands Section below.

II. Wetlands Impacts and Permits

A. Describe any wetland resource areas currently existing on the project site and indicate them on the site plan: The entire project shown in Figure 2 is located within Land Under the Ocean, Designated Port Areas, and Fish Runs.

B. Estimate the extent and type of impact that the project will have on wetland resources, and indicate whether the impacts are temporary or permanent:

Coastal Wetlands	Area (in square feet) or Length (in linear feet)
Land Under the Ocean	***~ 50 million square feet (~1,140 acres)***
Designated Port Areas	***~ 50 million square feet (~1,140 acres)***
Coastal Beaches	***N/A***
Coastal Dunes	***N/A***
Barrier Beaches	***N/A***
Coastal Banks	***N/A***
Rocky Intertidal Shores	***N/A***
Salt Marshes	***N/A***
Land Under Salt Ponds	***N/A***
Land Containing Shellfish	***N/A***
Fish Runs	***~ 50 million square feet (~1,140 acres)***
Land Subject to Coastal Storm Flowage	***N/A***

Inland Wetlands	
Bank	***N/A***
Bordering Vegetated Wetlands	***N/A***
Land under Water	***N/A***
Isolated Land Subject to Flooding	***N/A***
Bordering Land Subject to Flooding	***N/A***
Riverfront Area	***N/A***

C. Is any part of the project

1. a limited project? ___ Yes _X_ No
2. the construction or alteration of a dam? ___ Yes _X_ No; if yes, describe:
3. fill or structure in a velocity zone or regulatory floodway? ___ Yes _X_ No
4. dredging or disposal of dredged material? _X_ Yes ___ No; if yes, describe the volume of dredged material and the proposed disposal site: ***There will be approximately 6 million cubic yards of dredged material, all or most of which is presumed to be suitable for unconfined open-disposal at the Massachusetts Bay Disposal Site (MBDS). If any of the material is found unsuitable for MBDS disposal, appropriate disposal alternatives will be identified and evaluated in the Draft EIR/SEIS. It is possible that unsuitable sediments could be disposed of in confined aquatic disposal (CAD) cells beneath sections of the Main Ship Channel, Inner Confluence Area, Mystic River and Chelsea River, similar to what was done in the recently completely Boston Harbor Navigation Improvements Project.***
5. a discharge to Outstanding Resource Waters? ___ Yes _X_ No
6. subject to a wetlands restriction order? ___ Yes _X_ No; if yes, identify the area (in square feet):

D. Does the project require a new or amended Order of Conditions under the Wetlands Protection Act (M.G.L. c.131A)? _X_ Yes ___ No; if yes, has a Notice of Intent been filed or a local Order of Conditions issued? ___ Yes _X_ No; if yes, list the date and DEP file number:______________. Was the Order of Conditions appealed? N/A___ Yes ___ No. Will the project require a variance from the Wetlands regulations? ___ Yes _X_ No.

E. Will the project:

1. be subject to a local wetlands ordinance or bylaw? __ Yes _X_ No
2. alter any federally-protected wetlands not regulated under state or local law? ___ Yes _X_ No; if yes, what is the area (in s.f.)?

F. Describe the project's other impacts on wetlands (including new shading of wetland areas or removal of tree canopy from forested wetlands): There will be no impacts to the wetlands following construction activities.

III. Waterways and Tidelands Impacts and Permits

A. Is any part of the project site waterways or tidelands (including filled former tidelands) that are subject to the Waterways Act, M.G.L.c.91? _X_ Yes ___ No; if yes, is there a current Chapter 91 license or permit affecting the project site? _X_ Yes ___ No; if yes, list the date and number: ***It is assumed that there are existing Chapter 91 licenses for portions of the project site, these will be identified during the Draft EIR/SEIS process if needed.***

B. Does the project require a new or modified license under M.G.L.c.91? ___ Yes _X_ No; if yes, how many acres of the project site subject to M.G.L.c.91 will be for non-water dependent use? Current ___ Change ___ Total ___

C. Is any part of the project

1. a roadway, bridge, or utility line to or on a barrier beach? ___ Yes _X_ No; if yes, describe:
2. dredging or disposal of dredged material? _X_ Yes ___ No; if yes, volume of dredged material ***Approximately 6 million cubic yards***
3. a solid fill, pile-supported, or bottom-anchored structure in flowed tidelands or other waterways? ___ Yes _X_No; if yes, what is the base area? _______
4. within a Designated Port Area? _X_ Yes ___ No

D. Describe the project's other impacts on waterways and tidelands: ***The dredging project will have temporary impacts during construction. A mechanical bucket dredge will be***

used during the project and the material will be placed in scows for transport to the disposal site. Both dredging and disposal activities will result in short term water quality impacts. Extensive monitoring conducted in relation to the Boston Harbor Navigation Improvements Project demonstrated that these impacts were minimal and localized. The long-term impacts of the project include a deepened channel that will accommodate deep draft vessel traffic in Boston Harbor.

IV. Consistency:

A. Is the project located within the Coastal Zone? _X_ Yes ___ No; if yes, describe the project's consistency with policies of the Office of Coastal Zone Management: ***The Draft EIR/SEIS will contain a detailed description of the applicability of each CZM policy to the proposed dredging project. This project will be designed to comply with all applicable CZM policies.***

B. Is the project located within an area subject to a Municipal Harbor Plan? ___ Yes _X_ No; if yes, identify the Municipal Harbor Plan and describe the project's consistency with that plan:

WATER SUPPLY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to water supply (see 301 CMR 11.03(4))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to water supply? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the Wastewater Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Water Supply Section below.

II. Impacts and Permits

A. Describe, in gallons/day, the volume and source of water use for existing and proposed activities at the project site:

	Existing	Change	Total
Withdrawal from groundwater	___	___	___
Withdrawal from surface water	___	___	___
Interbasin transfer	___	___	___
Municipal or regional water supply	___	___	___

Not Applicable

B. If the source is a municipal or regional supply, has the municipality or region indicated that there is adequate capacity in the system to accommodate the project? ___ Yes ___ No

C. If the project involves a new or expanded withdrawal from a groundwater or surface water source,

1. have you submitted a permit application? ___ Yes ___ No; if yes, attach the application
2. have you conducted a pump test? ___ Yes ___ No; if yes, attach the pump test report

D. What is the currently permitted withdrawal at the proposed water supply source (in gallons/day)? _____ Will the project require an increase in that withdrawal? ___ Yes ___ No

E. Does the project site currently contain a water supply well, a drinking water treatment facility, water main, or other water supply facility, or will the project involve construction of a new facility? ___ Yes ___ No. If yes, describe existing and proposed water supply facilities at the project site:

	Existing	Change	Total
Water supply well(s) (capacity, in gpd)			
Drinking water treatment plant (capacity, in gpd)			
Water mains (length, in miles)			

F. If the project involves any interbasin transfer of water, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed?

G. Does the project involve

1. new water service by a state agency to a municipality or water district? ___ Yes ___ No
2. a Watershed Protection Act variance? ___ Yes ___ No; if yes, how many acres of alteration?
3. a non-bridged stream crossing 1,000 or less feet upstream of a public surface drinking water supply for purpose of forest harvesting activities? ___ Yes ___ No

Not Applicable

H. Describe the project's other impacts (including indirect impacts) on water resources, quality, facilities and services:

III. Consistency -- Describe the project's consistency with water conservation plans or other plans to enhance water resources, quality, facilities and services:

WASTEWATER SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to wastewater (see 301 CMR 11.03(5))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to wastewater? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the Transportation -- Traffic Generation Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Wastewater Section below.

II. Impacts and Permits

A. Describe, in gallons/day, the volume and disposal of wastewater generation for existing and proposed activities at the project site (calculate according to 310 CMR 15.00):

	Existing	Change	Total
Discharge to groundwater (Title 5)			
Discharge to groundwater (non-Title 5)			
Discharge to outstanding resource water			
Discharge to surface water			
Municipal or regional wastewater facility			
TOTAL			

Not Applicable

B. Is there sufficient capacity in the existing collection system to accommodate the project? ___ Yes ___ No; if no, describe where capacity will be found:

C. Is there sufficient existing capacity at the proposed wastewater disposal facility? ___ Yes ___ No; if no, describe how capacity will be increased:

D. Does the project site currently contain a wastewater treatment facility, sewer main, or other wastewater disposal facility, or will the project involve construction of a new facility? ___ Yes ___ No. If yes, describe as follows:

	Existing	Change	Total
Wastewater treatment plant (capacity, in gpd)			
Sewer mains (length, in miles)			
Title 5 systems (capacity, in gpd)			

E. If the project involves any interbasin transfer of wastewater, which basins are involved, what is the direction of the transfer, and is the interbasin transfer existing or proposed?

F. Does the project involve new sewer service by an Agency of the Commonwealth to a municipality or sewer district? ___ Yes ___ No

G. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of sewage sludge, sludge ash, grit, screenings, or other sewage residual materials? ___ Yes ___ No; if yes, what is the capacity (in tons per day):

Not Applicable

	Existing	Change	Total
Storage			
Treatment, processing			
Combustion			
Disposal			

H. Describe the project's other impacts (including indirect impacts) on wastewater generation and treatment facilities:

III. Consistency -- Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to wastewater management:

A. If the project requires a sewer extension permit, is that extension included in a comprehensive wastewater management plan? ___ Yes ___ No; if yes, indicate the EOEA number for the plan and describe the relationship of the project to the plan

TRANSPORTATION -- TRAFFIC GENERATION SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to traffic generation (see 301 CMR 11.03(6))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to state-controlled roadways? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the Roadways and Other Transportation Facilities Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Traffic Generation Section below.

II. Traffic Impacts and Permits

A. Describe existing and proposed vehicular traffic generated by activities at the project site:

Not Applicable

	Existing	Change	Total
Number of parking spaces			
Number of vehicle trips per day			
ITE Land Use Code(s):			

B. What is the estimated average daily traffic on roadways serving the site?

Roadway	Existing	Change	Total
1.			
2.			
3.			

C. Describe how the project will affect transit, pedestrian and bicycle transportation facilities and services:

III. Consistency -- Describe measures that the proponent will take to comply with municipal, regional, state, and federal plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services:

ROADWAYS AND OTHER TRANSPORTATION FACILITIES SECTION

I. Thresholds

A. Will the project meet or exceed any review thresholds related to roadways or other transportation facilities (see 301 CMR 11.03(6))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to roadways or other transportation facilities? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to <u>both</u> questions A and B, proceed to the Energy Section. If you answered "Yes" to <u>either</u> question A or question B, fill out the remainder of the Roadways Section below.

II. Transportation Facility Impacts

A. Describe existing and proposed transportation facilities at the project site:

	Existing	Change	Total
Length (in linear feet) of new or widened roadway	________	________	________
Width (in feet) of new or widened roadway	________	________	________
Other transportation facilities:			

Not Applicable

B. Will the project involve any

1. Alteration of bank or terrain (in linear feet)? ________
2. Cutting of living public shade trees (number)? ________
3. Elimination of stone wall (in linear feet)? ________

III. Consistency -- Describe the project's consistency with other federal, state, regional, and local plans and policies related to traffic, transit, pedestrian and bicycle transportation facilities and services, including consistency with the applicable regional transportation plan and the Transportation Improvements Plan (TIP), the State Bicycle Plan, and the State Pedestrian Plan:

ENERGY SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to energy (see 301 CMR 11.03(7))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to energy? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to <u>both</u> questions A and B, proceed to the Air Quality Section. If you answered "Yes" to <u>either</u> question A or question B, fill out the remainder of the Energy Section below.

II. Impacts and Permits

A. Describe existing and proposed energy generation and transmission facilities at the project site:

	Existing	Change	Total
Capacity of electric generating facility (megawatts)	________	________	________
Length of fuel line (in miles)	________	________	________

Length of transmission lines (in miles) ________ ________ ________
Capacity of transmission lines (in kilovolts) ________ ________ ________

B. If the project involves construction or expansion of an electric generating facility, what are

1. the facility's current and proposed fuel source(s)?
2. the facility's current and proposed cooling source(s)?

C. If the project involves construction of an electrical transmission line, will it be located on a new, unused, or abandoned right of way? ___ Yes ___ No; if yes, please describe:

D. Describe the project's other impacts on energy facilities and services:

III. Consistency -- Describe the project's consistency with state, municipal, regional, and federal plans and policies for enhancing energy facilities and services:

Not Applicable

AIR QUALITY SECTION

I. Thresholds

A. Will the project meet or exceed any review thresholds related to air quality (see 301 CMR 11.03(8))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to air quality? ___ Yes _X_ No; if yes, specify which permit:

C. If you answered "No" to both questions A and B, proceed to the Solid and Hazardous Waste Section. If you answered "Yes" to either question A or question B, fill out the remainder of the Air Quality Section below.

II. Impacts and Permits

A. Does the project involve construction or modification of a major stationary source (see 310 CMR 7.00, Appendix A)?___ Yes ___ No; if yes, describe existing and proposed emissions (in tons per day) of:

	Existing	Change	Total
Particulate matter	______	______	______
Carbon monoxide	______	______	______
Sulfur dioxide	______	______	______
Volatile organic compounds	______	______	______
Oxides of nitrogen	______	______	______
Lead	______	______	______
Any hazardous air pollutant	______	______	______
Carbon dioxide	______	______	______

Not Applicable

B. Describe the project's other impacts on air resources and air quality, including noise impacts:

III. Consistency

A. Describe the project's consistency with the State Implementation Plan:

B. Describe measures that the proponent will take to comply with other federal, state, regional, and local plans and policies related to air resources and air quality:

SOLID AND HAZARDOUS WASTE SECTION

I. Thresholds / Permits

A. Will the project meet or exceed any review thresholds related to solid or hazardous waste (see 301 CMR 11.03(9))? ___ Yes _X_ No; if yes, specify, in quantitative terms:

B. Does the project require any state permits related to solid and hazardous waste? ___ Yes _X_ No ; if yes, specify which permit: ***Current presumptions based on testing conducted to date by the Army Corps of Engineers under a plan approved by the Environmental Protection Agency are that no solid or hazardous waste permits will be required. This presumption will be confirmed by detailed examination in the Draft EIR/SEIS and contingencies will be developed if needed.***

C. If you answered "No" to both questions A and B, proceed to the Historical and Archaeological Resources Section. If you answered, "Yes" to either question A or question B, fill out the remainder of the Solid and Hazardous Waste Section below.

II. Impacts and Permits

A. Is there any current or proposed facility at the project site for the storage, treatment, processing, combustion or disposal of solid waste? ___ Yes ___ No; if yes, what is the volume (in tons per day) of the capacity:

	Existing	Change	Total
Storage	______	______	______
Treatment, processing	______	______	______
Combustion	______	______	______
Disposal	______	______	______

B. Is there any current or proposed facility at the project site for the storage, recycling, treatment or disposal of hazardous waste? ___ Yes ___ No; if yes, what is the volume (in tons or gallons per day) of the capacity:

Not Applicable

	Existing	Change	Total
Storage	______	______	______
Treatment, processing	______	______	______
Combustion	______	______	______
Disposal	______	______	______

C. If the project will generate solid waste (for example, during demolition or construction), describe alternatives considered for re-use, recycling, and disposal:

D. If the project involves demolition, do any buildings to be demolished contain asbestos? ___ Yes ___ No

E. Describe the project's other solid and hazardous waste impacts (including indirect impacts):

III. Consistency--Describe measures that the proponent will take to comply with the State Solid Waste Master Plan: Should upland disposal be warranted for some dredge material, reuse opportunities (e.g. landfill cover) will be considered.

HISTORICAL AND ARCHAEOLOGICAL RESOURCES SECTION

I. Thresholds / Impacts

A. Is any part of the project site a historic structure, or a structure within a historic district, in either case listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes _X_ No; if yes, does the project involve the demolition of all or any exterior part of such historic structure? ___ Yes ___ No; if yes, please describe:

B. Is any part of the project site an archaeological site listed in the State Register of Historic Places or the Inventory of Historic and Archaeological Assets of the Commonwealth? ___ Yes ___ No; if yes, does the project involve the destruction of all or any part of such archaeological site? ___ Yes ___ No; if yes, please describe: ***Not yet determined. Will be examined during the Draft EIR/SEIS preparation.***

C. If you answered "No" to all parts of both questions A and B, proceed to the Attachments and Certifications Sections. If you answered, "Yes" to any part of either question A or question B, fill out the remainder of the Historical and Archaeological Resources Section below.

D. Have you consulted with the Massachusetts Historical Commission? ___ Yes _X_ No; if yes, attach correspondence. ***The MHC will be sent a copy of this ENF and will be consulted during the preparation of the Draft EIR/SEIS.***

E. Describe and assess the project's other impacts, direct and indirect, on listed or inventoried historical and archaeological resources: ***Not yet determined. Will be examined during the Draft EIR/SEIS preparation.***

II. Consistency -- Describe measures that the proponent will take to comply with federal, state, regional, and local plans and policies related to preserving historical and archaeological resources: ***MHC/SHPO will be consulted during the Draft EIR/SEIS preparation. Applicable cultural resources, if any, will be addressed in accordance with MHC/SHPO policies.***

ATTACHMENTS:

1. Plan, at an appropriate scale, of existing conditions of the project site and its immediate context, showing all known structures, roadways and parking lots, rail rights-of-way, wetlands and water bodies, wooded areas, farmland, steep slopes, public open spaces, and major utilities.

2. Plan of proposed conditions upon completion of project (if construction of the project is proposed to be phased, there should be a site plan showing conditions upon the completion of each phase).

3. Original U.S.G.S. map or good quality color copy (8-½ x 11 inches or larger) indicating the project location and boundaries

4 List of all agencies and persons to whom the proponent circulated the ENF, in accordance with 301 CMR 11.16(2).

5. Other:

CERTIFICATIONS:

1. The Public Notice of Environmental Review has been/will be published in the following newspapers in accordance with 301 CMR 11.15(1):

Boston Globe	***January 30, 2003***
Boston Herald	***January 30, 2003***

2. This form has been circulated to Agencies and Persons in accordance with 301 CMR 11.16(2).

Date: January 31, 2003

Signature of Responsible Officer or Proponent

Name (print or type)

Michael A. Leone
Massachusetts Port Authority
One Harborside Drive
Boston, MA 02128
Phone (617) 946-4413

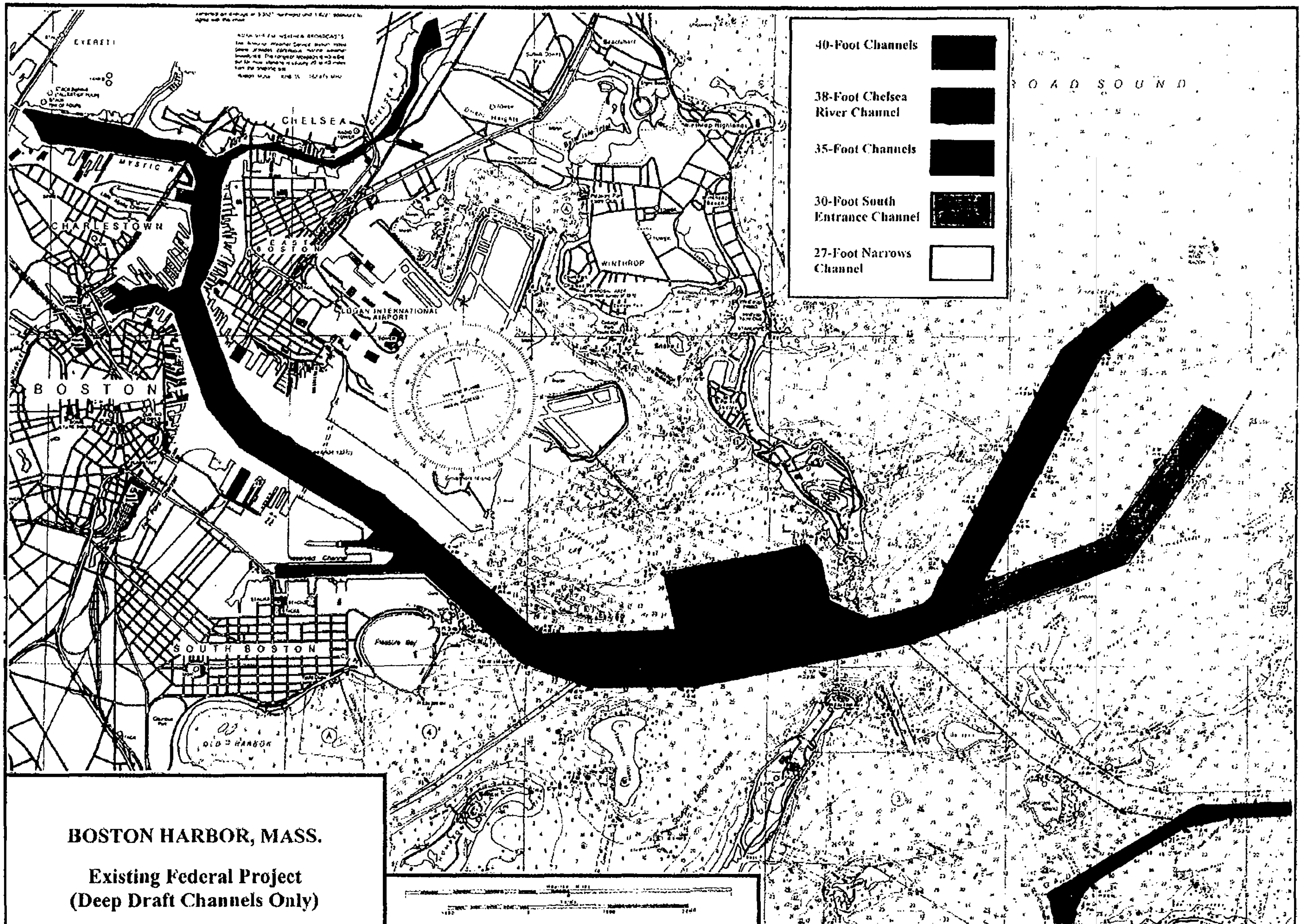
Date: January 31, 2003

Signature of person preparing ENF

Name (print or type)

Jacki Wilkins
Massachusetts Port Authority
One Harborside Drive Suite 200s
East Boston, MA 02128
(617) 568-3558

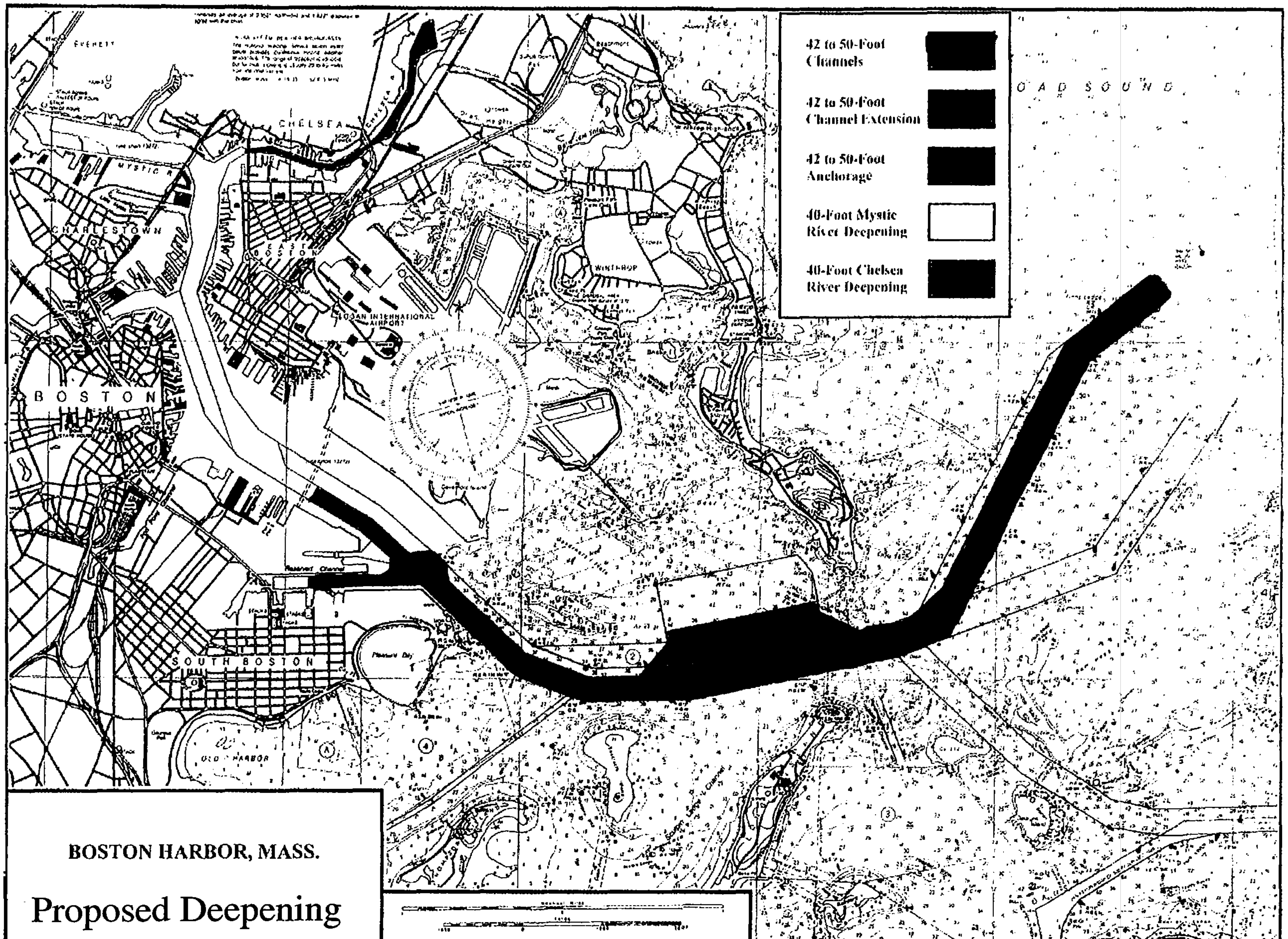
Figure 1



BOSTON HARBOR, MASS.

Existing Federal Project
(Deep Draft Channels Only)

Figure 2


42 to 50-Foot Channels
42 to 50-Foot Channel Extension
42 to 50-Foot Anchorage
40-Foot Mystic River Deepening
40-Foot Chelsea River Deepening
EVERETT
CHELSEA
CHARLESTOWN
EAST BOSTON
BOSTON
LOGAN INTERNATIONAL AIRPORT
WINTHROP
SOUTH BOSTON
BOSTON HARBOR, MASS.
Proposed Deepening

ATTACHMENT 1

Proposed Outline For
The Boston Harbor Deep Draft Navigation Improvement Project
Draft EIR/SEIS

Cover Sheet
Table of Contents
List of Acronyms
Executive Summary (discussion of effects and matrix)

1.0 INTRODUCTION
- 1.1 Project Purpose and Need
  - 1.1.1 Purpose of the Action (clear statement of purpose)
  - 1.1.2 Historical Importance of the Port of Boston
  - 1.1.3 Discussion of Previous Dredging Projects in the Port of Boston
  - 1.1.4 Need for Navigation Improvement (Economic Benefits)
    - 1.1.4.1 Navigational Efficiency
    - 1.1.4.2 Containerized Cargo Volumes
    - 1.1.4.3 Ability to Attract New Shipping Lines
    - 1.1.4.4 Maintain Refined Oil Product Capacity
- 1.2 Procedural History
  - 1.2.1 Congressional Authorization
  - 1.2.2 Public Participation Process
  - 1.2.3 Inter-Agency Coordination
- 1.3 Summary of Major Changes from the 1995 Final EIR/S for Previous Boston Harbor Navigation Improvement Project

2.0 ALTERNATIVES
- 2.1 Project Design Alternatives (Sections include a succinct description of each alternative)
  - 2.1.1 No Action
  - 2.1.2 Project Design Alternatives
- 2.2 Identification of Disposal Alternatives (Sections include a succinct description of each alternative)
- 2.3 Site Screening Process
- 2.4 Alternatives Considered and Eliminated from Detailed Study (alternatives matrix)
  - 2.4.1 Beneficial Use Alternatives
  - 2.4.2 Upland Disposal Alternatives
  - 2.4.3 Other Alternatives
- 2.5 Alternatives Evaluated (alternatives matrix)
- 2.6 Alternative 1: No-Action
- 2.7 Alternative 2: Site 1
- 2.8 Alternative 3: Site 2
- 2.9 Alternative 4: Site 3
- 2.10 Preferred Design and Disposal Alternative

3.0 AFFECTED ENVIRONMENT (brief introduction explaining section for dredging and disposal sites)
- 3.1 Location
- 3.2 Historic Navigation Projects in the Project Area (Types, Quantities, and Locations of Material Disposed from Boston Harbor where known)

ATTACHMENT 1

3.3 Physical Environment
- 3.3.1 Geological Setting
- 3.3.2 Physical Oceanography
- 3.3.3 Sediment Characteristics
  - *3.3.3.1 Physical Characteristics (Grain size, etc)*
  - *3.3.3.2 Metals Distributions*
  - *3.3.3.3 Organic Contaminants*
  - *3.3.3.4 Sediment Quality (toxicity)*

3.4 Water Quality
- 3.4.1 Temperature, Salinity, and Density
- 3.4.2 Water Column Turbidity
- 3.4.3 Dissolved Oxygen
- 3.4.4 Nutrients
- 3.4.5 Contaminants

3.5 Biological Environment (ecology)
- 3.5.1 Benthic Invertebrates
  (Includes infaunal and epifaunal communities; discussion of community and sediment type relationship)
- 3.5.2 Fish (includes life tables for relevant species)
  - *3.5.2.1 Spatial and Temporal Distribution*
  - *3.5.2.2 Commercially Important Fish Distribution*
  - *3.5.2.3 Recreationally Important Fish Distribution*
  - *3.5.2.4 Ecologically Important Fish Distribution*
  - *3.5.2.5 Spawning Strategies (Demersal and Pelagic)*
  - *3.5.2.6 Food and Habitat Requirements*
  - *3.5.2.7 Essential Fish Habitat*
- 3.5.3 Shellfish (includes life tables for relevant species)
  - *3.5.3.1 Spatial and Temporal Distribution of Shellfish*
  - *3.5.3.2 Spawning Strategies*
  - *3.5.3.3 Food and Habitat Requirements*
- 3.5.4 Lobster
- 3.5.5 Marine and Coastal Birds (includes life table for relevant species)
  - 3.5.5.1 *Coastal Species*
  - *3.5.5.2 Marine Species*
- 3.5.6 Marine Mammals and Reptiles (life tables for relevant species)
  - *3.5.6.1 Cetaceans (Whales, Dolphins, Porpoises)*
  - *3.5.6.2 Pinnipeds*
  - *3.5.6.3 Reptiles (Turtles)*
- 3.5.7 Rare, Threatened, Endangered Species and Species of Special Concern (includes life table for relevant species); (References Biological Assessment or other agency coordination as appropriate)
- 3.5.8 Contaminants in Organisms
  - 3.5.8.1 (Subsections include comparison to other nearby sites, recent data and discuss relative to FDA Advisory Levels; one or two paragraphs on potential of human consumption and risk)
  - *3.5.8.2 Benthic Infauna*
  - 3.5.8.3 *Fish and Shellfish*

3.6 Socio-economic Environment
- 3.6.1 Commercial and Recreational Fisheries
  (Discussions of catch Data of Commercially and Recreationally Important Fish and Shellfish)

ATTACHMENT 1

3.6.2 Shipping (Includes discussion of transportation, air quality and noise issues)
3.6.3 Recreational Activities
3.6.4 Natural or Cultural Features of Historical Importance

3.7 Site Specific Disposal Data

3.7.1 Disposal Site 1:

3.7.1.1 Location/bathymetry
3.7.1.2 Physical Oceanography
3.7.1.3 Transport (location and movement in water relative to amenities and beaches, etc.)
3.7.1.4 Sediment Quality
3.7.1.5 Contaminants, toxicity
3.7.1.6 Water Quality
3.7.1.7 Biota/Ecology - Plankton, Benthos, Fish/Shellfish, Birds, Mammals and Reptiles Endangered Species
3.7.1.8 Fishing Activities
3.7.1.9 Shipping/Navigation
3.7.1.10Historic/Archaeological
3.7.1.11Other Human Uses

3.7.2 Site 2:

3.7.2.1 As for Site 1

3.7.3 Site 3:

3.7.3.1 As for Site 1

4.0 ENVIRONMENTAL CONSEQUENCES

Describes approach to evaluating consequences of the alternatives (includes direct, indirect and cumulative impact definitions – general summary of dredging and disposal)

4.1 Environmental Consequences of No Action Alternative

4.2 General Dredging Impacts (General description and consequences of no dredging or disposal, beneficial use and/or upland alternatives)

4.2.1 Water Quality/Sediment Quality
4.2.2 Biological Resources
4.2.3 Threatened and Endangered Species
4.2.4 Historical and Archaeological Resources
4.2.5 Noise and Odor

4.3 General Impacts of Dredge Material Disposal (Including relevant DAMOS Monitoring results)

4.3.1 Disposal Process in Open Water
4.3.2 Water Column Impacts
4.3.3 Sediment Changes
4.3.4 Burial of Benthic Epifaunal and Infaunal Invertebrates and Fish
4.3.5 Effects of Suspended Solids on Life Stages filter (feeders, invertebrates, lobster, fish)
4.3.6 Effects on Marine Wildlife
4.3.7 Long-term Impact and Recovery
4.3.8 Contaminant Bioaccumulation Potential/Risk

4.3.8.1 Ecological Risk
4.3.8.2 Human Health from Fish and Shellfish

4.3.9 Threatened and Endangered Species
4.3.10 Historical and Archaeological Resources

4.4 Secondary Impacts

4.4.1 Commercial and Recreational Fisheries

ATTACHMENT 1

BOSTON HARBOR
MASSACHUSETTS

NAVIGATION IMPROVEMENT STUDY

FINAL FEASIBILITY REPORT
AND FINAL SUPPLEMENTAL
ENVIRONMENTAL IMPACT STATEMENT
AND MASSACHUSETTS
FINAL ENVIRONMENTAL IMPACT REPORT

APPENDIX Q

HARBOR BOTTOM MATERIAL
TYPES CLASSIFICATION

PREPARED BY:
OCEAN SURVEYS, INC.
OLD SAYBROOK, CT

THIS APPENDIX UNCHANGED FROM JULY 2008 DRAFT

OCEAN SURVEYS, INC.
MARINE AND FRESHWATER SURVEY SERVICES
91 SHEFFIELD STREET
OLD SAYBROOK CT 06475
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6 April 2006

Lisa Lefkovitz
Battelle Duxbury Operations
397 Washington St.
Duxbury, MA 02332

SUBJECT: FINAL REPORT NO. 05ES027
SEDIMENT MAPPING
BOSTON HARBOR, BOSTON, MASSACHUSETTS

Dear Ms. Lefkovitz:

Ocean Surveys, Inc. (OSI) is pleased to submit this letter report of findings based on a review of the side scan sonar, core samples, grab samples and subbottom profile data collected as part of a geological study for the proposed Navigation Improvement Project for Boston Harbor, a project to deepen the main shipping channel. OSI has been tasked with correlating coring data with the remote sensing data to enhance the previously presented surface map and generate sediment type maps of the seafloor and the –47 feet MLLW and –50 feet MLLW surfaces.

The side scan sonar and subbottom data ("Chirp" subbottom profiler data) analyzed for this review were collected by OSI during field operations conducted during the periods of 24 September to 8 October 2002 and 6-9 February 2003. Please refer to OSI Report No. 02ES066 for a comprehensive discussion of field procedures, processing techniques and survey results for that investigation. Core data were provided to OSI by the Army Corps of Engineers (ACOE) via Battelle.

The area covered by this investigation includes a 6.8 nautical mile length of the federal channel, with varying widths, from Pier 6 eastward past Deer Island (Figure 1). A total of approximately 240 nautical miles of side scan sonar data were collected for this project including the main shipping channel, Reserve Channel and turning area, Anchorage No. 2 in President Roads, and a proposed Mystic River CAD site.

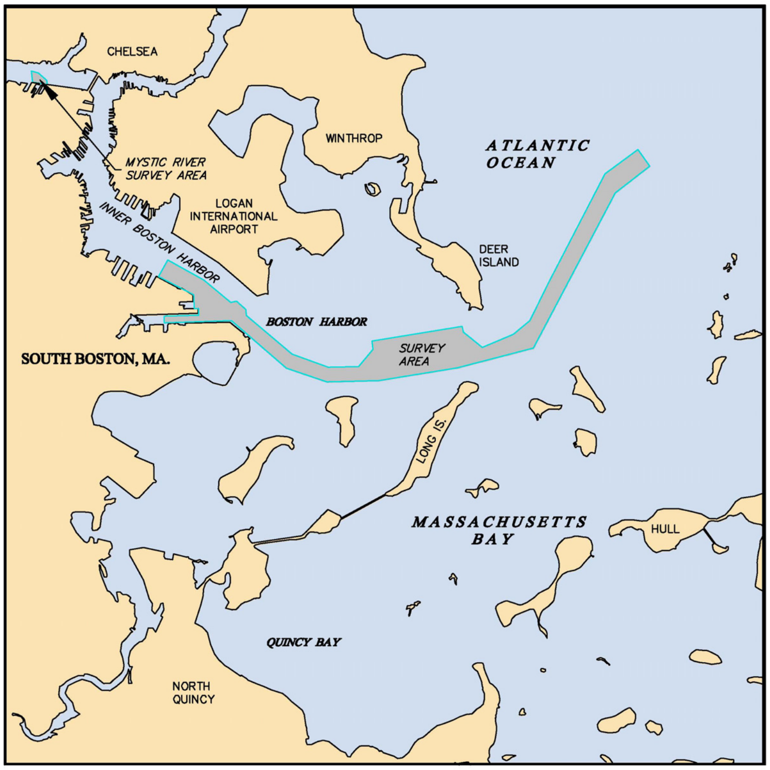


FIGURE Q-1. Location map showing the survey areas in Boston Harbor.

Data Products

Three sets of Microstation drawings, using ACOE base sheets, have been generated to illustrate the results of the mapping tasks. Full size drawing sheets (14 sheets per drawing set, 42 sheets total) have been submitted under separate cover. Electronic drawing files on CD are attached to this report, along with setup procedures for plotting each set of drawings. The procedures are provided electronically (on the CD) and printed at the end of this report.

Modification of the Surface Map

The surficial sediments map was originally generated based on the analysis of available side scan sonar and subbottom profiler records correlated with a very limited number of grab samples (4) completed by OSI. The results of that review are discussed in OSI Final Report #04ES069 (please refer to the report for further discussion). For the present task, the surficial sediments map was further reviewed based on the core data provided by ACOE (see attached table).

The modified surface map is presented in reduced format at the end of this report as Figure Q-2. Based primarily on their acoustic reflective characteristics, the core samples provided and the limited number of grab samples, three material types were identified in the sonar records (Types I-III). Type I materials also include bedrock identified in the subbottom records that is at or near the surface (within 3-5 feet). A sub-type, Type IIIA was also identified using the subbottom profiler records as a Type III sediment containing sufficient organic content to prevent acoustic penetration using a chirp 2-16 kHz. transducer. All material types are listed in the following table.

Material Type	Definition
Type I	Predominantly coarse grained materials consisting of gravel and or bedrock.
Type II	Predominantly poorly sorted fine to coarse grained materials, consisting of coarse to fine grained sand.
Type III	Predominantly fine grained materials, consisting of fine sands, silt and mud.
Type IIIA	Predominantly fine grained materials with organic content, such as silt and mud.

In general, surficial materials in the survey area east of Deer Island Light appear to be a mix of Type I and II, whereas bottom materials west of this point are predominantly Type II. Although apparently localized, Type I materials do exist in President Roads as demonstrated by the material retrieved in Grab sample No. 1. In addition, some localized Type III and IIIA materials were located along the northern edge of the survey area in President Roads.

Proceeding farther west into the harbor, sediments remain primarily Type II and Type III except where bedrock exists close to or on the bottom. Surficial Type III sediments apparently thin westward past navigation buoys Green #3 and Red #4 where Type I sediments were located near the center of the channel. In a few places a veneer of highly aqueous, Type III materials may exist over the coarser materials. Type I materials also exist near the bottom particularly east of Castle Island, in the Reserve Channel, and northwest of the Reserve Channel and turning area.

Sonar images of the bottom in the Mystic River site revealed generally Type II and III materials with some Type I materials located in the northeast corner of this CAD area.

The core findings generally correlated well with the interpretations presented in the surficial sediments map. It is important to note however, that cores were generally not conducted in Type I areas. Therefore, only very limited ground truthing (Grab Sample No. 1) has been accomplished in these areas. In order to verify the material composition of Type 1 areas, more direct sampling should be conducted.

<u>Subsurface Map Generation</u>

Prior to correlation and mapping, the subbottom records were reviewed. Previous analysis of the subbottom data resulted in the mapping of the "acoustic basement". The acoustic basement is defined as a mappable interface (i.e. acoustic reflector) that defines the deepest seismic penetration on a record. Within the survey area, the acoustic basement reflector is generally indicated by a strong semi-continuous seismic return at highly variable depths. The characteristics of the acoustic basement reflector are suggestive of an interface marking the top of rock or overlying till layer, however without specific ground truth correlation the actual composition of the acoustic basement could not be determined.

The subbottom record above the acoustic basement ranged from areas with multiple relatively flat lying reflectors representing internal interfaces within the unconsolidated sediments to areas of little or no reflectors. Areas with little or no reflectors are typically caused by a lack of sufficient contrast in acoustic impedance in the subbottom layers or because shallow subsurface gaseous sediments or other materials impede the acoustic signal penetration. A key factor in accurately determining material composition at a given subsurface depth (-47 and –50 feet MLLW are the mapping depths for this task) is the presence of subbottom layering (on the seismic record) that can be correlated to layer changes described in the cores. Within the unconsolidated section, no individual reflector was distinguishable from record to record that appeared to indicate a significant composition change. Instead, a pattern of reflectors that may represent small composition changes within an overall sedimentary unit was recognized. The lack of a single "tracer" reflector limited the ability to correlate acoustic reflectivity changes in the subbottom data with sediment interfaces encountered in the cores.

Figure Q-3 presents a subbottom profiler section exemplifying the pattern of reflectors that have been interpreted to represent the clay unit as well as the underlying acoustic basement.

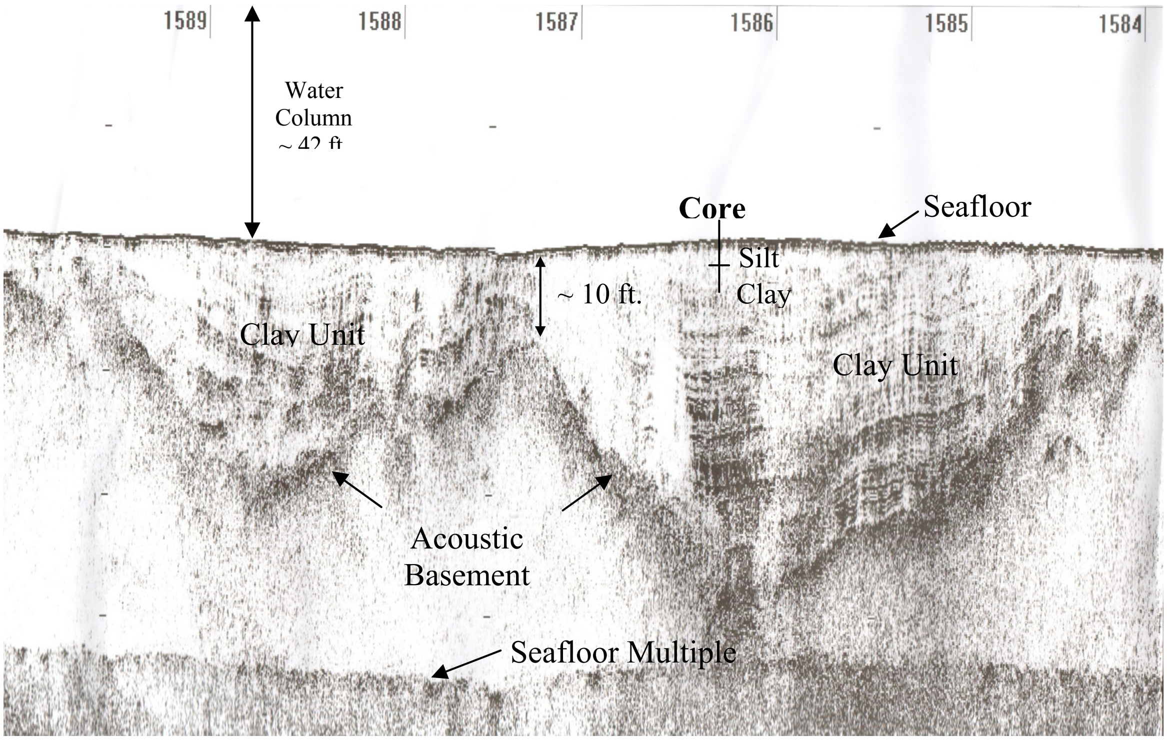


Figure Q-3: "Chirp" subbottom profile record illustrating typical characteristics for clay unit and acoustic basement reflector.

The main objective of this task was to use core data to ground truth subbottom profiler data to estimate material types present within the survey area at the two target depths (-47feet, -50feet MLLW). In order to accomplish this task, several processing and analysis steps were completed. These steps are summarized below:

1. Modify and expand the coring data spreadsheet "summary of stations_surface sed type.xls" to select only cores to be used (highlighted in yellow), extract geographic coordinates and convert to X,Y NAD27, Mass State Plane, 2001, feet, using Corpscon for windows ver 5.1

2. Using previously presented, OSI generated maps, delineate boundaries of the areas where the water depth is greater than the mapping depths (-47, -50feet) and where acoustic basement is expected at or above mapping depths.
3. Overlay the core locations on the map of water depths and extract the water depths at each core location, for inclusion in the core data spreadsheet
4. Using copies of core logs "bos-1-1.pdf" and "bos-2.pdf" summarize core findings in spreadsheet, include total depth of core replicate reported by client, also enter any pertinent information from all other replicates from core location. Estimate depth of bottom of core, using water depth determined above and estimate material at –47 feet and –50 feet based only on core info.
5. Review subbottom record at each core location to correlate core data to subbottom data. In most cases interfaces seen in core data (mostly thin layer of silt overlying clay) will not be discernable in the seismic record because the interface is within the upper few feet of the subsurface. If a relatively thick section of clay is present in the core with no underlying material identified and it correlates to the possible clay layer on the subbottom record, AND that layer continues to a depth below the target depths, the sediment type is estimated to be clay.
6. "Map" the subsurface unit, i.e. clay as far as possible, on the subbottom profiler record in either direction from the core location along the trackline.
7. Delineate boundaries of areas of similar characteristics/estimated sediment types.

In general, the core data reveal that throughout much of the survey area a surficial silt layer, ranging in thickness from a few inches to 3 feet, overlies clay. Based on published descriptions of regional geology, this clay is most likely part of the Boston Blue Clay unit. Of the 69 cores used for this analysis, at least 60 contained some silt at the surface. The remaining cores contained varying assemblages of clay, sand, shell, gravel and rock. Clay was the predominant component in the core samples below the surface layer.

As the core data table shows (attachment), most of the cores did not penetrate to the target depths. Only six cores (FF, CC, BB, OO, EE and GG) penetrated to -47 feet or deeper and none of these penetrated to –50 feet. For Cores FF and CC, penetration to -47 feet occurred in a different core replicate than the one described in the core summary for that location. Because most of the cores did not reach the target depths the core data provided only limited direct evidence of the material at -47 and –50 feet. In cases where clay was found in the core, but not to the target depths, it was assumed clay was present at -47 and –50 feet if several other conditions were met: no additional core attempts for that location had conflicting results (i.e. different material at depth); subbottom records did not indicate that acoustic basement was present; and subbottom reflectors that were characteristic of a clay unit correlated to the clay found in the core.

In order to construct the surface maps at –47 feet and –50 feet MLLW a classification scheme was developed to present the results of correlation and analysis. The following is a description of each category delineated on the surface maps:

Water – Results of hydrographic surveys, provided by ACOE indicate water is present at the target depth (i.e. water depth greater than or equal to –47 feet and –50 feet).

Acoustic Basement – Previous subsurface mapping indicates that acoustic basement, likely representing rock or till is present at the mapped surface.

Clay, higher confidence – Within the area delineated, cores directly indicate clay at target depth and subbottom records also indicate clay.

Clay, lower confidence – Within the area delineated, no cores reach the target depth. Subbottom records exhibit reflectors that are characteristic of clay.

Unknown – No cores within the area or cores do not reach target depth and coring results were insufficient to extrapolate to target depth. In addition, subbottom records do not provide sufficient insight to estimate material type at target depth, either due to lack of seismic signal penetration (previously mapped as "Organics") or no reflectors at target depth that are characteristic of clay (AB reflector may be present below target depth.)

Subsurface Mapping Results

Surface maps at each target depth have been generated and are presented in 11x17" format. These maps are included at the end of this report as Figures Q-4 and Q-5.

At -47 feet MLLW, (Figure Q-4) significant areas of "Clay, Higher Confidence" are mapped in the eastern part of Reserved Channel, continuing southeastward in the main channel and in the President Roads area. All of the cores that went to at least –47 feet are located within these areas as well as several cores that had clay to the bottom of the core at depths greater than -40 feet. Many of the subbottom returns exhibited characteristics typically associated with a clay unit, as presented in Figure Q-2. In other areas along the main channel (i.e. north of the Reserved channel, 2 areas within the Boston North Channel) no core data were available to provide direct correlation to subbottom records, however many of the subbottom records exhibited similar characteristics as those in areas that could be correlated to clay in the cores. It is estimated that clay is present at –47 feet within these areas although with lower confidence.

An area particularly noteworthy is located along the southern edge of the main channel west of President Road. This area has been classified as unknown. There are several cores located within this area (Y2, X, W, W2, V, U) however the coring results are inconsistent: All of the cores had clay at the bottom but none went deeper than -45' and cores X and V hit "refusal" above –47 feet. No further description is provided so it is not known if refusal was due to compact nature of the clay or a composition change such as till or rock. Seismic penetration was inhibited in this area so subbottom records do not provide insight into the composition of the materials. The depth of the mapped acoustic basement reflector is highly variable in the areas immediately adjacent to this unknown area so it is possible that the acoustic basement (i.e. till or rock) may be present at –47 feet at some locations within this unknown zone.

The map generated for the –50 feet MLLW surface (Figure Q-5) is very similar to the –47 feet MLLW map. A significant difference between the two surfaces is the change in the delineation of the boundaries for water depth and for acoustic basement. Also, the confidence level of all of the interpreted clay areas is relatively lower at –50 feet MLLW because none of the cores penetrated to that depth, therefore the presence of clay in the core had to be extrapolated further. Although there was no direct evidence of clay at –50 feet MLLW, areas where the subbottom record indicated a clear continuation of the acoustic properties interpreted as representing the clay unit down to –50 feet, were classified as "Clay – high confidence".

Since most cores contained silt at the surface it is reasonable to expect a surface layer of silt of variable thickness throughout much of the survey area. The silt-clay interface was not identified acoustically, i.e. no mappable reflectors correlating to the silt-clay interface in the cores were identified on the subbottom records. Therefore it was not possible to delineate any silt that may be present at the target depths; however, it is likely that silt may be encountered along the margins of the areas where water depths are at or below –47 feet and –50 feet. This silt "margin" is the surficial silt in areas where water depths are a few inches to 3 feet (estimated thickness of silt layer in cores) above the mapped depths.

Summary

The surface map previously generated for the survey area has been revised and two subsurface maps have been generated by correlating historic coring results with remote sensing data collected by OSI in 2002 and 2003. The confidence level of the interpretations made in mapping is dependent on the consistency of the core logs and summary table provided to OSI as well as the presence of subsurface reflectors. It is important to refer to the coring results table presented here and the original core logs while reviewing the final maps. Further direct sampling, especially in areas interpreted as coarse material (Type I) is recommended to verify material composition.

OSI appreciates the opportunity to further analyze data collected for this project and continue to support Battelle. If any questions arise regarding the survey or results please call or e-mail at your convenience.

Sincerely,

OCEAN SURVEYS, INC.

Margaret H. Sano

Margaret H. Sano
Project Scientist

MHS/ms
Attachments

Core Data Correlation Summary Table

Sampling Site	Date Sampled	Depth of description	Core Log Description (surface)	NAD27 Easting	NAD27 Northing	Water Depth From Hydro Data	Depth of Penetration/Summary of Description from Hand Written Core Logs**	Depth to Bottom of Core	Est material at 47' (based on all attempts, cores only)	Sub-bottom Record Interpretation with Correlation to Cores
NN	08/27/03	0 to 4.3'	Silt	727721.9	492472.9	39.8	5.2' 52-64" olive clay	45		AB at 42.5
MM	08/28/03	0 to 2.6'	Silt	729695.1	491263.3	39.7	2.6' all silt	42.3		AB at 41.5
LL	08/12/02	0 to 1.9'	Silt	729802.0	490711.5	38.2	4.9' 23-61" grey clay hit refusal	43.1		AB at 40.5
LL*	08/27/03	0 to 3.3'	Silt	729816.4	490703.8	38.3	5.9' 40-70" olive clay	44.2		AB at 40.5
FF	08/12/02	0 to 3.3'	Gray clay	730062.5	489579.7	42.0	4.9' 40-43" some sand, clay 43-51" grey clay hit refusal x2	46.9		This result conflicts with FF from 9/2/03, from subbottom it looks like AB is deeper, assume clay.
FF*	09/02/03	0 to 1'	Silt (one replicate had olive clay)	730065.2	489583.8	40.2	4.2' 12-18" olive clay, 18-24" silt 24-50" olive clay (one replicate 5' all olive clay) - penetration to 6.5'	44.4	clay	Reflectors might be silt/clay interface, can't tell, AB is deeper.
CC	09/02/03	0 to 2.1'	Silt	732057.6	488872.1	40.2	5.2' 26-62" olive clay, one atempt had clay to 75"	45.4	clay	Possible reflector at silt/clay interface. AB close to surface nearby.
BB	08/12/02	0 to 0.5'	Silt	732561.2	488653.6	42.0	3.9' 6-41"grey clay hit refusal	45.9		Good internal reflectors, extends laterally, clay at both 47,50.

Sampling Site	Date Sampled	Depth of description	Core Log Description (surface)	NAD27 Easting	NAD27 Northing	Water Depth From Hydro Data	Depth of Penetration/Summary of Description from Hand Written Core Logs**	Depth to Bottom of Core	Est material at 47' (based on all attempts, cores only)	Sub-bottom Record Interpretation with Correlation to Cores
BB*	09/03/03	0 to 5.8'	Silt over olive clay	732547.0	488639.7	42.0	5.8' silt over clay, silt layer very thin < 5"	47.8	clay	Clay at both 47,50.
Z	08/14/02	0 to 2.1'	Silt	733781.7	487637.5	40.0	2.1' all silt hit refusal x2	42.1		AB at 44 or less.
Z*	08/27/03	0 to 1.9'	Silt	733785.1	487640.8	40.0	1.9' all silt, hit refusal	41.9		AB at 44 or less.
W	08/25/03	0 to 5.2'	Silt	735139.3	486555.0	38.0	6.1' 32-63"dk sand some silt 63-73" olive clay	44.1		Organics? No penetration, no correlation.
X	08/14/02	0 to 3.6'	Silt	734540.2	486970.0	40.0	3.8' all silt 43" hit refusal x2	43.8		Organics? No penetration, no correlation.
X*	08/27/03	0 to 3.25'	Silt	734540.7	486974.0	40.0	3.2' all silt hit refusal	43.2		Organics? No penetration, no correlation.
V	08/09/02	0 to 3.3'	Silt	736109.7	485978.6	38.0	3.4' 40-42" gravel hit refusal	41.4		Organics? No penetration, no correlation.
V*	08/21/03	0 to 3.9'	Silt	736108.5	485981.5	38.0	4.6' 47-55" dk gry sand and grvl	42.6		Organics? No penetration, no correlation.
U	08/09/02	0 to 2.9'	Silt	736873.6	485854.2	39.3	3.4' 35-41" clay	42.7		On edge of organics, no correlation with core.
U*	08/22/03	0 to 3.9'	Sil	736879.0	485844.5	39.4	5.3' 47-65" olive clay	44.7		Possibly clay, no sign of AB.

Sampling Site	Date Sampled	Depth of description	Core Log Description (surface)	NAD27 Easting	NAD27 Northing	Water Depth From Hydro Data	Depth of Penetration/Summary of Description from Hand Written Core Logs**	Depth to Bottom of Core	Est material at 47' (based on all attempts, cores only)	Sub-bottom Record Interpretation with Correlation to Cores
T	08/14/02	0 to 0.16'	Silt and medium grain sand; few shell pieces	738223.5	485594.9	41.6	2.4' 2-29" clay, hit refusal	44		Deeper, strong reflectors below 50', assume clay at 47, 50.
T*	08/22/03	0 to 0.9'	Silt with shell fragments (one replicate had olive clay with gravel and rocks)	738227.0	485588.9	41.5	2.8' 3-4" olive clay, 5'7" sand w/shell frgmts 8-34" olive clay (different replicate than surface description)	44.3		Possibly clay, AB much deeper.
S	08/14/02	0 to 1.5'	Silt and fine sand	740076.2	485648.7	41.1	2.1' 18-26" clay hit refusal x2	43.2		Probably clay at 47, 50, AB near 55.
S*	08/25/03	0 to 1.3'	Silt	740043.5	485651.4	41.1	4.2' 16-51" olive clay	45.3		Probably clay at 47, 50, AB near 55.
R	08/14/02	0 to 0.5'	Silt and fine sand	741599.0	485674.4	38.5	4.9' 6-35" soft clay, 35-41"organic veg/peat, 41-58" soft dark clay-like, ht refusal xs	43.4		No reflectors near 47, 50 - possibly clay.
R*	08/25/03	0 to 1.16'	Sand with some shell fragments and rocks	741587.4	485665.2	38.4	4.1' 14-20" silt 20-49"olive clay	42.5		No reflectors near 47, 50 - possibly clay.

Sampling Site	Date Sampled	Depth of description	Core Log Description (surface)	NAD27 Easting	NAD27 Northing	Water Depth From Hydro Data	Depth of Penetration/Summary of Description from Hand Written Core Logs**	Depth to Bottom of Core	Est material at 47' (based on all attempts, cores only)	Sub-bottom Record Interpretation with Correlation to Cores
Q	08/09/02	0 to 0.8'	Clay with small amount of sand mixed in	741843.1	486134.6	42.0	.8' clay, hit refusal	42.8		AB is much deeper, but no shallow reflectors to correlate.
Q*	08/14/02	0 to 0.4'	Silt, gravel, small amount of clay	741843.1	486134.6	42.0	.9' 5-10"gravel/stones, hit refusal	42.9		AB is much deeper, but no shallow reflectors to correlate.
AA	08/12/02	0 to 1.25'	Silt	733061.3	488156.2	42.0	3.5' 15-30" grey clay, hit refusal	45.5		No reflector correlates to silt/clay interface. Clay at 47, AB close to 50.
AA*	09/03/03	0 to 1.5'	Silt	733068.7	488146.5	42.0	1.5' all silt, trace clay at bottom(one attempt had 0-12"silt, 12-18"clay, 18-27"silt 27-33" olive clay)	43.5		No reflector correlates to silt/clay interface. Clay at 47, AB close to 50.
J	08/13/02	0 to 0.75'	Many shells, some sand	753351.6	492169.9	40.0	1.1' 9-13" silt and some clay hit refusal	41.1		AB at or near surface in area.
KK	08/08/02	0 to 0.3'	Dark organic silt	727727.8	489466.6	42.0	2.9', bottom 29" boston blue clay, hit refusal 2x	44.9		AB reflector clear, dips below -50, no shallow reflector to correlate w/core.

Sampling Site	Date Sampled	Depth of description	Core Log Description (surface)	NAD27 Easting	NAD27 Northing	Water Depth From Hydro Data	Depth of Penetration/Summary of Description from Hand Written Core Logs**	Depth to Bottom of Core	Est material at 47' (based on all attempts, cores only)	Sub-bottom Record Interpretation with Correlation to Cores
KK*	08/19/03	0 to 1.16'	Dark organic silt	727757.7	489456.6	42.0	2.1' 13-25" olive clay	44.1		AB reflector clear, dips below -50, no shallow reflector to correlate w/core.
JJ	08/08/02	0 to 0.5'	Silt	727928.8	489611.1	42.0	2.0' 6"-9"sand9-16"gravel, clay plug at bottom, hit refusal	44		AB reflector depth highly variable in this area, no direct correlation w/core.
JJ*	08/19/03	0 to 0.58'	Silt	727930.6	489606.8	42.0	2.1' 6-18"sand/grvl, 18-25"sand/olive clay	44.1		AB reflector depth highly variable in this area, no direct correlation w/core.
HH	08/08/02	0 to 0.6'	Silt	728252.3	489739.1	41.9	2' 8-24" sandy clay, hit refusa	43.9		In general AB reflector depth highly variable, shallow near this core (~47).
HH*	08/18/03	0 to 2.4'	Dark organic silt with some sand mixed in	728236.4	489750.1	42.0	3.1' 29-38" olive clay	45.1		In general AB reflector depth highly variable, shallow near this core (~47).
II	08/08/02	0 to 0.8'	Silt	728426.7	489517.6	42.0	2.4' 10-18"sand/grvl mix, 18-29" clay, hit refusal	44.4		AB reflector near surface here, may be cause of refusal on core.
II*	08/18/03	0 to 0.58'	Silt	728424.3	489521.0	42.0	.8' 7-8" grey clay	42.8		AB reflector near surface here.

Sampling Site	Date Sampled	Depth of description	Core Log Description (surface)	NAD27 Easting	NAD27 Northing	Water Depth From Hydro Data	Depth of Penetration/Summary of Description from Hand Written Core Logs**	Depth to Bottom of Core	Est material at 47' (based on all attempts, cores only)	Sub-bottom Record Interpretation with Correlation to Cores
OO	08/09/02	0 to 0.6'	Silt and silty sand with broken shells	743047.4	487887.8	43.5	2' 2-7"broken shells, sand 7-18"f, med sand, 18-24"clay, hit refusal	45.5		No reflectors near 47, 50 - possibly clay. AB deeper.
OO*	08/29/03	0 to 2'	Medium to coarse sand, some silt	743039.8	487862.2	44.0	3.4' 23-41"very dense olive clay (one attempt had clay to 80")	47.4	clay	No reflector to correlate silt/sand/clay boundary, probably clay near 47, 50 . AB deeper.
PP	08/09/02	0 to 0.6'	Dark sandy silt	742093.2	487895.2	41.4	1.7' 6-19"grey clay, hit refusal	43.1		No reflector near 47, possibly clay; flat reflector ~51, could be AB.
PP*	08/28/03	0 to 2.1'	Sandy silt/silt	742079.2	487879.1	41.6	3.3' 25-39" olive clay, very dense	44.9		No reflector near 47, possibly clay; flat reflector ~51, could be AB.
QQ	08/09/02	0 to 2.8'	Silt	740965.6	487590.2	40.0	3.9' 34"-42"sandy silt, 42-46'CLAY, Hit refusal	43.9		No internal reflectors near 47, 50 - possibly clay. AB deeper.
QQ*	08/28/03	0 to 2.3'	Sandy silt	740954.5	487592.3	40.0	3.7' 18-37" f-md dark sand w/shells 37-43" dense olive clay (one attempt had clay to 61")	43.7		No internal reflectors near 47, 50 - possibly clay. AB deeper.

Sampling Site	Date Sampled	Depth of description	Core Log Description (surface)	NAD27 Easting	NAD27 Northing	Water Depth From Hydro Data	Depth of Penetration/Summary of Description from Hand Written Core Logs**	Depth to Bottom of Core	Est material at 47' (based on all attempts, cores only)	Sub-bottom Record Interpretation with Correlation to Cores
DD	08/12/02	0 to 0.8'	Silt	730089.7	490042.0	43.9	1.3' 10-16" sand few stones, hit refusal	45.2		N reflectors, AB at or near surface, uneven riverbed reflector.
EE	08/12/02	0 to 0.16'	Silt	730421.0	489902.0	42.0	3.8' 2-34" grey clay, 34-46"sandy clay, hit refusal	45.8		AB reflector up and down in this area, appears deeper than 50 at core location.
EE*	09/02/03	0 to 6'	Olive clay	730419.1	489887.5	42.0	6' all olive clay, not as hard	48	clay	AB reflector up and down in this area, appears deeper than 50 at core location, correlates to clay in core at 47.
GG	08/12/02	0 to 0.25'	Silt	730424.1	489834.9	42.0	3.7' 3-40" grey clay, hit refusal	45.7		AB reflector up and down in this area, appears deeper than 50 at core location.
GG*	09/02/03	0 to 7.1'	Olive clay	730421.0	489826.6	42.0	7.2' all olive clay	49.2	clay	AB reflector up and down in this area, appears deeper than 50 at core location, correlates to clay in core at 47.
TT	08/15/02	0 to 4.16'	Silt	718105.8	505162.4	30.4	5' 50-60" clay	35.4		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.

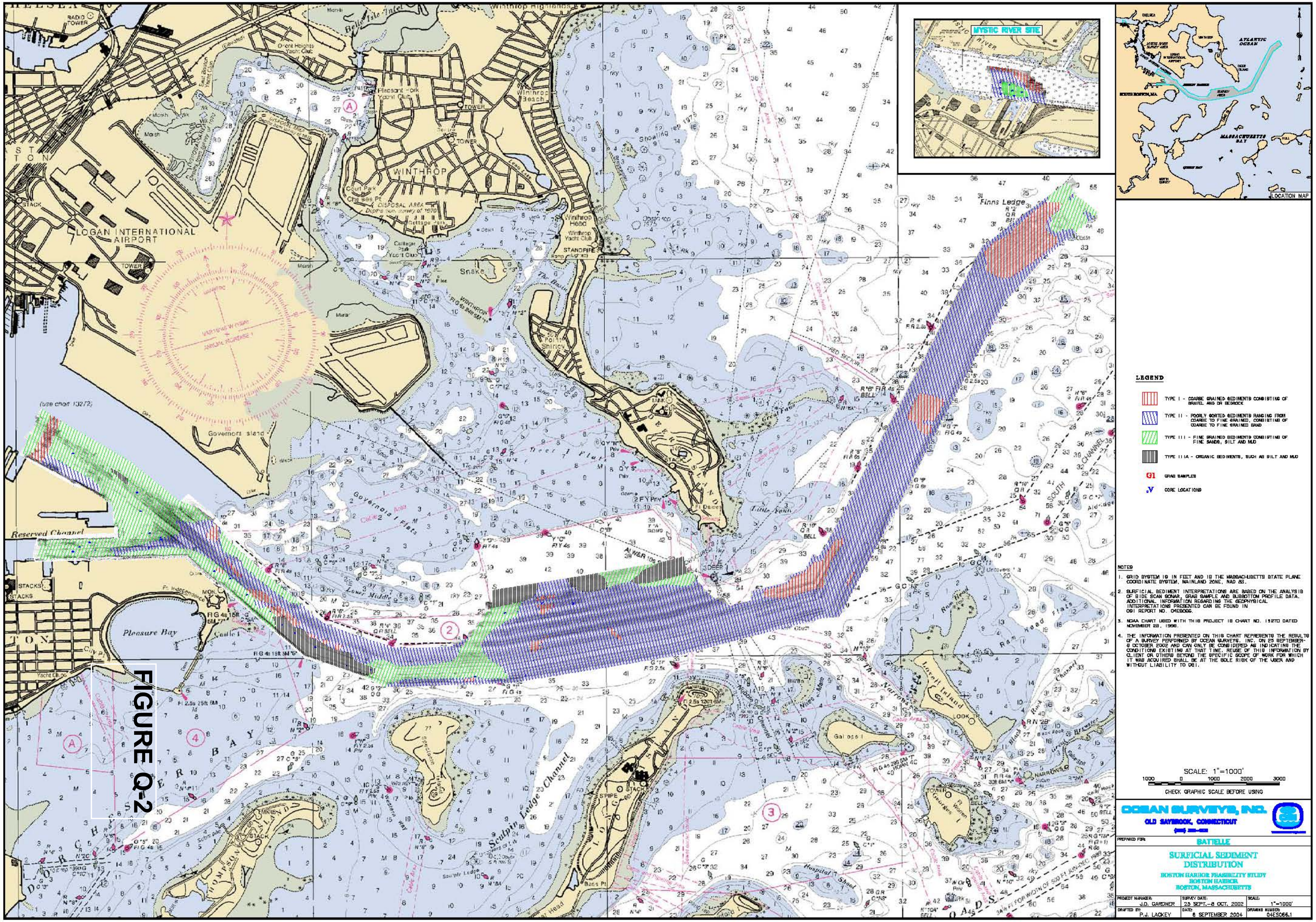
Sampling Site	Date Sampled	Depth of description	Core Log Description (surface)	NAD27 Easting	NAD27 Northing	Water Depth From Hydro Data	Depth of Penetration/Summary of Description from Hand Written Core Logs**	Depth to Bottom of Core	Est material at 47' (based on all attempts, cores only)	Sub-bottom Record Interpretation with Correlation to Cores
TT*	08/19/09	0 to 5.75'	Dark organic silt	718111.3	505172.7	30.5	8' 69-99" olive clay	38.5		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.
WW	08/15/02	0 to 1.25'	Silt	718070.4	505355.0	31.6	2.8' 15-32" clay	34.4		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.
WW*	08/21/03	0 to 3.25'	Silt	718076.8	505356.7	31.5	6.8' 37-81" olive clay	38.3		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.
YY	08/15/02	0 to 9'	Silt	718089.6	505519.5	34.3	2.5' 11-21" silty brown peat, wood debris, 21-22" clean clay 22-26" sandy clay 26-30"peat +clay refusal (appears to be mistype of surface depth from client, should be 0.9' instead of 9')	36.8		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.
YY*	08/21/03	0 to 2.75'	Silt	718090.6	505522.2	34.3	5.8' 33-69" olive clay (went to 9' on one attempt all clay on bottom)	40.1		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.

Sampling Site	Date Sampled	Depth of description	Core Log Description (surface)	NAD27 Easting	NAD27 Northing	Water Depth From Hydro Data	Depth of Penetration/Summary of Description from Hand Written Core Logs**	Depth to Bottom of Core	Est material at 47' (based on all attempts, cores only)	Sub-bottom Record Interpretation with Correlation to Cores
RR	08/15/02	0 to 3.5'	Silt with some sand	718901.7	505053.0	35.1	5.1' 42-43"sand, 43-48" fine sandy clay 48-62" clay	40.2		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.
RR*	08/20/03	0 to 3.8'	Silt	718905.8	505057.8	35.1	5.2' 46-63" clay	40.3		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.
SS	08/15/02	0 to 0.25'	Silt	718516.5	505115.3	31.9	2.8' 3-34" clean clay	34.7		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.
SS*	08/20/03	0 to 1.75'	Silt	718502.1	505114.1	32.1	7.4' 21-89" clay	39.5		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.
VV	08/15/02	0 to 0.16'	Light brown silt	718455.3	505271.3	33.0	3.9' 2-44"silt with clay and trace fine sand	36.9		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.
VV*	08/20/03	0 to 4.25'	Silt	718456.6	505268.1	33.0	6.5' 51-78" olive clay	39.5		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.
XX	08/15/02	0 to 5.25'	Clay with black silt, trace of black sand	718378.2	505441.8	34.4	6.1' 63-71" clay	40.5		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.

Sampling Site	Date Sampled	Depth of description	Core Log Description (surface)	NAD27 Easting	NAD27 Northing	Water Depth From Hydro Data	Depth of Penetration/Summary of Description from Hand Written Core Logs**	Depth to Bottom of Core	Est material at 47' (based on all attempts, cores only)	Sub-bottom Record Interpretation with Correlation to Cores
XX*	08/21/03	0 to 3.25'	Silt	718376.8	505449.3	34.2	5.6' 38-68" olive clay	39.8		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.
UU	08/15/02	0 to 4.5'	Black clay, black silt, trace of sand	718741.2	505217.2	34.6	5.2' 54-59" clay	39.8		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.
UU*	08/20/03	0 to 5.16'	Silt	718752.1	505225.2	34.3	5.1' all silt, no clay(one attempt had clay 51-71")	39.4		No Reflectors, in CAD site, fill material?, cores didn't go to target depths.
NN2	08/15/02	0 to 2.9'	Silt	727729.2	492470.8	39.8	4.5' 35-54" clay	44.3		AB above 47, correlates to refusal.
MM2	08/15/02	0 to 3'	Silt	729692.4	491271.1	39.8	3' all silt refusal	42.8		AB above 47, correlates to refusal.
CC2	08/15/02	0 to 3'	Silt	732057.8	488863.2	40.0	4.4' 36-53" clay	44.4		possible reflector at silt/clay interface. AB close to surface nearby.
Y2	08/15/02	0 to 3.1'	Silt	734136.0	487222.3	40.0	4.4' 37-53" clay	44.4		No reflectors, possible shallow organics, masking below. No correlation with core results.

Sampling Site	Date Sampled	Depth of description	Core Log Description (surface)	NAD27 Easting	NAD27 Northing	Water Depth From Hydro Data	Depth of Penetration/Summary of Description from Hand Written Core Logs**	Depth to Bottom of Core	Est material at 47' (based on all attempts, cores only)	Sub-bottom Record Interpretation with Correlation to Cores
W2	08/15/02	0 to 3.5'	Silt	735142.9	486538.9	38.0	5.6' 42-68" clay	43.6		No reflectors, possible shallow organics, masking below. No correlation with core results.

Columns shaded gray are taken directly from core logs provided by ACOE. (BOS-1-1.PDF, BOS-2.PDF).
*Asterisk(*) added by OSI to distinguish between two cores with the same label.
**Depth summary/core findings transcribed from core logs provided by ACOE.


MYSTIC RIVER SITE
LOCATION MAP
LOGAN INTERNATIONAL AIRPORT
WINTHROP
LEGEND
TYPE I - COARSE GRAINED SEDIMENTS CONSISTING OF GRAVEL AND OR BEDROCK
TYPE II - POORLY SORTED SEDIMENTS RANGING FROM COARSE TO FINE GRAINED, CONSISTING OF COARSE TO FINE GRAINED SAND
TYPE III - FINE GRAINED SEDIMENTS CONSISTING OF FINE SANDS, SILT AND MUD
TYPE IIIA - ORGANIC SEDIMENTS, SUCH AS SILT AND MUD
G1 GRAB SAMPLES
V CORE LOCATIONS
NOTES
1. GRID SYSTEM IS IN FEET AND IS THE MASSACHUSETTS STATE PLANE COORDINATE SYSTEM, MAINLAND ZONE, NAD 83.
2. SURFICIAL SEDIMENT INTERPRETATIONS ARE BASED ON THE ANALYSIS OF SIDE SCAN SONAR, GRAB SAMPLE AND SUBBOTTOM PROFILE DATA. ADDITIONAL INFORMATION REGARDING THE GEOPHYSICAL INTERPRETATIONS PRESENTED CAN BE FOUND IN OSI REPORT NO. 04ES066.
3. NOAA CHART USED WITH THIS PROJECT IS CHART NO. 13270 DATED NOVEMBER 28, 1998.
4. THE INFORMATION PRESENTED ON THIS CHART REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 25 SEPTEMBER-8 OCTOBER 2002 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.
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1000 0 1000 2000 3000
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PROJECT MANAGER: J.D. GARDNER
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DRAFTED BY: P.J. LACKEY
DATE: 6 SEPTEMBER 2004
DRAWING NUMBER: 04ES066.1
SHEET 1 OF 1

FIGURE Q-2

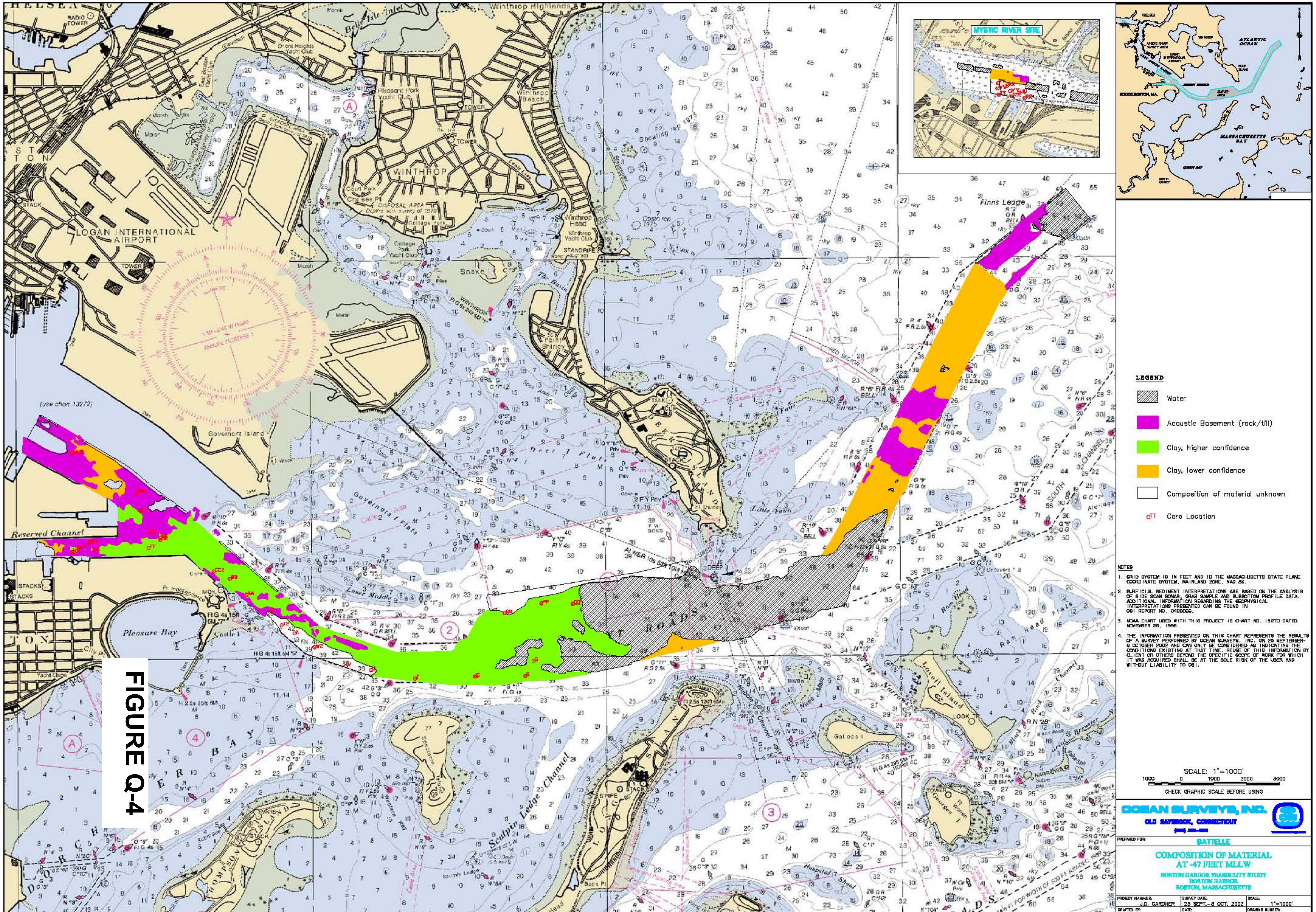


FIGURE Q-4
LOGAN INTERNATIONAL AIRPORT
WINTHROP
MYSTIC RIVER SITE
LEGEND
Water
Acoustic Basement (rock/till)
Clay, higher confidence
Clay, lower confidence
Composition of material unknown
Core Location
NOTES
1. GRID SYSTEM IS IN FEET AND IS THE MASSACHUSETTS STATE PLANE COORDINATE SYSTEM, MAINLAND ZONE, NAD 83.
2. SURFICIAL SEDIMENT INTERPRETATIONS ARE BASED ON THE ANALYSIS OF SIDE SCAN SONAR, GRAB SAMPLE AND SUBBOTTOM PROFILE DATA. ADDITIONAL INFORMATION REGARDING THE GEOPHYSICAL INTERPRETATIONS PRESENTED CAN BE FOUND IN OSI REPORT NO. 04ES066.
3. NOAA CHART USED WITH THIS PROJECT IS CHART NO. 13270 DATED NOVEMBER 28, 1998.
4. THE INFORMATION PRESENTED ON THIS CHART REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 25 SEPTEMBER-8 OCTOBER 2002 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.
SCALE: 1"=1000'
1000 0 1000 2000 3000
CHECK GRAPHIC SCALE BEFORE USING
OCEAN SURVEYS, INC.
OLD SAYBROOK, CONNECTICUT
PREPARED FOR: BATTELLE
COMPOSITION OF MATERIAL
AT -47 FEET MLLW
BOSTON HARBOR FEASIBILITY STUDY
BOSTON HARBOR
BOSTON, MASSACHUSETTS
PROJECT MANAGER: J.D. GARDNER
SURVEY DATE: 25 SEPT.–8 OCT. 2002
SCALE: 1"=1000'
DRAFTED BY: P.J. LACKEY
DATE: 23 SEPTEMBER 2005
DRAWING NUMBER: 04ES066.1
SHEET 1 OF 1

FIGURE 4.

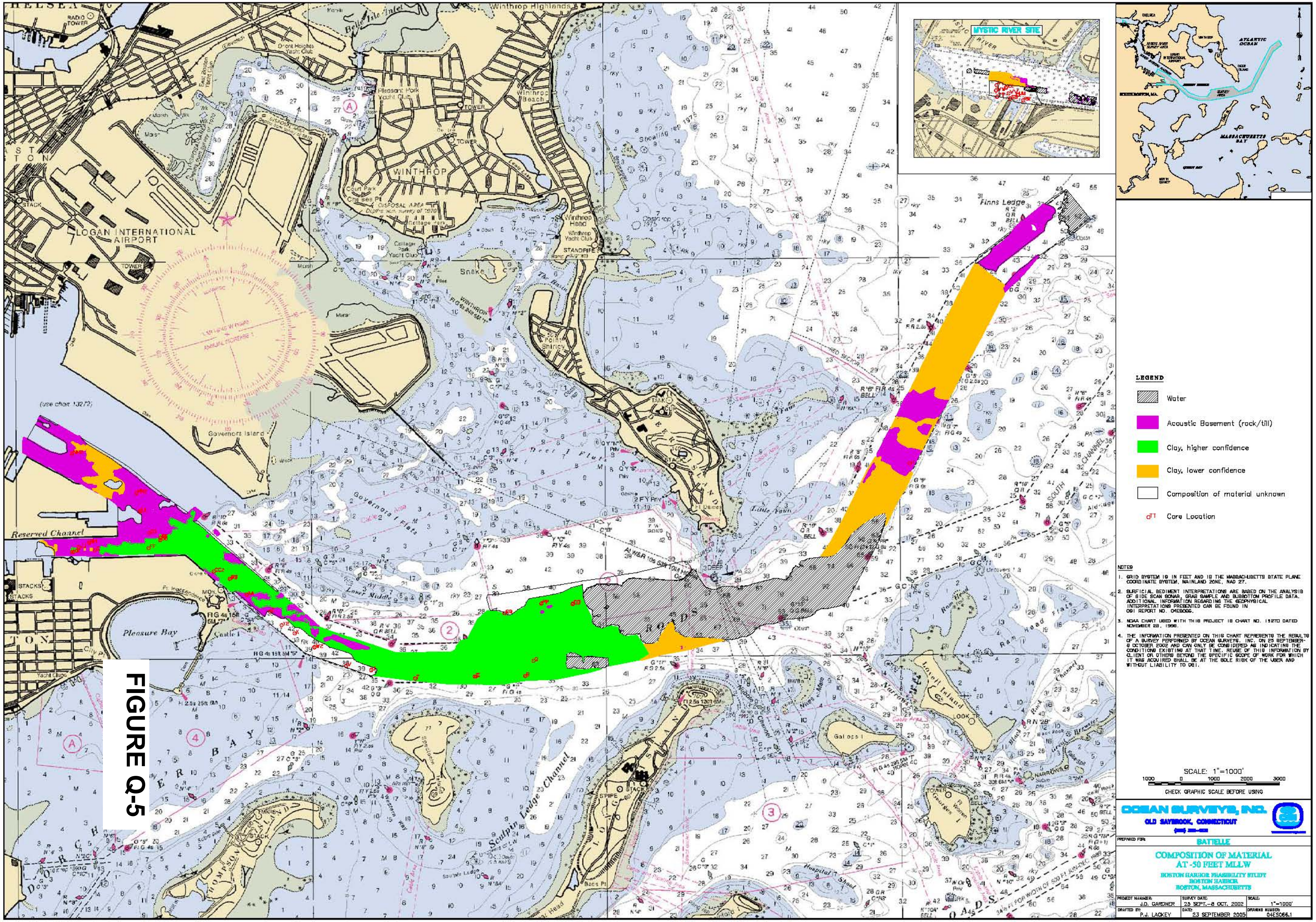


FIGURE Q-5
LOGAN INTERNATIONAL AIRPORT
WINTHROP
Governors Island
Reserved Channel
Pleasure Bay
Sculpin Ledge Channel
Finns Ledge
MYSTIC RIVER SITE
ATLANTIC OCEAN
MASSACHUSETTS BAY
LEGEND
Water
Acoustic Basement (rock/till)
Clay, higher confidence
Clay, lower confidence
Composition of material unknown
Core Location
NOTES
1. GRID SYSTEM IS IN FEET AND IS THE MASSACHUSETTS STATE PLANE COORDINATE SYSTEM, MAINLAND ZONE, NAD 27.
2. SURFICIAL SEDIMENT INTERPRETATIONS ARE BASED ON THE ANALYSIS OF SIDE SCAN SONAR, GRAB SAMPLE AND SUBBOTTOM PROFILE DATA. ADDITIONAL INFORMATION REGARDING THE GEOPHYSICAL INTERPRETATIONS PRESENTED CAN BE FOUND IN OSI REPORT NO. 04ES066.
3. NOAA CHART USED WITH THIS PROJECT IS CHART NO. 13270 DATED NOVEMBER 28, 1998.
4. THE INFORMATION PRESENTED ON THIS CHART REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 25 SEPTEMBER-8 OCTOBER 2002 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.
SCALE: 1"=1000'
1000 0 1000 2000 3000
CHECK GRAPHIC SCALE BEFORE USING
OCEAN SURVEYS, INC.
OLD SAYBROOK, CONNECTICUT
PREPARED FOR: BATTELLE
COMPOSITION OF MATERIAL AT -50 FEET MLLW
BOSTON HARBOR FEASIBILITY STUDY
BOSTON HARBOR
BOSTON, MASSACHUSETTS
PROJECT MANAGER: J.D. GARDNER
SURVEY DATE: 25 SEPT.-8 OCT. 2002
SCALE: 1"=1000'
DRAFTED BY: P.J. LACKEY
DATE: 23 SEPTEMBER 2005
DRAWING NUMBER: 04ES066.1
SHEET 1 OF 1

FIGURE 5.

BOSTON HARBOR
MASSACHUSETTS

DEEP DRAFT
NAVIGATION IMPROVEMENT STUDY

FINAL FEASIBILITY REPORT
AND FINAL SUPPLEMENTAL
ENVIRONMENTAL IMPACT STATEMENT
AND MASSACHUSETTS FINAL
ENVIRONMENTAL IMPACT REPORT

APPENDIX R
US ENVIROMENTAL PROTECTION AGENCY
MEMORANDUM
ON CAPPING OF FORMER
INDUSTRIAL WASTE SITE

THIS APPENDIX UNCHANGED FROM JULY 2008 DRAFT

APPENDIX R

US ENVIRONMENTAL PROTECTION AGENCY DOCUMENTS ON CAPPING OF THE FORMER INDUSTRIAL WASTE SITE IN MASSACHUSETTS BAY

CONTENTS

This Appendix to the Feasibility Report and Supplemental Environmental Impact Statement/Massachusetts Environmental Impact Report for the Boston Harbor Deep Draft Navigation Improvement contains three documents.

(1) A Memorandum from the U.S. Environmental Protection Agency, Region I (New England), Ocean and Coastal Protection Unit to the U.S. Army Corps of Engineers, New England District, Engineering Planning Division, dated July 17, 2008, updating the previous views of the agency on the IWS capping proposal.

(2) A Memorandum from the U.S. Environmental Protection Agency, Region I (New England), Ocean and Coastal Protection Unit to the U.S. Army Corps of Engineers, New England District, Engineering Planning Division, dated December 14, 2007 outlining EPA's views and concept for the beneficial use of dredged material from the Boston Harbor improvement dredging project to cap the former Industrial Waste Site in Massachusetts Bay

(3) A Data Analysis Report, dated 31 January 2008, prepared by Vincent J. Capone, Barkentine, Inc., under contract to U.S. EPA, on analysis of side scan sonar data collected by U.S. EPA at the Industrial Waste Site in July 2006

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND
Office of Ecosystem Protection
One Congress Street, Suite 1100, Boston, MA 02114-2023
www.epa.gov/ne

MEMORANDUM

To: Mark L. Habel, Chief
Navigation Section, Engineering Planning Division (CENAE-EP-PN)
From: Melville P. Coté, Jr., Manager
Ocean and Coastal Protection Unit
Date: July 17, 2008
Re: Remediation of the former Industrial Waste Site in Massachusetts Bay

The purpose of this memo is to provide an updated map of priority areas for remediation. As promised in our December 20, 2007, memo, we completed a final side scan sonar interpretation in early January 2008. The final report has been forwarded to your office.[1] Based on this interpretation, we revised our priority areas for remediation; they are displayed in Figure 1.

Area 1 is a known area of historical disposal of containers. There are almost 1000 targets listed in this area, most with a medium to high probability of identification as containers. Area 2 is also an area of historical disposal of containers. A high resolution side scan sonar was not performed in this area, so the level of confidence in identifying containers was not as high as in Area 1. The targets, however, appear to be similar to those found in Area 1. Area 3 is an area of lower density of targets. All priority areas avoid shipwrecks identified at the IWS.

The aerial coverage of the three priority areas for capping of containers are listed below. See Figure 1 for locations of each area.

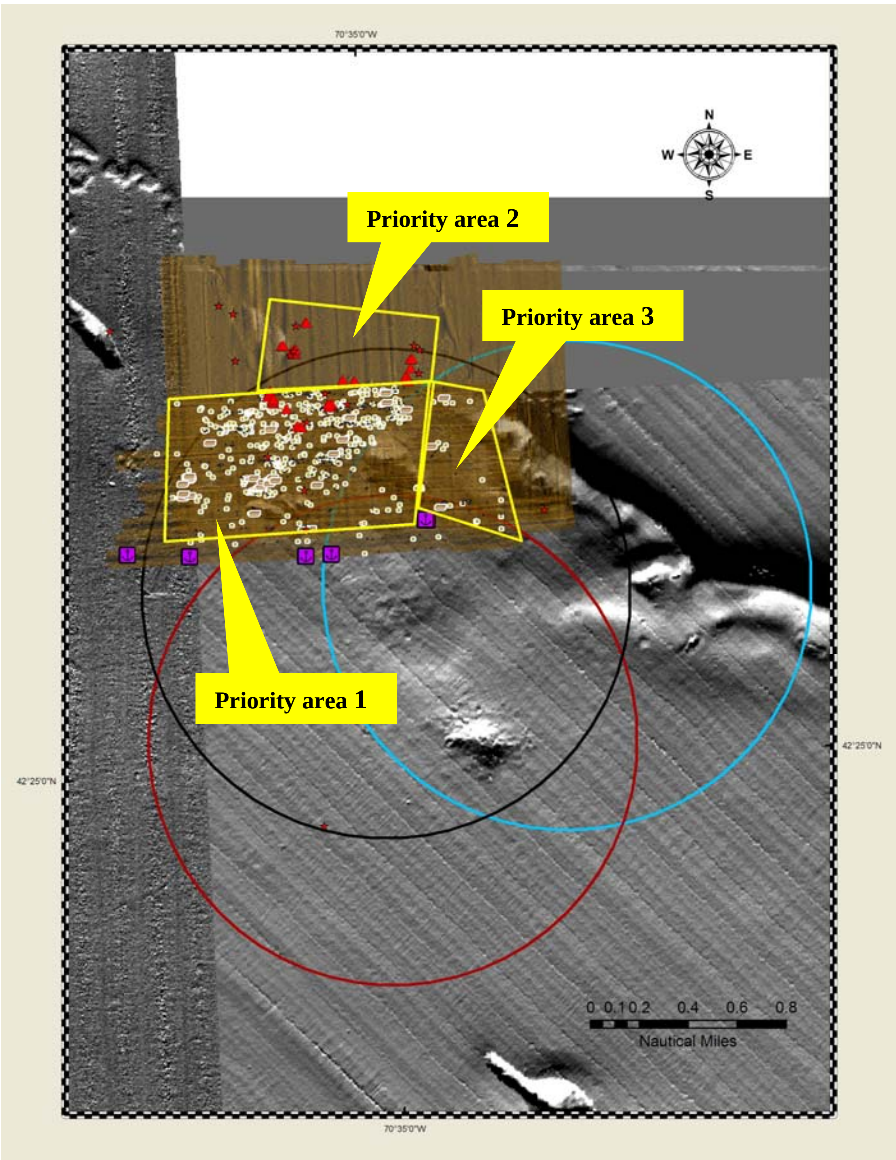
Priority area 1	514 acres
Priority area 2	189 acres
Priority area 3	146 acres
Total	849 acres

[1] Capone, Vincent J. Side Scan Sonar Data Processing and Analysis of US EPA IWS/MBDS Survey 2006. January 31, 2008.

Figure 1. Seafloor bathymetry, disposal sites, side scan sonar mosaic, and identification of targets at the former IWS. Three areas with higher densities of targets are displayed and ranked in order of priority for capping, based on presumed density of containers.

Symbols:

Black circle:	***Former IWS***
Red triangles and stars:	***Priority targets (containers) from surveys in 1991***
Gray symbols:	***Probable barrels, and containers with characteristics of metal***
Purple symbol:	***Shipwrecks***



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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MEMORANDUM

To: Mark L. Habel, Chief
Navigation Section, Engineering Planning Division (CENAE-EP-PN)
From: Melville P. Coté, Jr., Manager
Ocean and Coastal Protection Unit
Date: December 14, 2007
Re: Remediation of the former Industrial Waste Site in Massachusetts Bay

The purpose of this memo is to provide background information in support of a proposal by the U.S. Army Corps of Engineers New England District (Corps) to reduce risks associated with historically disposed waste containers at and around the former Industrial Waste Site (IWS) in Massachusetts Bay. The Corps and EPA New England (EPA) are evaluating whether 6 to 15 million cubic yards (CY) of unconsolidated dredged material (mainly "Boston Blue Clay") generated by the Boston Harbor Navigation Improvement Project can be used to cap several of the historically disposed waste container concentrations in the former IWS. At a cap thickness of five feet, 6 million CY would cover about 1.2 square miles of bottom, while 15 million CY would cover 2.9 square miles. This proposed beneficial use represents a one-time opportunity to cap and isolate the bottom sediments and remaining containers and debris at the former IWS.

History of Disposal at the former IWS

Massachusetts Bay was used as a disposal site for industrial, chemical, and low-level radioactive wastes, construction debris, ordnance, and dredged material from the 1940s until 1977, and has continued to be used for dredged material disposal since then. The primary dumping sites included the:

- Industrial Waste Site (IWS; located 20 miles east of Boston at 290 feet depth, also known as the "Foul Area");
- Boston Lightship Disposal Site (BLDS; located 10 miles east of Boston in 150 to 200 feet depth); and
- Marblehead Light Site (MLS; located about 8 to 10 miles southeast of Marblehead at 210 to 230 feet depth).

The history of disposal at the former IWS is outlined in more detail in the Massachusetts Bay Disposal Site evaluation studies (Hubbard *et al.*, 1988), the Draft EIS for Designation of the Massachusetts Bay Disposal Site (EPA, 1989), an assessment of the risks at the former IWS (NOAA 1996), and the 1996 Massachusetts Bay Disposal Site Management and Monitoring Plan

(SMMP; EPA, 1996). Briefly, the former IWS was routinely called the "Foul Area," because the material on the bottom "fouls" or damages commercial fishing nets. From the 1940s to 1977 dredged material, construction debris, barreled industrial waste in 55 gallon drums, waste buckets, encapsulated low-level radioactive waste (in concrete and coffin-shaped containers), munitions, and intentionally sunken derelict vessels were dumped in the northwest quadrant of the former IWS or dispersed around the northern perimeter up to 0.5 nm outside the former IWS (Wiley *et al.*, 1992). Few drums are found farther away from the former IWS.

Radioactive waste disposal ceased in 1959; industrial waste and construction material disposal ceased in 1977 when the overlapping interim Massachusetts Bay Disposal Site (MBDS) was designated by EPA for dredged material disposal only. The IWS was formally de-designated on February 2, 1990 (40CFR 228.12). Subsequent concerns regarding the status of these wastes and their potential effects on the fisheries of Massachusetts Bay and public health have been raised by agencies and environmental groups. In 1989, toxic fumes generated from retrieved barrels near the former IWS caused a debilitating injury to a fisherman. A number of fisherman are said to have retrieved and re-deposited waste containers during their trawling activities. Many of these barrels and other containers have corroded and their contents have presumably been released into the environment, including the surrounding waters and sediments.

Because of this area's past use as a dumping ground, the National Marine Fisheries Service (NMFS) closed the former IWS to harvesting of surf clam and ocean quahogs in 1980 (NOAA, 1996). In 1992, the Food and Drug Administration (FDA) and NMFS reissued this advisory, recommending a note be put on nautical charts, and advising all commercial and recreational fishermen to avoid harvesting bottom dwelling species from the area, including the MBDS (NOAA, 1996). There is, however, evidence of trawling activity within the site as revealed in imagery from a multibeam echosounder (Valentine *et al.*, 1996).

Surveys for Assessing Locations and Threats of Hazardous Waste Disposal

Beginning in 1973, several federal and state agencies have assessed the threats of chemical and low level radioactive wastes at the former IWS to the marine environment (e.g. Curtis and Mardis, 1984). Two surveys have positively identified waste containers and the remains of containers in and around the former IWS. In 1991, the International Wildlife Coalition (Wiley *et al.*, 1992) conducted a study (partially funded by EPA) to prioritize targets from side-scan sonar records and visually investigated them using a video camera on a remotely operated vehicle (ROV). An estimated 10,000 to 20,000 barrels centered near the northern edge of the former IWS were observed. Based on the ROV videos, most of these barrels were corroded or broken. No concrete coffins were observed. The locations of targets and positively confirmed waste containers are displayed in Figure 1, with results from a side scan sonar survey in 2006 (see below).

NOAA led a multi-agency risk assessment in 1992 to collect sediments, fish, and shellfish at sites identified in the 1991 survey for *in situ* and laboratory analyses of chemical contaminants and radioisotopes. Except for one sediment sample, no radioactivity above background levels was detected (NOAA, 1996).

Assessment of risks

Surveys at the Boston Lightship and Marblehead Light disposal sites by the EPA, NOAA and the Corps have not yielded potentially hazardous containers (Keith *et al.*, 1992; Polaris Imaging and Berger Associates, 1997). Thus, it is assumed that the vast majority of hazardous waste disposal in Massachusetts Bay occurred at the former IWS. Most of the visually observed barrels or drums are corroded or broken and it is assumed that most of the constituents have dispersed. Direct radiation measurements from barrels, or from sediments adjacent to barrels, are at background levels or do not pose risks to human health. The contributing agencies concluded that the low-level radioactive waste or the hazardous substances investigated did not pose an imminent and widespread human health or ecological threat. "However the documented presence and large concentration of waste containers along with known ordnance disposal in some area of the IWS, pose potentially significant occupational risks to users of bottom-tending mobile gear" (NOAA, 1996).

"The existing fishing advisory and the closure for surf clam and ocean quahog harvesting should continue. Further documentation of the locations of likely waste container fields within and contiguous to the IWS should be undertaken. Positions of concentrations of likely waste containers should be noted on nautical charts" (NOAA, 1996).

At a 1998 public meeting, EPA stated that it will: map the location and extent of waste container concentration areas within Massachusetts Bay; conduct a risk assessment for ecological endpoints and human health consumption of seafood in an area of known waste containers; and conduct a periodic sampling of sediment and seafood (fish and shellfish) to evaluate the risk to consumers (EPA, 1998). NOAA, with the USGS and other partners, completed the first task as a GIS product that combines geographical and site-specific information on Massachusetts Bay (USGS, 1999). EPA initiated the second task, a preliminary risk assessment (or "risk screen") in the form of a series of spreadsheet calculations, based on the approach conducted by Tetra Tech for the Gulf of Farrallones Disposal Site off the northern California coast. This risk assessment needs to be completed as part of an environmental assessment for this project.

Recent surveys

In 2006, EPA performed side-scan sonar of the former IWS using a digital dual-frequency Klein 3000 system, deployed from its Ocean Survey Vessel, the OSV Bold. Preliminary results of the interpretation of the side scan sonar records suggest that waste containers, construction debris and other man-made objects are still detectable on the marine floor at the former IWS. A final side-scan sonar interpretation product by a professional sonar analyst will be available in January 2008. This information will be used to determine the locations and spatial extent of historic waste containers proposed for capping and will also be included in the environmental assessments of the dredging project, the MBDS boundary modification (see below), and the updated SMMP.

Side-scan data were collected using 100 and 500 kHz frequencies, which allow the user to collect data at greater distance from the tow fish. Side-scan tracks and grids were calculated and planned in Klein SonarPro software, transferred to the OSV Bold onboard Nobeltec Navigation system for ship navigation purposes. Side-scan playback and acquisition was processed using Klein SonarPro software. Post-processing was conducted using the Chesapeake Technology software SonarWizMap. Navigation for the side scan transects was conducting using the OSV Bold Raytheon Differential GPS with vessel positioning to an accuracy of +/-5 m.

Transects were performed in three overlapping areas. Using GIS technology, Figure 1 displays the aerial coverage of the major north-south orienting transects that covered the former IWS where barrel fields had been previously identified in 1991 and 1992. During real time imaging, and in playback, over 200 targets were identified in this area. These targets include probable waste containers; construction debris, shipwrecks, geological features and anthropogenic features such as trawl marks and dredged material disposal mounds. EPA scientists have constructed a preliminary mosaic of the side-scan images, and compiled a preliminary identification of these targets. These targets are displayed and categorized in Figure 1. Five polygons were created to cover the majority of suspected and positively identified waste containers, and ranked according to the probable density of waste containers. This ranking, however, is likely to change based on the updated sonar interpretation in January 2008. The aerial coverage of these five polygons range from about 118 to 346 acres and totals about 857 acres (see Table 1).

Table 1. Aerial coverage of five priority areas for capping of containers. See Figure 1 for locations of each area.

Priority area 1	123.56 acres
Priority area 2	123.43 acres
Priority area 3	117.96 acres
Priority area 4	346.28 acres
Priority area 5	145.52 acres
Total	856.75 acres

Regulatory Authority

Dredged material may only be disposed of within the boundaries of the EPA-designated MBDS, which overlaps with the former IWS. To facilitate placement of dredged material in the IWS, EPA is exploring modifying the boundaries of the MBDS to encompass areas outside its current boundary that contain the greatest concentrations of barrels.

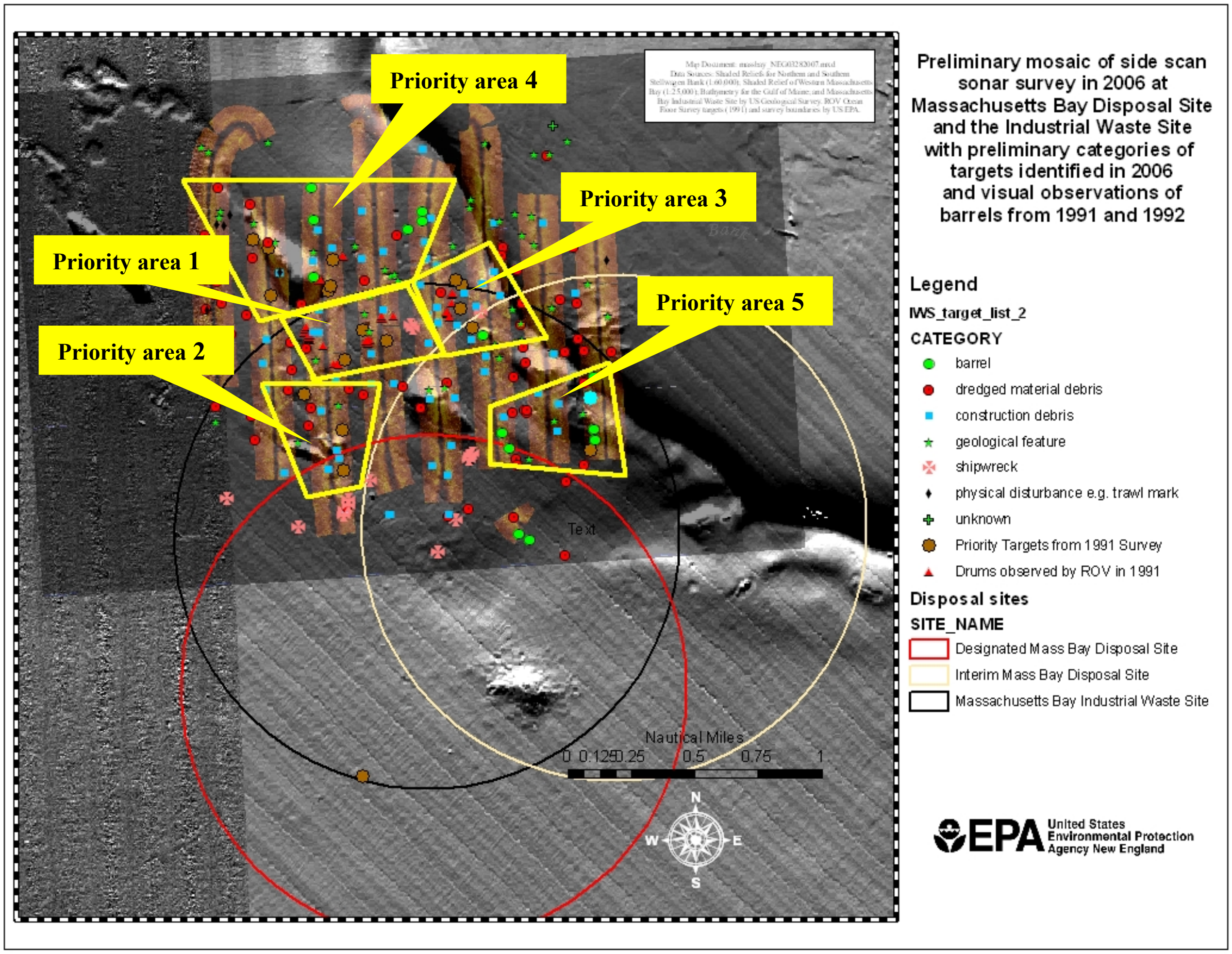
In 1977, the EPA's ocean dumping regulations (40 CFR 228.12) established the interim dredged material disposal site (interim MBDS). In 1993, EPA officially designated the MBDS for long-term use, reconfiguring the boundaries to overlap with both the former IWS and the interim MBDS, and to avoid the part of the former IWS that contained a high concentration of industrial waste barrels and the newly designated Stellwagen Bank National Marine Sanctuary (EPA, 1993). In the Record of Decision, EPA specified that this location was the best alternative because of its historical use and its avoidance of the SBNMS, and because it is in an area of sediment accumulation, so disposal mounds are not expected to suffer erosion. The area of the former IWS with the highest concentration of barrels was not part of the newly designated MBDS because of concerns that disposal of dredged material was not accurate enough to completely cover containers, without potential resuspension of contaminated sediments.

In order to cap and isolate waste containers, disposal outside the current boundaries of the MBDS is required. Because disposal of dredged material in not allowed outside a designated ocean disposal site, several regulatory options have been explored. The most practical option appears to be a modification of the boundaries of the MBDS. The Marine Protection, Research, and Sanctuaries Act (MPRSA) regulations at 40 CFR 228.11(a) provides the EPA site modification authority.

Modifications in disposal site use which involve the withdrawal of designated disposal sites from use or permanent changes in the total specified quantities or types of wastes permitted to be discharged to a specific disposal site will be made through promulgation of an amendment to the disposal site designation set forth in this part 228 and will be based on the results of the analyses of impact described in Sec. 228.10 or upon changed circumstances concerning use of the site.

Because of the opportunity to reduce risks of the historic disposal of the waste containers, and with technological and operational advances in the ability to dispose of dredged material in deeper waters (e.g. SAIC, 2003), EPA believes that the capping and isolation of containers may now be feasible, and thus that the circumstances of the site have changed. This action would require a rulemaking with appropriate environmental impact documentation under the National Environmental Policy Act, which is the same approach used by EPA Region 2 to modify the disposal site boundaries of the New York Bight Dredged Material Disposal Site (“Mud Dump Site”) from a two to 16-square mile site, now called the Historic Area Remediation Site. EPA is prepared to pursue this approach in support of the Corps proposed beneficial use project.

Figure 1. Seafloor bathymetry, disposal sites, side scan sonar mosaic, and preliminary identification of targets at the former IWS. Five areas with higher densities of targets are displayed and ranked in order of priority for capping, based on presumed density of containers.



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Side Scan Sonar Data Processing and Analysis

of

USEPA IWS/MBDS Survey 2006

Prepared By:

Vincent J. Capone, M.Sc.
Barkentine, Inc.

January 31, 2008

Table of Contents

List of Figures

Introduction

Barkentine, Inc. was provided with side scan sonar data collected at the Industrial Waste Site ((IWS; formerly known as the “Foul Area”) and the Massachusetts Bay Disposal Site (MBDS) in both of which are located in Massachusetts Bay. The data was collected by US Environmental Protection Agency (EPA) personnel aboard the EPA survey vessel *BOLD* during July of 2006.

The IWS/MBDS survey location was a permitted disposal site located approximately fifteen (15) nautical miles north east of Boston in Massachusetts Bay (Figure 1).The site was used for disposal from the late 1940’s until the late 1950’s. Disposal materials included hazardous and radioactive waste in fifty five (55), thirty (30) and five (5) gallon drums as well as concrete encased drums (Wiley et al., 1992 and NOAA, 1996).

Observations by Barkentine, Inc. (Formally Marine Search & Survey) personnel in 1991 also identified drums partially filled with concrete and disposal material.* In addition to hazardous waste and radioactive material the IWS/MBDS location also received dredge material, rock debris, sunken vessels, munitions, construction debris (Wiley et al., 1992, Personal Observations,* and NOAA, 1996).

In July 2006, the EPA collected side scan sonar data utilizing a Klein System 3000 integrated with a real time differential Global Positioning System (DGPS) onboard *S/V BOLD*. The data was collected in three (3) separate sections of the IWS/MBDS and consisted of three (3) separate data sets.

> Area 1. North-south transects at the Massachusetts Bay Disposal Site (MBDS N-S): 14 transects, 1210 meter line length, 100 meter line spacing, 150 meter sonar range.
>
> Area 2. North-south transects at the Industrial Waste Site (IWS N-S): 15 transects, 1852 meter line length, 200 meter line spacing, 150 meter sonar range.
>
> Area 3. East-west transects at a subset of the IWS (IWS E-W): 11 transects, 2242 meter line length, 125 meter line spacing, 75 meter sonar range.

All three data sets contained both high (500 kHz) and low (100 kHz) frequency data stored in the Klein Sonar Pro XTF format. Only the high frequency (500 kHz) was utilized in this analysis. Two (2) of the data sets (IWS N-S and MBDS N-S) were collected with the sonar set to the one hundred and fifty (150) meter range. The remaining data set (IWS E-W) was collected at the seventy five (75) meter range.

Barkentine, Inc. (BI) imported the data into the Chesapeake Technology Inc.'s processing software SonarWiz.MAP. Each of the data sets was then processed into a sonar mosaic.

Additionally the short range, high frequency, high resolution data was also analyzed to locate and identify possible drum like or potential concrete encasement targets. The target analysis was also conducted in Chesapeake Technologies SonarWiz.MAP. Each target was stored with a thumb nail image and assigned a classification including the confidence level of the identification.

Historical Perspective

Side scan sonar has been successfully utilized to locate fifty five (55) gallon drums and metallic debris on numerous occasions. Figure 2 shows a 500 kHz sonar image of two (2) confirmed, intact fifty five gallon drums imaged with Klein System 3000 sonar in a lake.

In general, analysis of the sonar targets without context, i.e. information about the survey location or target verification, contributes to a broader interpretation of the sonar data. When targets have been verified, the analysis of new targets from the same location results in a higher probability of accurate identifications.

BI was fortunate to participate in several surveys at the IWS/MBDS location which involved collecting sonar data, identifying targets and verifying the targets with an ROV. BI personnel piloted a MiniRover MKII which investigated and visually identified dozens of sonar targets at the IWS/MBDS location (Wiley et al., 1991). Later in 1991 BI personnel also assisted SAIC in a second sonar ROV survey.

During the 1991 ROV survey the International Wildlife Coalition (IWC) examined eighty nine (89) sonar targets of which sixty (60) were verified as drums.[+]

In addition to the IWS/MBDS surveys, BI has also conducted sonar surveys with ROV target verification on other sites containing hazardous waste drums and/or non hazardous 55 gallon drums. These sites included Lake Superior, Coastal New Jersey, Mississippi River and several inland lakes. This extensive experience with intact as well as degraded submerged drums provided a strong historical basis for identifying targets during the analysis of US EPA data collected in July of 2006.

Methodology

Barkentine, Inc. (BI) was provided with three (3) sets of side scan sonar data collected at the IWS/MBDS location. Two of the data sets (IWS N-S and MBDS N-S) were collected with the sonar range set at one hundred and fifty (150) meters. One data set (IWS E-W) was collected with the sonar set to a range of seventy five (75) meters.

Upon receiving the data, BI's objectives were as follows:

1) Create Three Geo-Referenced Mosiacs
2) Interpret Images and Classify Targets
3) Provide EPA with Rational for Classification
4) Provide EPA with Locations of All targets

Barkentine Inc imported the three (3) EPA data sets into separate projects utilizing Chesapeake Technologies, Inc. (CTI) SonarWiz.MAP sonar processing software. Each of the three data sets was treated independently and processed as an independent data set.

Each data set was comprised of dozens of raw sonar files in the XTF format. The raw XTF files were imported into a CTI project which plotted the files over the local nautical chart (NOAA 13200). Turns and data from outside the survey area were removed from the project leaving only contiguous survey lines covering the IWS/MBDS locations.

Each individual survey line was comprised of several XTF sonar files. The files for each line were aggregated for further processing. Each survey line of aggregated files was then subjected to a navigation smoothing process. Any errant GPS fixes were removed and the positional data were subjected to a three hundred (300) point splining function that smoothed the data track. Each aggregated and smoothed file was further processed by manually tracing the first bottom return. The CTI software then removed the water column and applied Time Varied Gain (TVG) to each file. The files were then combined into a high resolution mosaic for each data set. The mosaics were then sent to a professional print shop for hard copy printing.

BI also analyzed the sonar data identifying and classifying targets. Of Primary interest was to discriminate drum and encasement targets from other contacts such as rocks, boulders, lobster traps and construction debris. To discriminate between target types the highest resolution sonar data allows for the best classification. The shorter range sonar data produced higher resolution images. Thus data collected at the seventy five (75) meter range provided the best details to analyze targets. The longer range data (150m range) only allowed for the general enumeration of targets or identification of macro features such as dredge material.

The EPA IWS E-W data set was collected at a sonar range of seventy five (75) m providing the highest resolution information of the three data sets. Barkentine Inc analyzed the seventy five (75) meter range data file by file by locating and identifying the majority of the potential drum like targets within the surveyed IWS area. Each target was analyzed and classified into one (1) of ten (10) different categories. Each classification was represented by a color and icon on subsequent figures. Every target was electronically logged into a digital database which included its sonar image, position and measurements as well as its classification and probability.

The long range data sets did not have the resolution for definitive analysis of drum like targets. Barkentine, Inc. did review the data and log all point targets which may have been associated with drum like targets. This data was provided to the EPA in a digital data format.

All sonar and target analysis was conducted by Vincent J. Capone, M. Sc. who has over 20 years and thousands of hours of side scan sonar experience. He was the ROV pilot for the 1991 survey which investigated dozens of sonar targets in the IWS/MBDS. He also participated in the later sonar/ROV surveys conducted by SAIC and Deep Sea Systems.

Target Analysis & Classification

The goal of the analysis was to provide the EPA with a map of the drum and encasement targets. While analysis of sonar records cannot definitely prove a target is a drum, we can identify the targets which have the highest probability of being drum targets. This analysis is based upon personal experience with confirmed drum targets at this location and over twenty years (20) years side scan sonar experience.

The sonar analyst's skills and experience were critical to the target evaluation since many of the drums were in a degraded state with the characteristics generally associated with metallic debris. In general there were five (5) very similar target types the analyst attempted to differentiate between based upon the sonar target data. The similar target types were drums, partial drums, lobster traps, concrete encasements and rocks/boulders. The characteristics for the different targets types are discussed in detail under each classification definition.

To conduct the analysis in a methodical and scientific manner, BI developed a simple list of criteria to screen targets. When analyzing targets for drum like characteristics, each target was matched against three (3) basic criteria. The criteria were as follows:

a) Size & Shape
b) Metal Characteristics (Ringing and Flaring)
c) Micro - Environment Considerations

Size & Shape

Modern side scan sonar systems interfaced with GPS systems allow for fairly accurate size measurement of targets. By comparing the target size with that of a fifty five (55) gallon drum BI was able to pre-screen numerous targets. If a target had the approximate dimensions of a fifty five (55) gallon drum (0.9m x 0.6m) the target was given further consideration to be classified as a drum like target.

Target size alone is not the ultimate defining factor. Drum targets can be both larger and smaller than standard drum dimensions. Drums which have corroded away will appear smaller and exhibit a different sonar signature. Underwater video from the 1991 survey also showed significant numbers of drums in two or three drum clusters.* Drums encased in concrete will also exhibit size characteristics larger than a standard drum.

In addition to size, shape was also an important characteristic. The shape of the target would often indicate subtle differences that allowed the analyst to further determine how to best classify the target. Drums lying side by side would present a multiple target shape that superseded overall size characteristics.

Size and shape are often more accurately defined by the targets acoustic shadow than the actual target reflection. Metal targets will often produce a reflection larger than the actual target a characteristic known as flaring. Additionally some drum targets have sediment built up around the drum or spilled contents such as concrete creating a more reflective environment directly adjacent the drum. In the aforementioned instances, the target reflection appeared larger than the actual size as indicated by the targets acoustic shadow. Here the shadow provided a more accurate estimate of the above sediment target size. Obviously this analysis is only possible on targets with acoustic shadows.

In addition to dimensions, the analyst also considered the shadow, metallic characteristics such as ringing and flaring and proximity to well defined drum targets and/or proximity to dredge material and or glacial deposits.

Metal Characteristics (Ringing and Flaring)

BI has extensive experience with metallic sonar targets especially submerged drums. By examining numerous sonar targets with divers and ROV's, BI has found a strong positive correlation between ringing/flaring on the sonar record with metal targets. Sonar characteristics of metal targets such as flaring and ringing were important in differentiating metallic targets from rocks boulders and other natural material.

Ringing was term coined early on during the 1991 survey. The term defines a target with multiple returns from a single target. The source of the multiple returns was most likely some type of multi-path; however on some occasions a true reverberation may be noted. The term has continued in use describing the multiple returns related to metallic targets more as a descriptor than the more accurate definition of multi-path. When properly applying the definition Barkentine, Inc. has only found metallic targets produce the ringing characteristics.

Flaring has been defined as when a target produces a sonar return larger than the actual target. Metallic targets and less often rocks have been known to produce this type of response. To derive a true measurement of a flaring contact, only the portion of the target casting a shadow was measured.

Micro - Environmental Considerations

Targets were partially evaluated considering environmental conditions surrounding the contact. Targets within the boundaries of dredge material/rock disposal areas or amongst glacial deposits were more likely to be boulders, rocks or construction debris. Conversely targets outside these areas were more likely to be drum like targets or metallic debris as was shown in the 1991 ROV survey.* While this may slightly under report the number of drum like targets it will significantly reduce the number of false positives.

Another environmental consideration was proximity to shipwrecks. When targets in question were in close proximity (Approximately 5 to 10 meters) to a shipwreck, special consideration was given to the likelihood that the target was associated with those vessels rather than hazardous waste containers.

Some targets exhibited peculiar alignments which also influenced how the analyst interpreted the sonar image. For example Target 003 was a series of drum sized rectangular shapes linearly aligned along the long axis. This configuration is common for lobster traps rather than randomly dropped drums. Because of the alignment and other factors, Target 003 was designated as most probably being lobster traps.

Classifications

Barkentine Inc. separated targets into ten (10) separate classifications giving each a symbol and color. Classifications with similar implications were coded with the same color. For example, dredge material as well as rocks and boulders associated with dredge or rock disposal were both coded with a yellow circle. Drum Like Targets and metallic debris which represented the corroded remains of drums were both coded as red circles.

The classification, icon and color were as follows:

Drum Like Target	**Red Circle Icon**
Metallic Debris	**Red Circle Icon**
Possible Concrete Encasements	**Aqua Boxed X Icon**
Shipwreck	**Blue Circle Icon and Blue Polyline**
Fish	**Blue Circle Icon**
Lobster Trap	**Blue Circle Icon**
Dredge Material or Glacial Deposits	**Yellow Circle / Yellow Polyline**
Rock/Boulder	**Yellow Circle Icon**

None Drum Like	
Man Made Debris	**Navy Box Icon**
Unknown	**White Circle Icon**

The definition of each classification is as follows:
:

Drum Like Target –Red Circle Icon

Drum Like Target was used to define targets which embodied the characteristics of an intact drum. The highest probability contacts had dimensions roughly equivalent to a drum (Approximately 0.9m x 0.6m) and a rectangular shadow. Targets with only the dimensions or only the shadow were most often given a moderate probability of being a drum target. Based on the 1991 ROV survey any target outside dredge/rock disposal material and outside any glacial deposits was most likely to be a drum or remnants of a drum.

In addition to dimensions, the analyst also considered the shadow, metallic characteristics such as ringing and flaring and proximity to well defined drum targets and/or proximity to dredge material/glacial deposits.

The ROV target documentation in 1991 identified at only one target as a ghost lobster trap. The dimensions for local lobster traps ((0.9m to1.2m) x 0.5m x 0.4m) and drums were very close, especially considering the small errors associated measuring target size with side scan sonars. Other characteristics such as shape, shadow and target density were used to differentiate between the two types of targets.

Metallic Debris – Red Circle Icon

Metallic debris refers to targets which exhibit metal characteristics such as ringing or flaring but did not meet the size and shape criteria of a Drum Like Target.

Metallic debris are most often characterized by ringing and flaring. And as indicated previously, ringing and flaring have been positively correlated with metal targets. Through ROV target verification, BI has determined corroded partial drums will exhibit these characteristics as will other types of metallic debris. Within the confines of the IWS/MBDS most all the ringing targets examined in 1991 were the corroded remains of drums.

These Metallic Debris targets most probably represent the corroding partial remains of the steel drums.

Of the two indicators, ringing is a stronger indicator of a metallic target. Targets which exhibited ringing were given a high probability of being metallic debris and targets which exhibited flaring and no ringing where given a moderate probability of being a metallic target.

Targets smaller than a complete drum which exhibited neither ringing nor flaring but due to proximity to well defined drum targets outside known dredge material/glacial deposits were given a low probability.

In general based on the 1991 ROV survey any target outside dredge and rock disposal material or glacial deposits was most likely to be a drum or remnants of a drum. Some metallic debris was associated with construction materials however during the ROV survey these no drum metallic targets were only noted in close proximity (5-10 meters) to dredge/rock disposal locations.

Shipwreck – Blue Circle Icon and Blue Polyline

Sunken vessels were designated as shipwrecks.

Dredge Material/Glacial Deposits – Yellow Circle Icon and Yellow Polyline

For the purposes of this report the term Dredge Material was used to identify all types of dredge, and rock material deposited in the survey area. Additionally some of the rock material seen on the side scan may also be naturally occurring glacial deposits.

Rock/Boulder – Yellow Circle Icon

Many of the dredge/rock disposal areas contained individually identified rocks or boulders. BI did not attempt to identify all rocks and boulders only those in proximity to drum like targets or outside the obvious dredge/rock disposal locations.

Non-Drum Like – Man Made Debris – Navy Box Icon

Many times targets appeared man made but were obviously not Drum Like or associated with drums such as the metallic debris. An example of this category would be a long piece of pipe. Obviously man made but not a drum or remains of a drum. These types of targets were designated as Non-Drum Like - Man Made Debris.

This category differs from Unknown Material in that the target is definitely man made such as a piece of pipe but not a drum or encasement.

Possible Concrete Encasements – Aqua Boxed X Icon

Barkentine Inc. classified some targets as possible concrete encasements when the size was larger than a drum with a regular rectangular shape. Reports indicate single drums encased in four (4) to five (5) inches of concrete which would increase the target dimensions to approximately 1.0m x 0.8m. There were also rumors in the early 1990's of concrete coffins approximately two (2) meters in length.*

Rectangular targets larger than expected for a standard fifty five (55) gallon drum were considered as potential encasement targets. To be considered a potential concrete encasement not only did the targets have to exhibit the minimum dimensions but also had to display a strong solid rectangular shape. Some encasement targets demonstrated scouring, which was consistent with a large heavy object in fairly soft sediment.

Lobster Trap - Blue Circle Icon

Targets which exhibited clean crisp rectangular signatures within the proper size constraints and with fishing gear characteristics were designated as lobster traps. Lobster traps utilized locally were found to be two sizes; 0.9m x 0.5m x 0.4m and 1.2m x 0.56m x 0.4m.

BI's sonar analyst has extensive experience imaging both drums and lobster traps. While lobster traps have similar dimensions to 55 gallon drums several characteristics differentiate traps from drums.

Lobster traps are slightly smaller in width and height than a drum. The traps tend to have less solid a return than an intact drum but have a more rectangular structure than a corroded drum remnant.

When appropriate, additional factors such as alignment were used to help characterize the target as a lobster trap. Lobster traps are deployed in strings with the long axis of the trap aligned with the string. ROV and sector sonar observations of the drums indicated a stochastic pattern. Thus as with Target 003 the alignment of several rectangular contacts would suggest a higher probability of being a string of traps rather than drums.

Since the characteristics are very similar to drums there could be some lobster traps which were designated as drums and vice versa. Previous onsite ROV operations have shown a very high density of drums and very low density of lobster traps. Of the 89 targets examined by the IWC only one (1) target was a lobster trap.*

Unknown Material – White Circle Icon

Targets which could not be identified as a Drum Like or Dredge Material/Rocks/Glacial Deposits but did appear to have shape or size characteristics close to drums were designated as Unknown Material. In general these targets had no definitive shape or shadow normally associated with Drum Like targets and occurred outside the confines of dredge material and glacial deposits. These targets also did not possess the distinctive ringing associated with metallic targets.

Fish – Blue Circle Icon

Targets which exhibited the classic characteristics of fish schools were identified as such. Fish schools typically present a diffuse cloud like target with detached shadows.

For each classification Barkentine also assigned a confidence level. Every classified target was also rated as having a high, moderate or low probability of being as classified. The confidence level reflected the analyst's certainty in his classification of the target. In general because of this analyst's experience with ROV observations at this location, confidence levels were better than at a location where no verification had been executed.

Target Accuracy

BI examined features in the sonar data prior to smoothing to determine the repeatable accuracy of the target data. Most of the positional error was probably due to the long cable lengths and the layback algorithm used by Sonar Pro to calculate the towfish position. If the towfish was not transmitting depth information, the Sonar Pro layback will resort to a theoretical cantenary equation which results in a larger layback error. Additionally the version of Sonar Pro used to collect the data will sometimes produce poor representations of towfish position in sharp turns at long cable lengths. Now available new versions of Sonar Pro may be more accurate.

To adjust the data for such errors BI measured the distance between specific points on adjacent lines to determine the layback error. We found the pre-adjustment error to be as much as but not greater than forty (40) meters. The layback was adjusted in CTI until significant features of adjacent lines matched within the mosaic. The layback error was probably greater towards the ends of the survey lines where cable adjustments were being executed.

BI found that prior to any adjustments match points could be offset by as much as forty (40) meters. After adjustment the alignment was significantly better. To better determine the post adjustment accuracy BI matched points on a shipwreck comparing the IWS N-S positions with IWS E-W positions. The difference between post processed points was approximately twenty five (25) meters.

The true accuracy would be best defined by comparing a larger number of points between the two data sets. Unfortunately the range and resolution differences did not allow accurate comparison of numerous small targets such as drums or rocks. Only one (1) large shipwreck target appeared in multiple data sets.

Results

Barkentine Inc. carefully analyzed the high resolution, 75 meter range sonar data. The analysis resulted in over one thousand (1000) contacts designated into ten (10) different categories (Figure 3). An image of each target along with pertinent information is available in digital target Appendix I.

Red circles represent materials which were most likely related to steel drum in various states of decay. The aqua boxed X icons represented potential concrete encasements. Blue icons represented shipwrecks, schools of fish and lobster traps while yellow represents materials related to dredge and rock material disposal and /or natural glacial deposits. Non-drum man made objects were represented by navy box icons and unknown non native materials by white circles.

The one thousand and thirty seven (1037) targets represented a sampling of the targets but not every single target in the sonar data set. Because of the enormous number of contacts, BI focused on drum like, metallic debris and encasement targets and did not record every possible rock, dredge material or non native target.

Targets related to drums dominate the north west and north center of the IWS E-W survey area (Figure 4). From approximately 42-26.55 N to 42-26.18 N and from 070-35.94 W to 070-34.75 W appears to have the highest concentration of drum like targets and metallic debris. The exception to the aforementioned bounded box would be the south east corner which appears to contain mostly dredge material.

This concentration of drum like and metallic debris targets most likely continues further north to 42-26.82 as indicated by the large number of unidentified point targets found in the IWS N-S sonar records (Fig. 5).

Analysis of the IWS E-W survey area also suggested two areas of possible encasement targets. Figures 6 and 7 indicate the concentration of possible encasement targets as shown by the aqua boxed X icons. The potential encasement targets in Figure 6 are centered about a location of approximately 42-26.17 N / 070-35.61 W. The potential encasement targets in Figure 7 are centered about a location of approximately 42-26.21 N / 070-36.03 W. The yellow polylines in Figures 6 and 7 denote areas of dredge and rock disposal. An enlargement of a possible encasement target is shown in Figure 8. Small point targets and scouring are both visible in the image.

BI also examined the long range data (IWS N-S and MBDS N-S) for large targets. Large objects such as shipwrecks and dredge material were observed. However the range/resolution of the data prevented detailed small target analysis. Figure 9 illustrates the mapped areas of dredge /rock material disposal on the IWS N-S mosaic. Shipwrecks and dredge/rock disposal material in the MBDS are shown in Figure 10.

BI was able to enumerate unidentified point targets in both long range data sets. While these targets did not receive the scrutiny of the short range data the distribution of small point targets most probably represents additional information regarding the distribution of drums. As was mentioned previously, any sonar target investigated during the early 1990's, outside the boundaries of dredge, construction or natural hard bottom material was almost always drum related. Thus the undesignated point targets associated with the long range sonar data most likely reflect the distribution of drum remains.

The aforementioned targets and locations were provided to the EPA in an ASCII data format. The area of such targets was designated by a polylines and provide to the EPA via an electronic dxf file.

Discussion

The analysis of the targets was based upon BI experience in the IWS/MBDS area as well as side scan sonar/ROV operations on other submerged drum sites. No interpretation of sonar imagery can be as reliable as actual visual verification and the analysis provides BI's best interpretation.

The results of the detailed target analysis provide a good representation of the distribution of drum like targets and metallic debris within the IWS E-W survey area. The actual number of drum related targets within the survey area was probably much higher than quantified in this analysis. Based upon sonar and visual analysis of the targets in 1991 all most all the targets outside dredge material/glacial deposit areas were drum related.

Additionally the area directly under the sonar towfish (Nadir Zone) has substantially less resolution than other portions of the sonar record. Small targets within these nadir zones were not counted. So the total number of drum like targets is higher than reported in this analysis just by the nature of the under reporting in the nadir zone.

A third reason for the probable under reporting of drum like targets was related to the state of decomposition. BI did not report targets composed of a few strongly reflecting pixels. These targets did not provide sufficient definition for a true analysis. However during the IWC ROV survey, targets which appeared as a few bright pixels on the sector sonar were often found to be remnants of drums.* Many of these small targets were observed but not counted in this analysis.

The seventy five (75) meter range digital sonar data collected by the EPA was of a higher resolution than collected on previous surveys. With the higher quality data it was possible to analyze targets with much greater accuracy than on earlier surveys. The increased resolution made it possible with a reasonable probability to identify potential concrete encasements which was not possible with earlier sonar surveys.

The new Klein System 3000 high frequency, short range data offered significantly more resolution than previous surveys completed in the early 1990s. Smaller beam angles and advancements in signal processing provided more definition at short ranges that enabled the analyst to better distinguish between target types and identify potential encasement targets.

During the IWC ROV investigation of the IWS/MBDS no encasement targets were located. That survey did locate a few drums which had been partially filled with concrete.[+] The two clusters of potential encasement targets probably represent a small percentage of the total since burial, aquatic vegetation and other factors can easily obscure encasement characteristics. Only those targets which strongly resembled a concrete encased drum were included in this category. None of the targets were marked as a high probability since no video verification has ever been successfully completed on this type of target.

Barkentine, Inc. respectfully reserves the right to amend this report should new information become available.

Citations

National Oceanic and Atmospheric Administration (NOAA). 1996. The Massachusetts Bay Industrial Waste Site: A Preliminary Survey of Hazardous Waste Containers and an Assessment of Seafood Safety. (May and June 1992). NOAA Technical Memorandum NOS ORCA 99. Edited by John Lindsay.

+ Wiley Testimony before the Subcommittee on Fisheries and Wildlife Conservation, November 4, 1991

Wiley, D.N, V. Capone, D.A. Carey, and J.P. Fish. 1992. Location survey and condition inspection of waste containers at the Massachusetts Bay Industrial Waste Site and surrounding areas, Internal Report submitted to US EPA Region 1. International Wildlife Coalition, Falmouth, MA. 59 pp.

* Personal Recollections from Field Operations at the IWS and MBDS locations

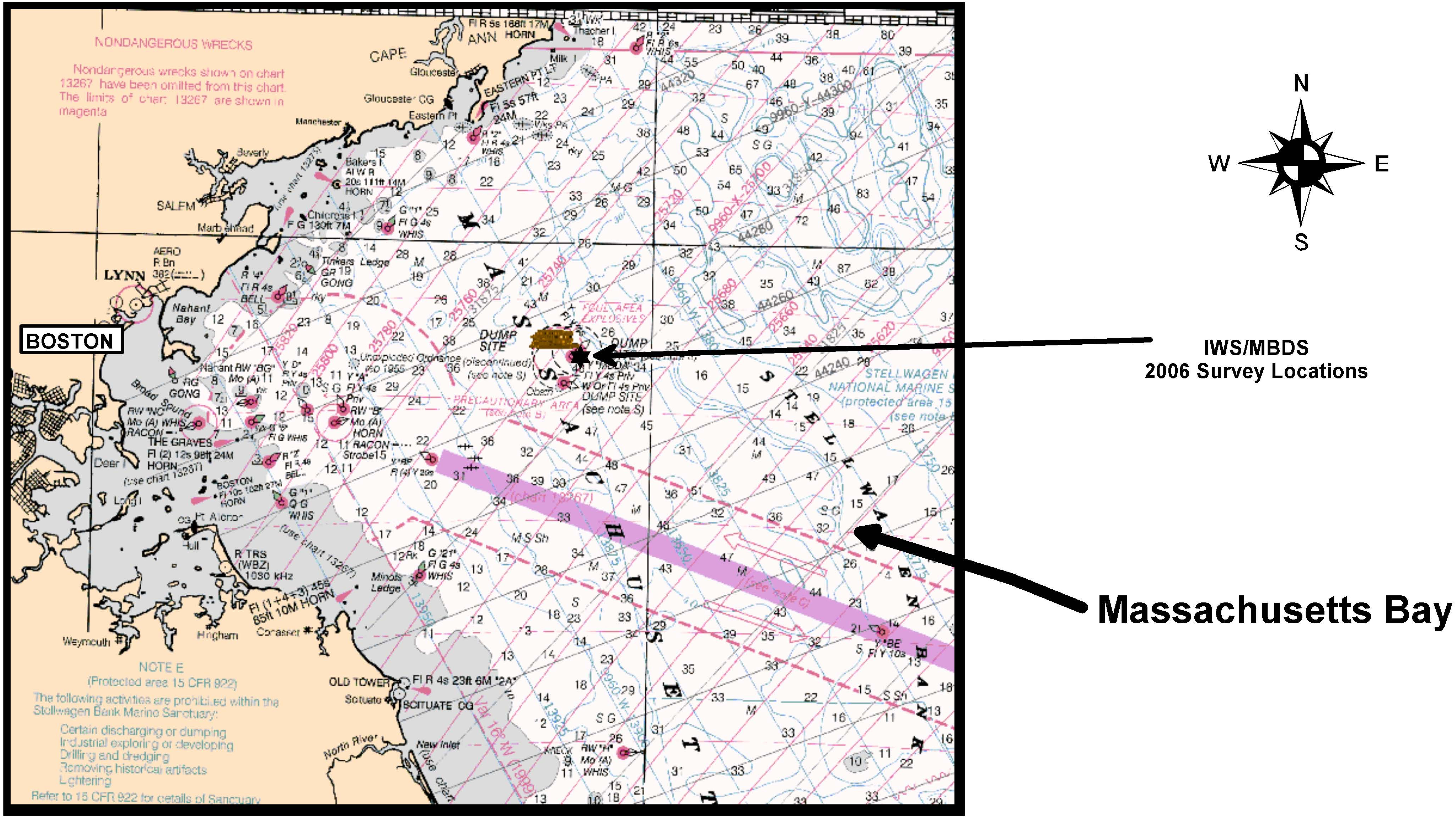


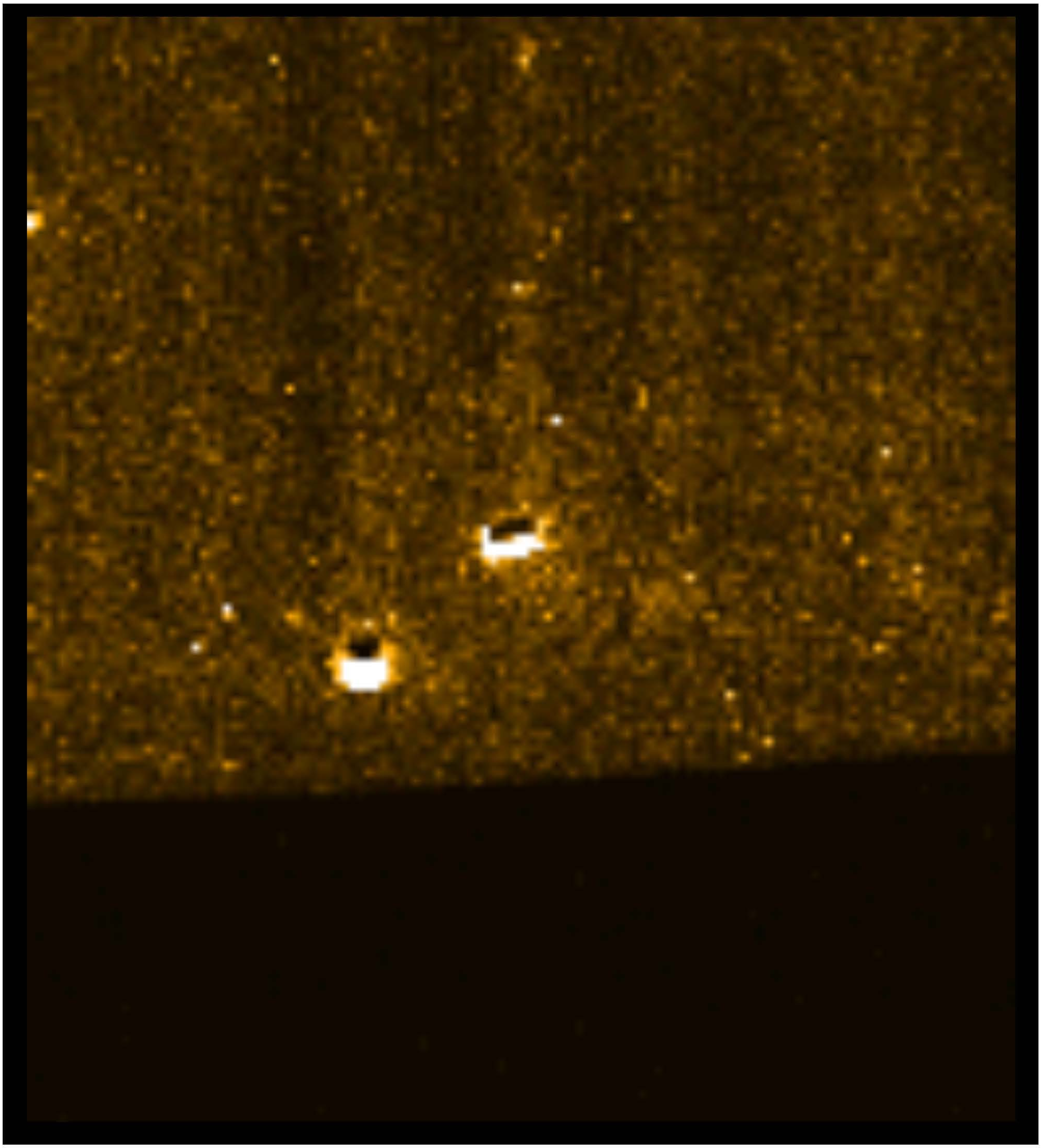
Figure 1

IWS/MBDS Location

IWS/MBDS Sonar Survey Report

Barkentine, Inc.

Rev. 2/7/08



Two Confirmed and Intact 55 Gallon Drums
Imaged with a Klein System 3000 Sonar
in a Fresh Water Lake

Figure 2

IWS/MBDS
Sonar Survey Report

Barkentine, Inc.

Rev. 2/7/08

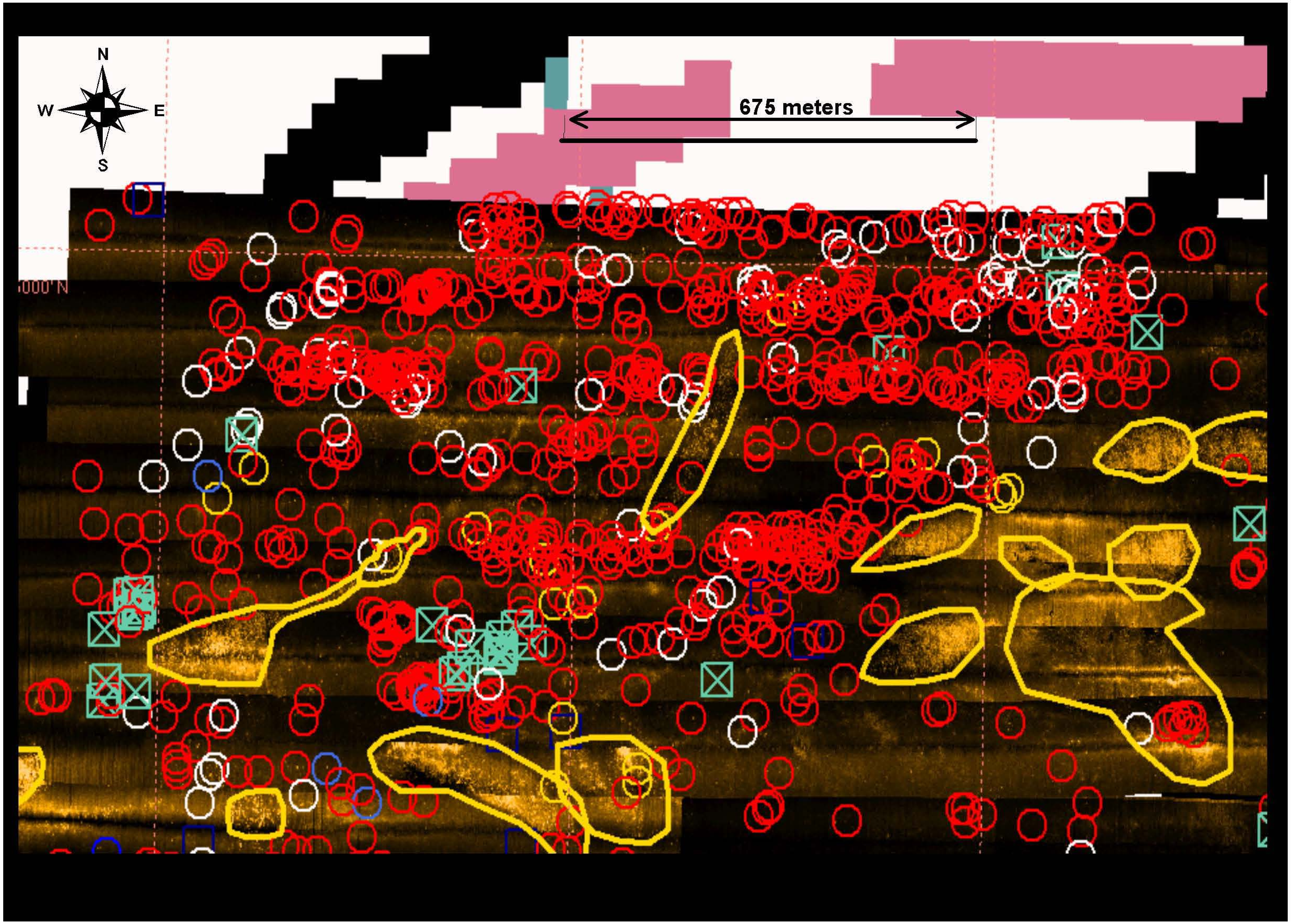
Figure 3

IWS EW Target Locations

IWS/MBDS Sonar Survey Report

Barkentine, Inc.

Rev. 4/1/08



Legend

- Drum Like Metallic Debris
- Fish Fishing Gear Shipwrecks
- Dredge Material Glacial Deposits
- Non-Drum Man Made
- Potential Encasement Targets
- Unknown Material

Figure 4 — IWS EW High Density Drum Like and Metallic DebrisTarget Locations

IWS/MBDS Sonar Survey Report

Barkentine, Inc.

Rev. 2/7/08

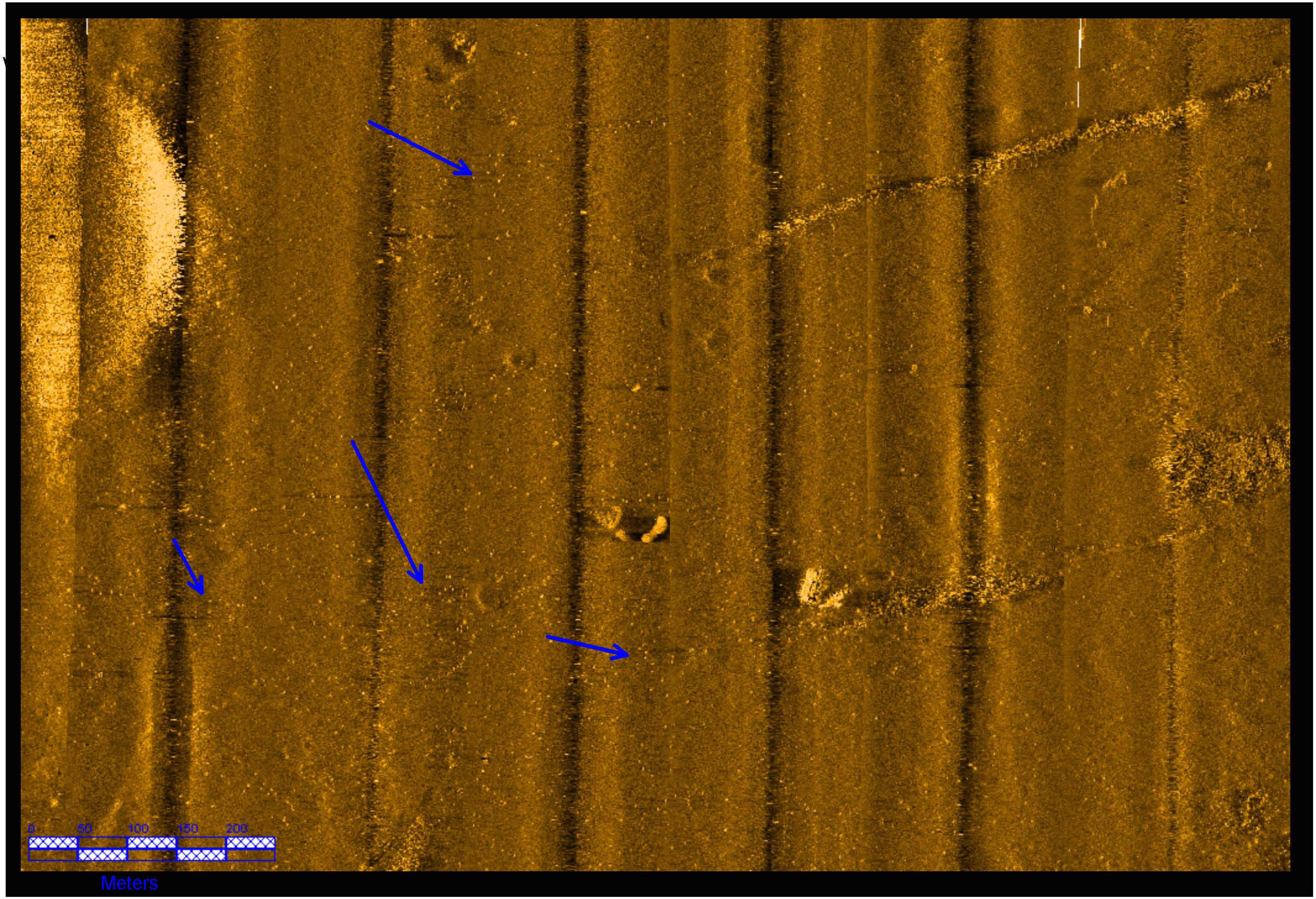


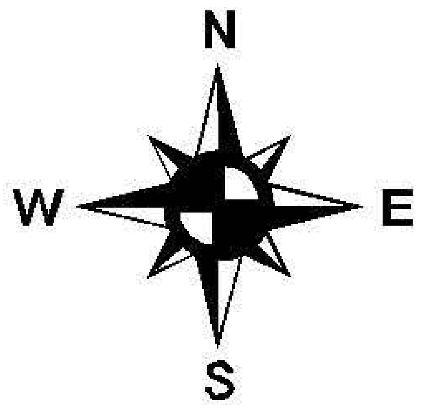
Figure 5

Unidentified Point Targets
on IWS NS Mosaic
North of IWS EW Mosaic

IWS/MBDS
Sonar Survey Report

Barkentine, Inc.

Rev. 2/7/08



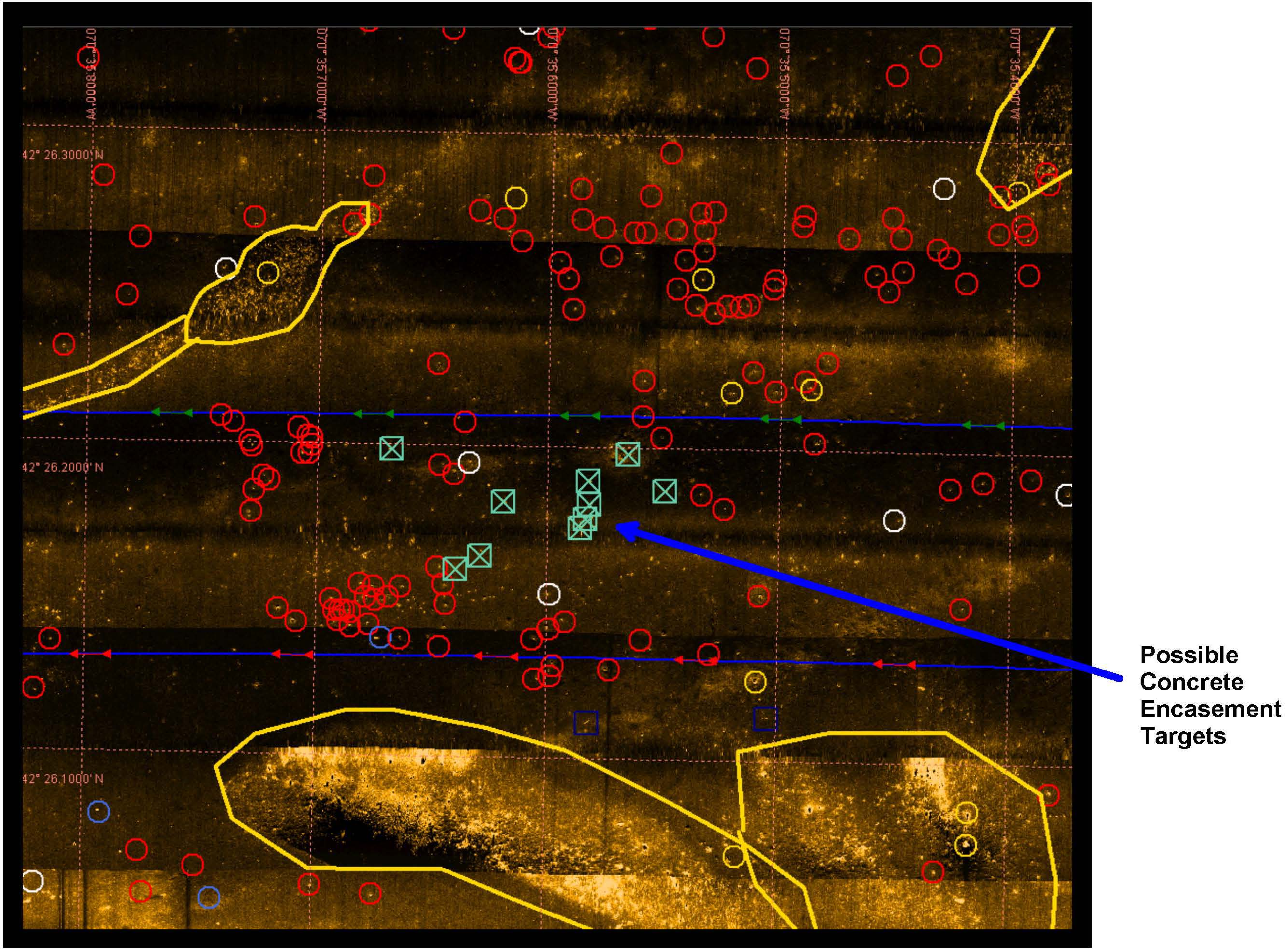


Figure 6

**Possible Concrete Encasement Targets
Centered at Approximately
42-26.17N / 070-35.61W**

**IWS/MBDS
Sonar Survey Report**

Barkentine, Inc.

Rev. 2/7/08

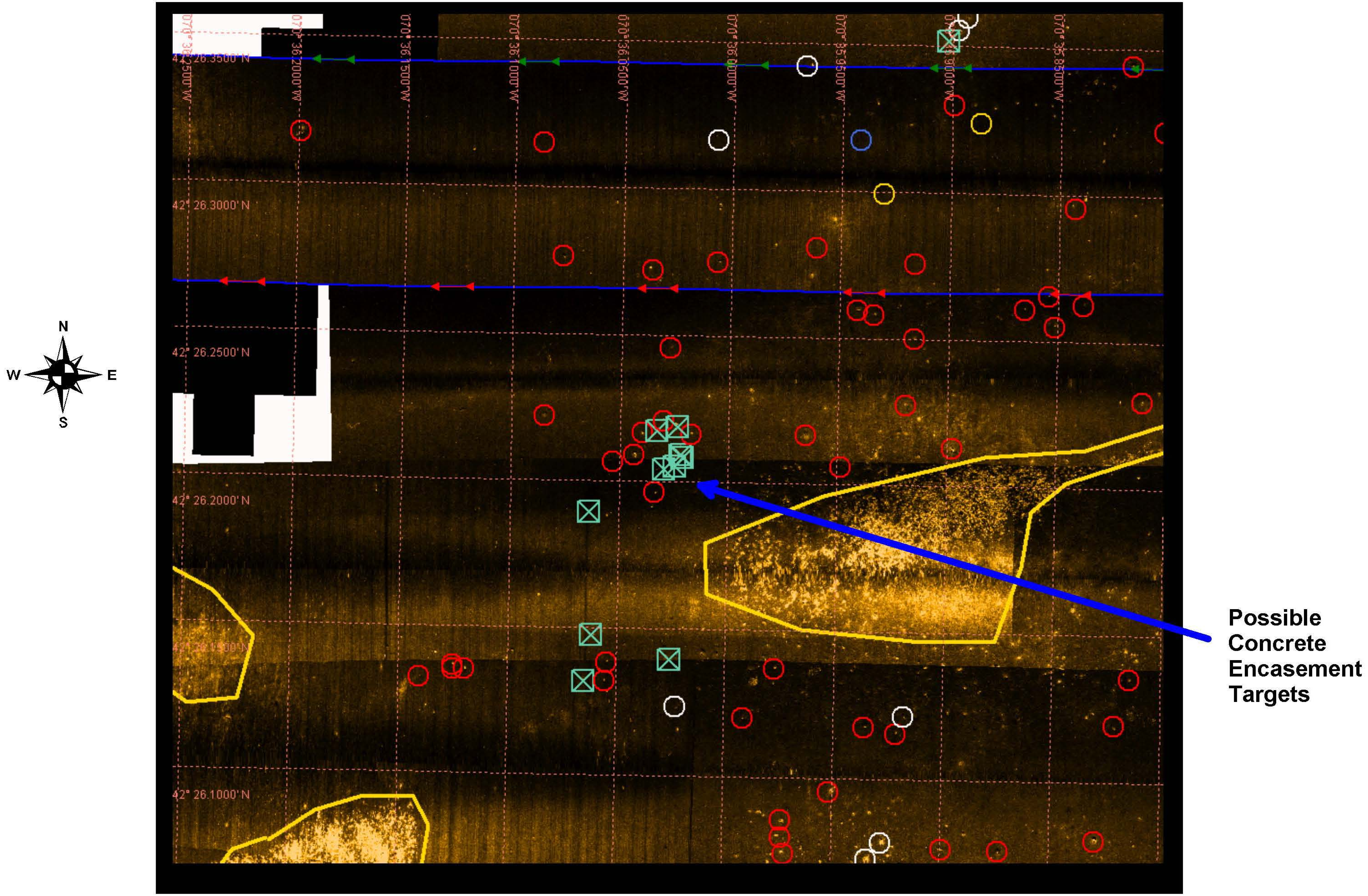


Figure 7

Possible Concrete Encasement Targets
Centered at Approximately
42-26.21N / 070-36.03W

IWS/MBDS
Sonar Survey Report

Barkentine, Inc.

Rev. 2/7/08

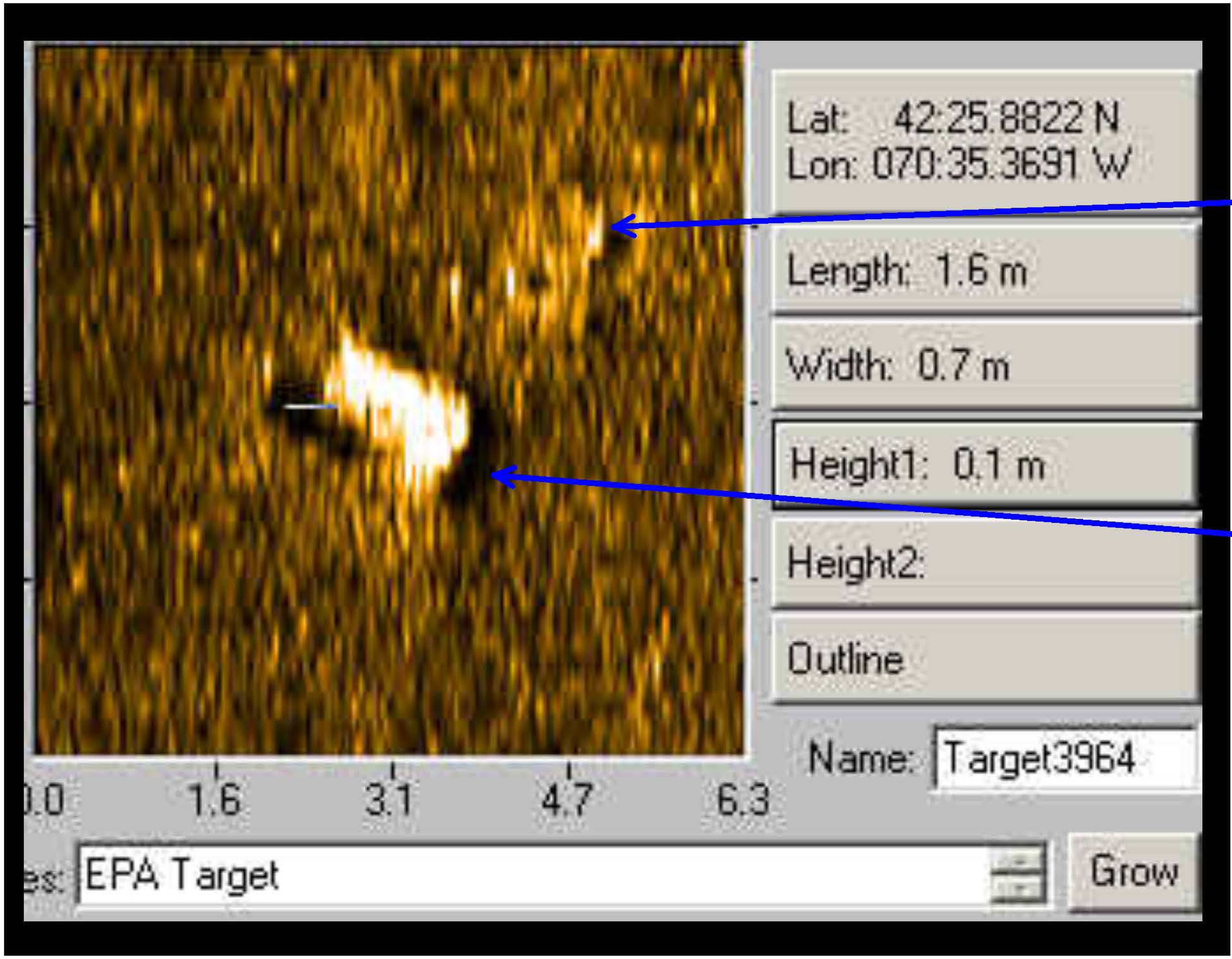


Figure 8

Enlarged Sonar Image of a Possible Concrete Encasement Target

IWS/MBDS Sonar Survey Report

Barkentine, Inc.

Rev. 2/7/08

Figure 9

IWS N-S Mosaic
Dredge Material

IWS/MBDS
Sonar Survey Report

Barkentine, Inc.

Rev. 4/1/08

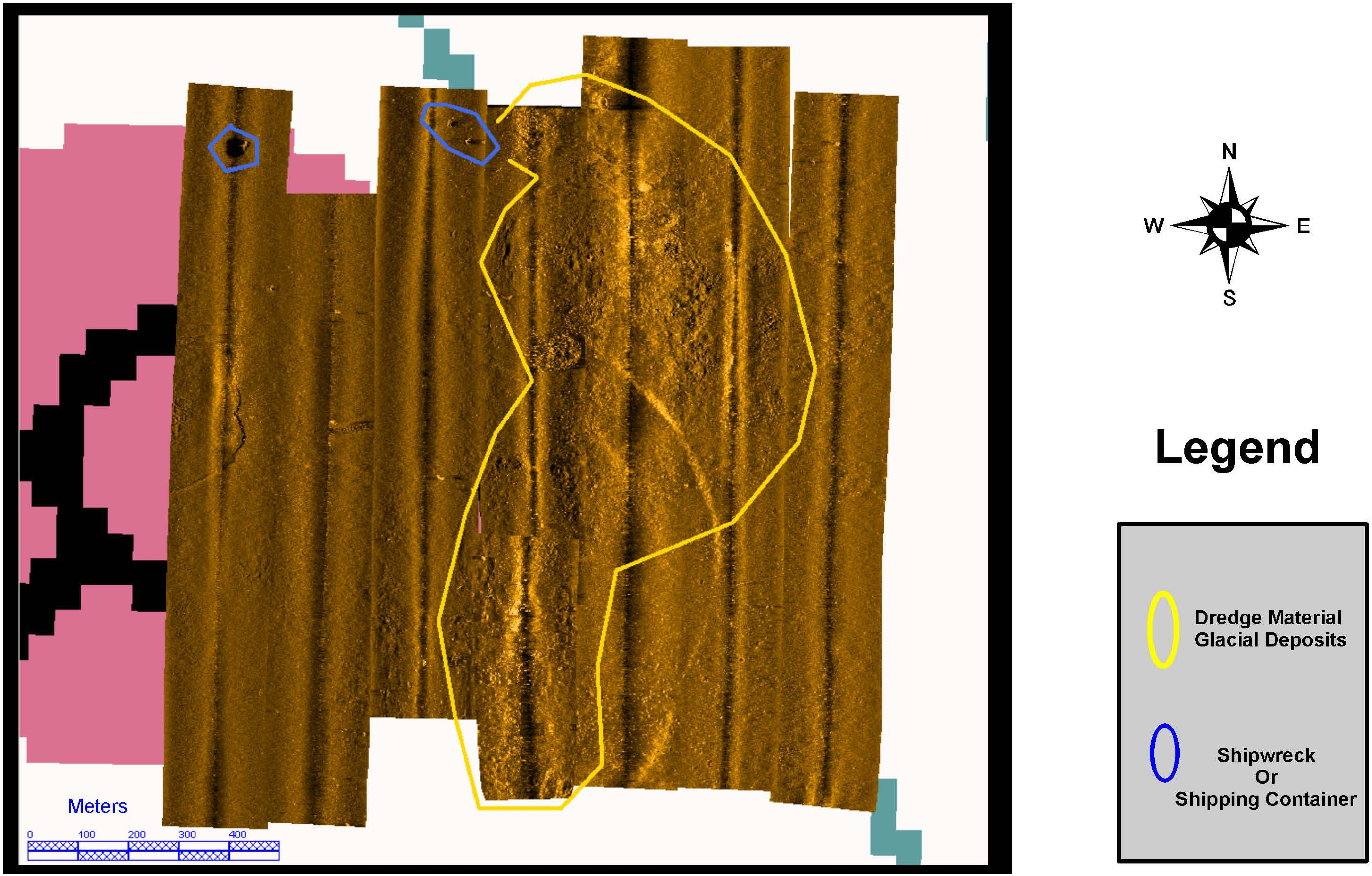


Figure 10

MBDS N-S Mosaic
Dredge Material

IWS/MBDS
Sonar Survey Report

Barkentine, Inc.

Rev. 4/1/08

BOSTON HARBOR
MASSACHUSETTS

DEEP DRAFT
NAVIGATION IMPROVEMENT STUDY

FINAL FEASIBILITY REPORT
AND FINAL SUPPLEMENTAL
ENVIRONMENTAL IMPACT STATEMENT
AND MASSACHUSETTS FINAL
ENVIRONMENTAL IMPACT REPORT

APPENDIX S

BENEFICIAL USE OF DREDGED MATERIAL
FOR HARD BOTTOM HABIATAT CREATION

BIOLOGICAL RESOURCE DATA SUMMARY
AND SITE RANKING

(THIS APPENDIX UNCHANGED FROM 2008 DRAFT)

APPENDIX S
BOSTON HARBOR NAVIGATION IMPROVEMENT STUDY

BENEFICIAL USE OF DREDGED MATERIAL FOR ENHANCED HARD BOTTOM HABIATAT

BIOLOGICAL RESOURCE DATA SUMMARY AND SITE RANKING

FINAL REPORT

Contract Number DACW33-03-D-004
Delivery Order No. 05

To:

U.S. Army Corps of Engineers
North Atlantic Division
New England District
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JANUARY 2006

US ARMY CORPS
OF ENGINEERS
New England District

Battelle
The Business of Innovation

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

The U.S. Army Corps of Engineers, New England District (NAE) (the Corps), and the Massachusetts Port Authority (Massport) are preparing a joint Supplemental Environmental Impact Statement/Report (SEIS/R) for the Boston Harbor Deep Draft Navigation Improvement Project. The purpose of the joint SEIS/R is to evaluate the feasibility of deep draft navigation improvements to the Boston Harbor, Massachusetts Federal Navigation Project. The project will explore alternatives for accommodating increased deep draft vessel traffic in Boston Harbor including a no action alternative. Alternatives will include incremental deepening schemes for the Broad Sound North Entrance Channel, President Roads Ship Channel (there are some sections of the channel that need to be deepened) and Anchorage area, Reserved Channel and a portion of the Main Ship channel from -40 feet (ft) up to -50 ft mean lower low water (MLLW), a portion of the Mystic River channel from -35 ft to -40 ft MLLW and the Chelsea River channel from -38 ft to -40 ft MLLW.

While the full range of disposal alternatives will be investigated, it is expected that the majority of the material will be suitable for placement at the Massachusetts Bay Disposal Site. During the dredging, rock and cobble material will be blasted or dredged from the various channels to be deepened as par of any improvement project. It is being proposed that portions of this rock/cobble material be used to enhance hard-bottom habitat within Massachusetts Bay. The purpose of this report is to characterize the baseline conditions within five potential enhancement sites and to perform an initial ranking of the sites in order of suitability, based on criteria identified and discussed by the Corps and the project's technical working group. Once the sites are ranked in order of suitability, additional investigations will then be conducted on the most suitable site(s) to determine the load bearing capacity of the substrate to support disposal of rock and cobble.

2.0 APPROACH

This section describes the technical approach taken to identify the potential enhancement sites, characterize the baseline conditions within each site, and rank the sites in order of suitability.

2.1 Site Identification

The Corps held a meeting on August 3, 2004 with the Massachusetts Lobstermen Association, the Boston Harbor lobstermen, Massachusetts Division of Marine Fisheries (MADMF), and Massport. During the meeting, potential enhancement sites were identified that are 1) in water that is 30 feet (ft) or deeper, 2) not readily used by the lobstermen, and 3) are not used by the fishermen (according to the lobstermen). The sites identified for hard-bottom enhancement are located in Nantasket Roads, Massachusetts Bay, Broad Sound, Nahant Bay, and Magnolia (Figure 1).

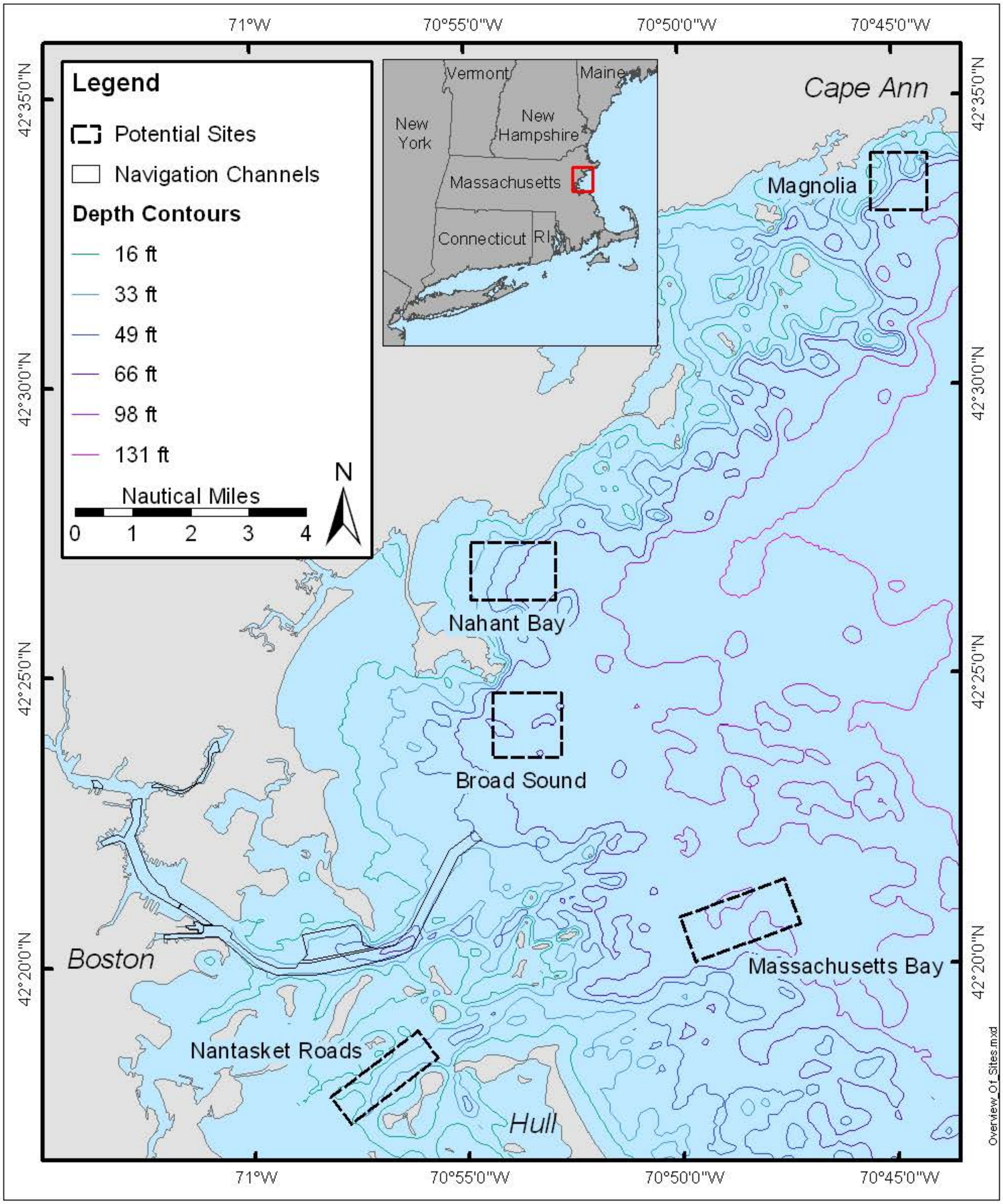


Figure 1. Potential Sites for Hard-bottom Enhancement.

2.2 Biological Resource Surveys

In September 2004, a series of surveys (sidescan, Sediment Profile Imaging [SPI], and benthic) was conducted to collect information to describe the benthic community at five potential enhancement sites (Nantasket Roads, Massachusetts Bay, Broad Sound, Magnolia, and Nahant Bay). Each of these surveys is described briefly below; more details are provided in the respective survey reports (Corps, 2004a; Corps, 2004b; Corps, 2004c).

2.2.1 Sidescan Sonar Survey

Between September 1 and 8, 2004, aquatic remote sensing investigations were conducted at each of the five potential enhancement sites to classify the benthic substrate composition within each of the sites (Corps, 2004a). Side-scan sonar data were collected within each site and a towed underwater video sled was deployed at five locations within each site to ground-truth sonar data and to provide more detailed descriptions of benthic substrates and visible biota. Each video drift lasted between 5 and 15 minutes. At least one benthic grab sample was collected within each site during the sidescan sonar survey and was co-located with video drift transects. Contents of the grabs collected during the side scan sonar survey were digitally photographed and described based on grain size and texture.

Mosaics were created from the sidescan data collected and were provided in geo-referenced JPEG formats and HTML web-enabled format suitable for viewing and analysis with Environmental Systems Research Institute, Inc. (ESRI) ArcGIS Desktop software (i.e., Arcview®, ArcExplorer®), AutoCAD®, and other GIS software. Maps of dominant benthic substrates (i.e., ledge/rock, cobble, gravel-cobble mix, coarse sand through small cobble mix, coarse sand and gravel, sand, muddy sand, and mud) were also created based on the evaluation of sidescan sonar, video, and benthic grab-sample data. Based on interpretation of the sidescan mosaics and video observations, suitable locations for the Sediment Profile Imaging (SPI) survey were selected and mapped. SPI locations were chosen based on identification of soft-bottom areas representing the range of soft-bottom habitat types within a given site.

2.2.2 Sediment Profile Imaging (SPI) Survey

To characterize the benthic habitats at the proposed disposal sites, an SPI survey was conducted on September 11, 2004. Seven stations were located within each area (Figure 2) based on preliminary review of the sidescan data collected as described above (Corps, 2004b). Sites were chosen that represented soft bottom that could easily be penetrated by the SPI camera and that represented the range of soft-bottom habitat types within each area. Areas that could not be sampled by using SPI methodology (e.g., hard-bottom areas) were characterized by other means such as sidescan and video. At each station, a digital Hulcher sediment profile camera was deployed twice. A video feed from the digital camera to the surface vessel allowed monitoring of camera operation and image capture in real time. All sediment profile images were analyzed visually with data on all features being recorded in a preformatted spreadsheet file. The least disturbed image, usually the last in the series, was analyzed digitally with Adobe PhotoShop and NTIS Image programs.

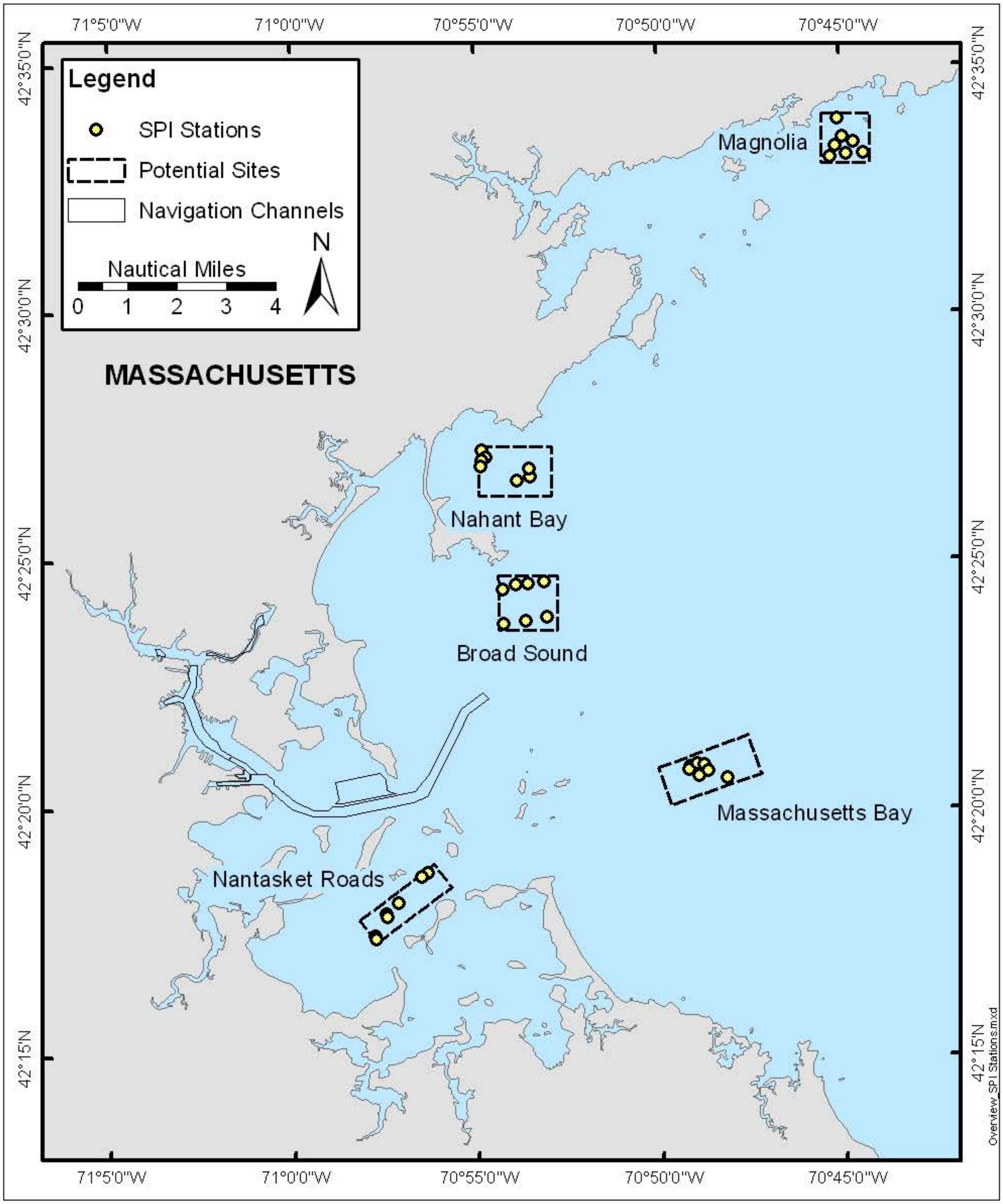


Figure 2. Sediment Profile Imaging Sampling Locations.

The SPI results were used to determine the typical range of values for the apparent Redox Potential Discontinuity (RPD), surface roughness (whether biologically or physically induced), grain size (composite of grain size throughout entire photograph), presence of any layering in the sediment, presence of methane or other evidence of low dissolved oxygen, and a comparison of benthic organisms observed by those collected from the grab samples. These data were used to determine whether or not there were important differences in benthic community and habitat parameters among sites and whether or not these differences in benthic community or habitat parameters were associated with differences in grain size of the substrate. The SPI surface type and underlying sediment data were used to determine which sites are appropriate to support rock rubble.

Sediment profile data were also used to estimate successional stage of the fauna (Rhoads and Germano, 1986). Characteristics associated with pioneering or colonizing (Stage I) assemblages (as described by Odum, 1969), such as dense aggregations of small polychaete tubes at the surface and shallow apparent RPD layers, are easily seen in sediment profile images. Advanced or equilibrium (Stage III) assemblages also have characteristics that are easily seen in profile images, such as deep apparent RPD layers and subsurface feeding voids. Stage II is intermediate to Stages I and III, and has characteristics of both (Rhoads and Germano, 1986). A set of SPI parameters are evaluated to estimate successional stage with the generalized associations described in Table 1 (- = not associated with, + = associated with, ++ = moderately associated with, +++ = strongly associated with).

Table 1. Relationship of SPI Parameters with Successional Stage.

Parameter	Successional Stage		
	I	II	III
	<1	1-3	>2
Max depth RPD (cm)	<2	>2	>4
Small Tubes	+++	++	+
Large Tubes	-	++	+++
Burrows	-	++	+++
Feeding Voids	-	+	+++
Small Infauna	+++	++	+
Large Infauna	-	+	++
Epifauna	+	++	++

The organism-sediment index (OSI) is a multi-parameter index, developed by Rhoads and Germano (1986) from data provided by the sediment profile images, to characterize benthic habitat quality in soft-bottom estuarine and coastal embayments (Corps, 2004b). The OSI defines quality of benthic habitats by evaluating the depth of the apparent RPD, successional stage of macrofaunal organisms, the presence of gas bubbles in the sediment (an indication of high rates of methanogenesis that are associated with high carbon inputs to the sediments), and visual signs of the presence of low dissolved oxygen conditions (sulfide covered tubes, anaerobic sediment at the interface, bacterial mats) at the sediment-water interface. The OSI ranges from −10, poorest quality habitats, to +11, highest quality habitats.

Although Rhoads and Germano (1986) established the index for estuaries and coastal waters, OSI values >6 indicate good habitat conditions and are generally associated with bottoms that are not heavily influenced by stress. The OSI level that defines this breakpoint for dynamic offshore bottoms, such as Massachusetts Bay, Broad Sound, and Nahant Bay, has not been determined and could be higher or lower than 6 (Corps, 2004b). Diaz *et al*. (2003) recalibrated the OSI for use in Chesapeake Bay, a temperate coastal embayment, and found that an OSI of 3 was the breakpoint between stressed and non-stressed habitat based on comparison with a benthic index of biotic integrity (Weisberg et al. 1997). Thus for this report, the OSI is used as a relative indicator of habitat conditions with higher OSI values associated with higher benthic habitat quality.

2.2.3 Benthic Survey

On September 16 and 17, 2004, sediment grab sampling was conducted at three stations within each of the five potential hard-bottom enhancement sites in and around Boston Harbor, MA (Corps, 2004c) (Figure 3). Station coordinates were determined based on the sidescan and SPI data collected during earlier surveys (Corps, 2004a; Corps, 2004b) and were chosen to represent the range of soft-bottom sediments within each area. At each of the benthic infauna stations, sediment was collected for infauna, grain-size distribution, and total organic carbon (TOC) analyses.

Several ecological metrics were calculated for each infauna sample within a geographic subset—total abundance, total species, Shannon Diversity (H') calculated using $\log_2$, Pielou's (1966) Evenness (J'), log-series *alpha* diversity (May, 1975), and the ten most abundant species. The software package BioDiversity Professional, Version 2 (© 1997 The Natural History Museum / Scottish Association for Marine Science) was used to perform calculations of total species, log-series *alpha*, H', and J'. Log-series *alpha* is a diversity measure used to characterize infaunal communities. Rosenzweig (1995) showed that several diversity estimators increase markedly with increasing sample size and advocated using Simpson's diversity or log-series *alpha*, because neither exhibited much sample-size bias. Log-series *alpha* is used here as an unbiased estimator of species richness. Log-series *alpha* is completely insensitive to the changes in species evenness. For this report, H' was calculated by using $\log_2$ because that is closest to Shannon's original intent (E. Gallagher personal communication, 2001). H' would have a value of 0 if there was only one species in a sample and would be at a maximum when all species in the sample have the same number of individuals. In practice, values of H' range from < 0 to just greater than 6. Because H' values calculated by using different logarithms vary substantially, the reader must be cautious when comparing values calculated for this report with those presented elsewhere.

Rarefaction analysis [$E(S_n)$, the expected number of species in a sample of size n] (Sanders, 1968; Hurlbert, 1971) on pooled (i.e., summed abundances) samples from each station was also conducted. Rarefaction is a numerical analysis that allows for comparisons of species richness among samples that have unequal sizes (Ludwig and Reynolds, 1988). The approach, which was developed by Sanders (1968) and corrected by Hurlbert (1971), estimates the numbers of species expected in a sample of n individuals from a population of N individuals represented by S species. The results allow the number of species expected for a given sample size to be compared within and across sites.

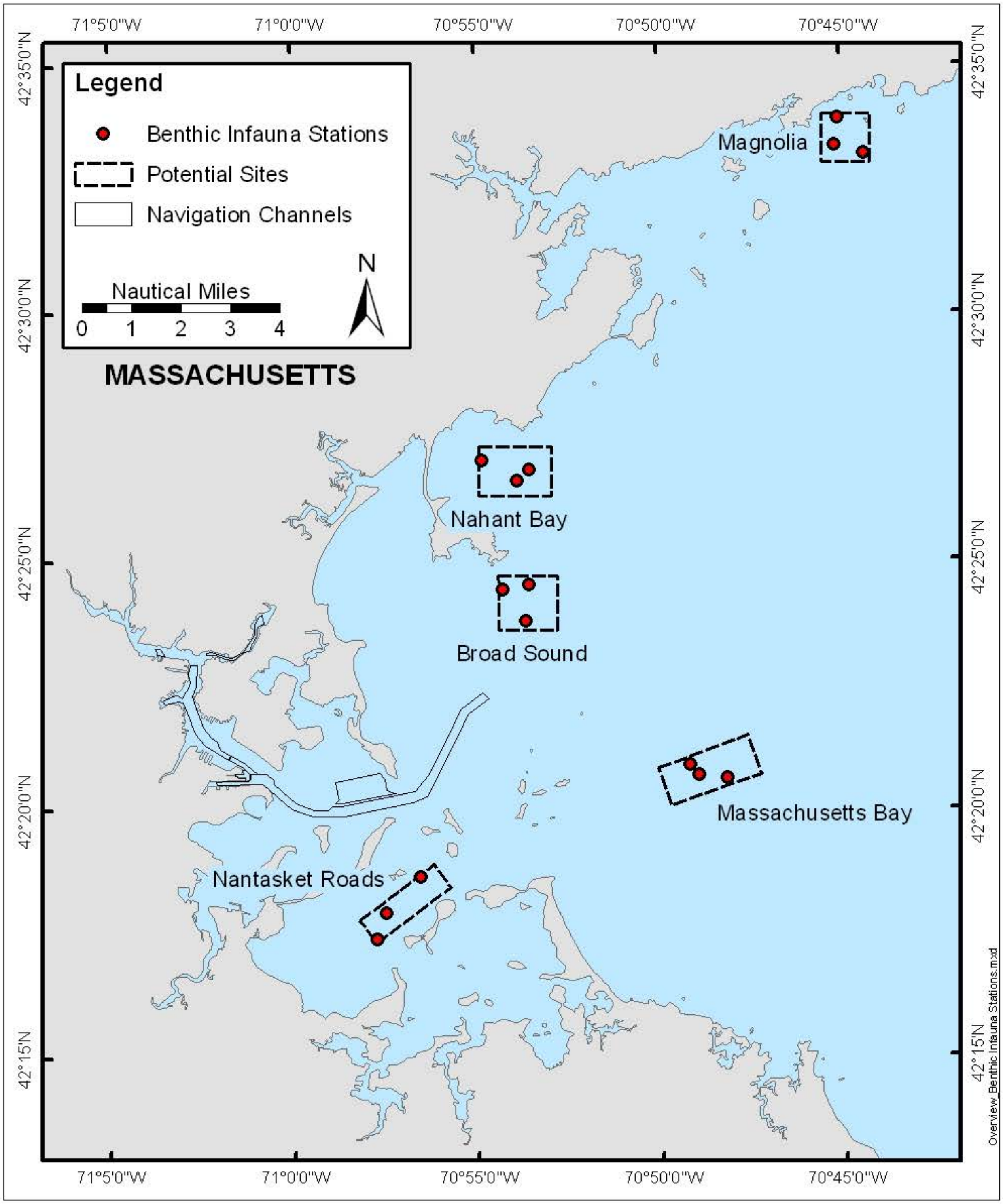


Figure 3. Benthic Survey Grab Sampling Locations.

2.3 Other Available Data

Additional biological data sources were located that describe the fish, shellfish, and lobster communities in and around the five potential enhancement sites and were used, along with the benthic community data collected by the Corps, to characterize the biological productivity and rank the suitability of the potential sites.

2.3.1 Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801-1882, April 13, 1976) strengthened the ability of NMFS and the Fishery Management Councils to "protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans." This habitat, referred to as essential fish habitat (EFH), is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The Magnuson-Stevens Act requires the Fishery Management Councils to describe and identify EFH for managed species and to draft Management Plans for these species that describe ways to minimize, to the extent practicable, adverse effects on EFH from fishing practices and to identify other actions to encourage the conservation and enhancement of EFH.

The NMFS 10 x 10 minute squares that encompass the five potential enhancement sites (Figure 4) were queried to determine which of the Federally managed species and their respective life-history stages have EFH designated within those sites (NOAA, 2005a). The latitude and longitude coordinates for these squares are listed in Table 2.

Table 2. Coordinates of EFH Squares that Encompass Potential Enhancement Sites.

Boundary	North	East	South	West
Square 3	42° 30.0' N	70° 50.0' W	42° 20.0' N	71° 00.0' W
Square 4	42° 20.0' N	70° 50.0' W	42° 10.0' N	71° 00.0' W
Square 5	42° 40.0' N	70° 40.0' W	42° 30.0' N	70° 50.0' W
Square 6	42° 30.0' N	70° 40.0' W	42° 20.0' N	70° 50.0' W

Separate maps were compiled by NMFS to show the EFH for seven skate species (NOAA, 2005a). Skate species with EFH in coastal Massachusetts waters, including those within the potential enhancement sites, are the little skate (*Raja erinacea*) (juvenile and adult), thorny skate (*Amblyraja radiata*) (juvenile), and winter skate (*Raja ocellata*) (juvenile). EFH maps, based on the areas of highest relative abundance for each of these species and life stages during NMFS trawl surveys (1963 - 1999), are shown in Figure 5. Only the shaded squares in U.S. waters represent the EFH designation.

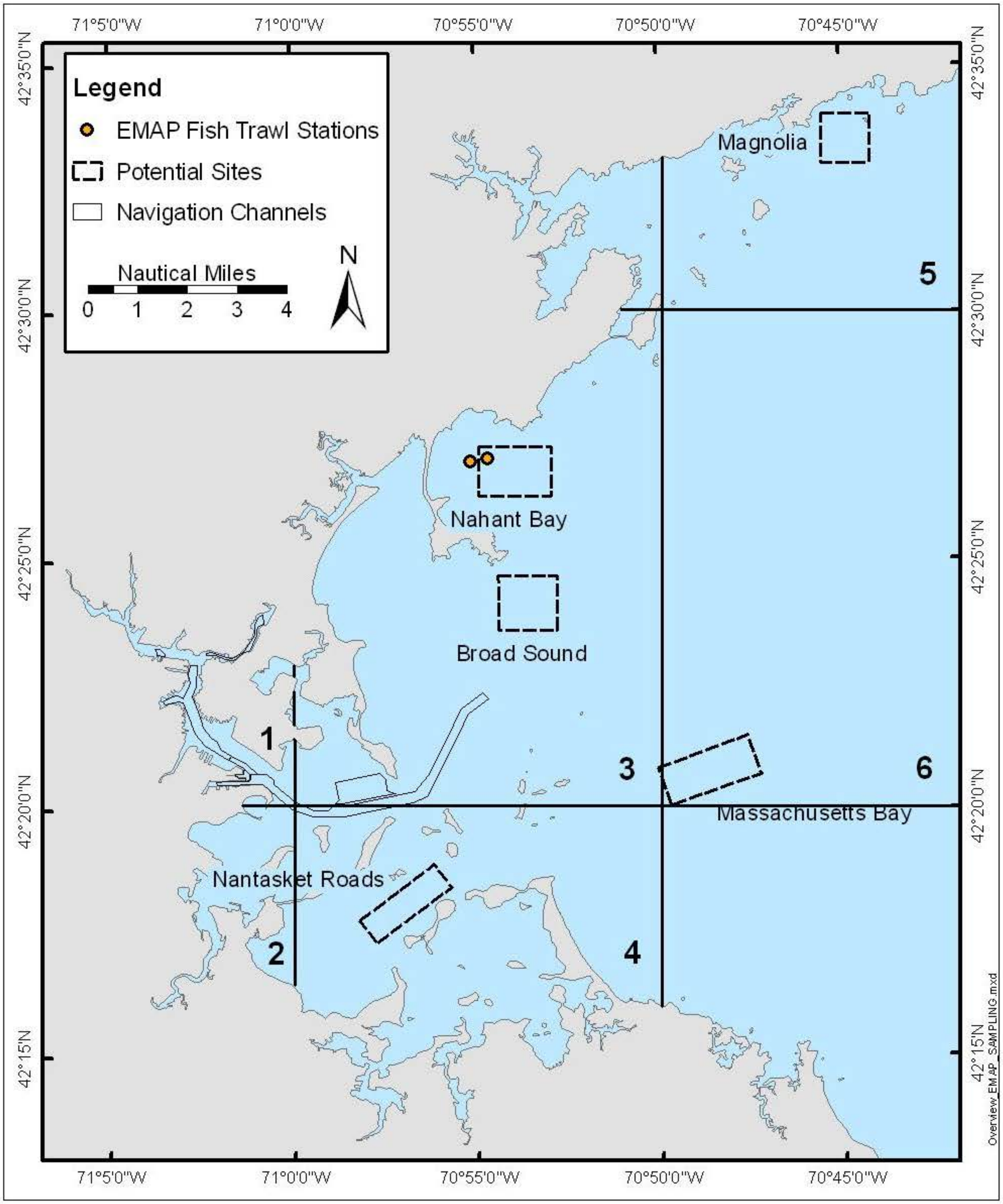
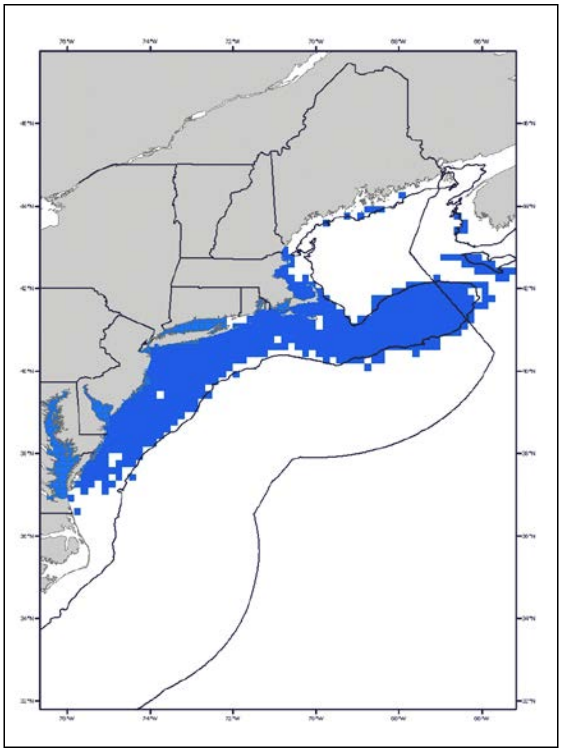
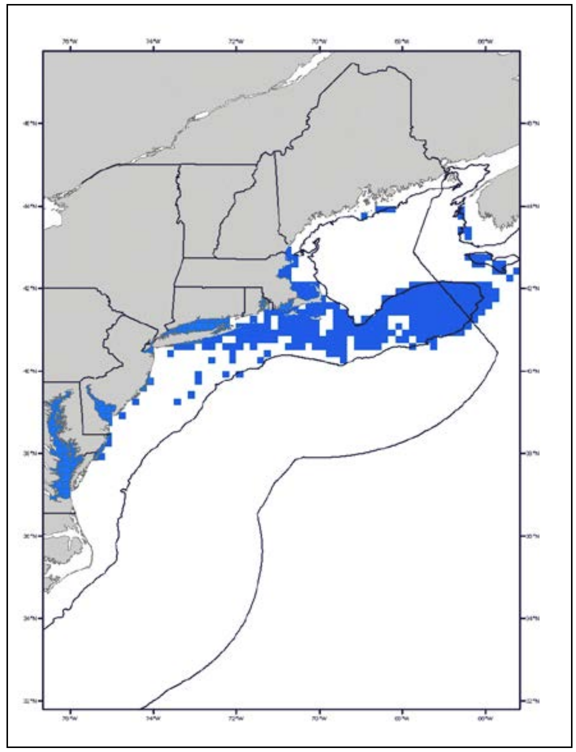


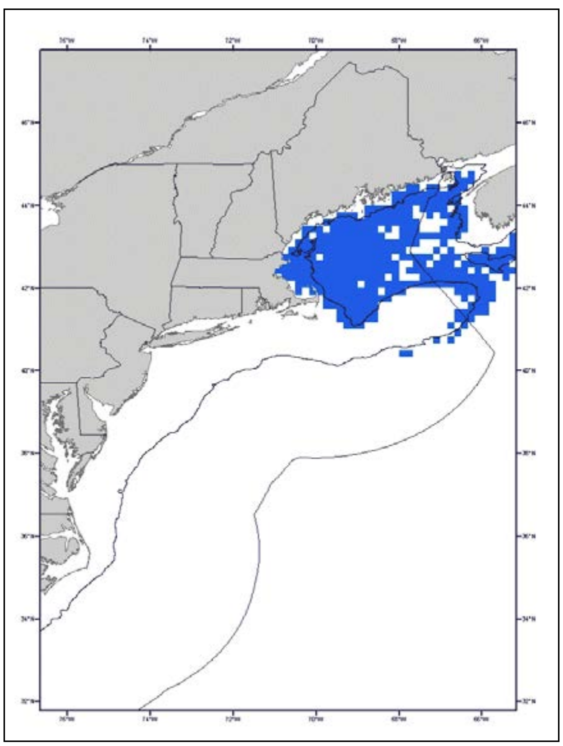
Figure 4. 10 x 10 Minute EFH Squares and EMAP Sampling Stations.



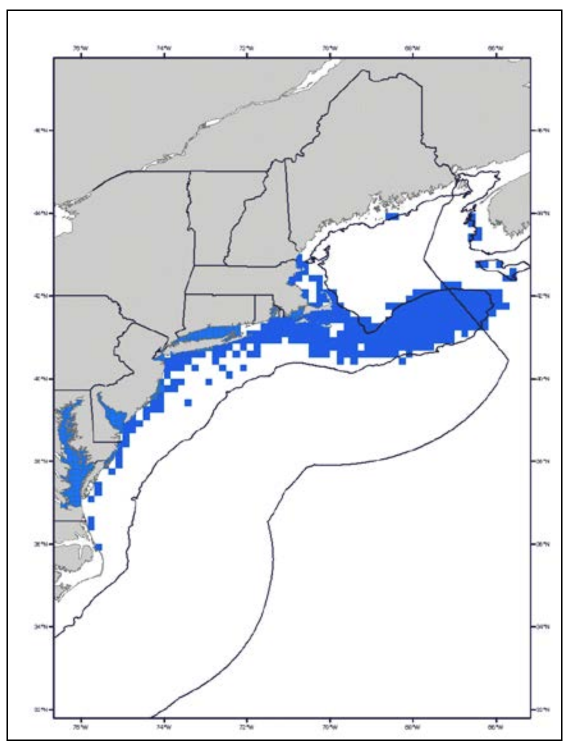
Little skate juvenile EFH
(58% of the observed range of this life stage)



Little skate adult EFH
(57% of the observed range of this life stage)



Thorny skate juvenile EFH
(66% of the observed range of this life stage)



Winter skate juvenile EFH
(48% of the observed range of this life stage)

Figure 5. EFH Designation in Coastal Massachusetts for Skate Species.

2.3.2 Environmental Monitoring Assessment Program

The U.S. Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) is a research program to develop the tools necessary to monitor and assess the status and trends of national ecological resources. EMAP assesses the condition of the Nation's coastal resources through the National Coastal Assessment (NCA), an integrated, comprehensive monitoring program among the coastal states. One of the stations (MA00-0093-A) from the September 2000 EMAP NCA fish trawl survey was located within, and one (MA00-0091-A) was adjacent to, the Nahant Bay site (EPA, 2005) (Figure 4).

2.3.3 Shellfish Suitability Areas

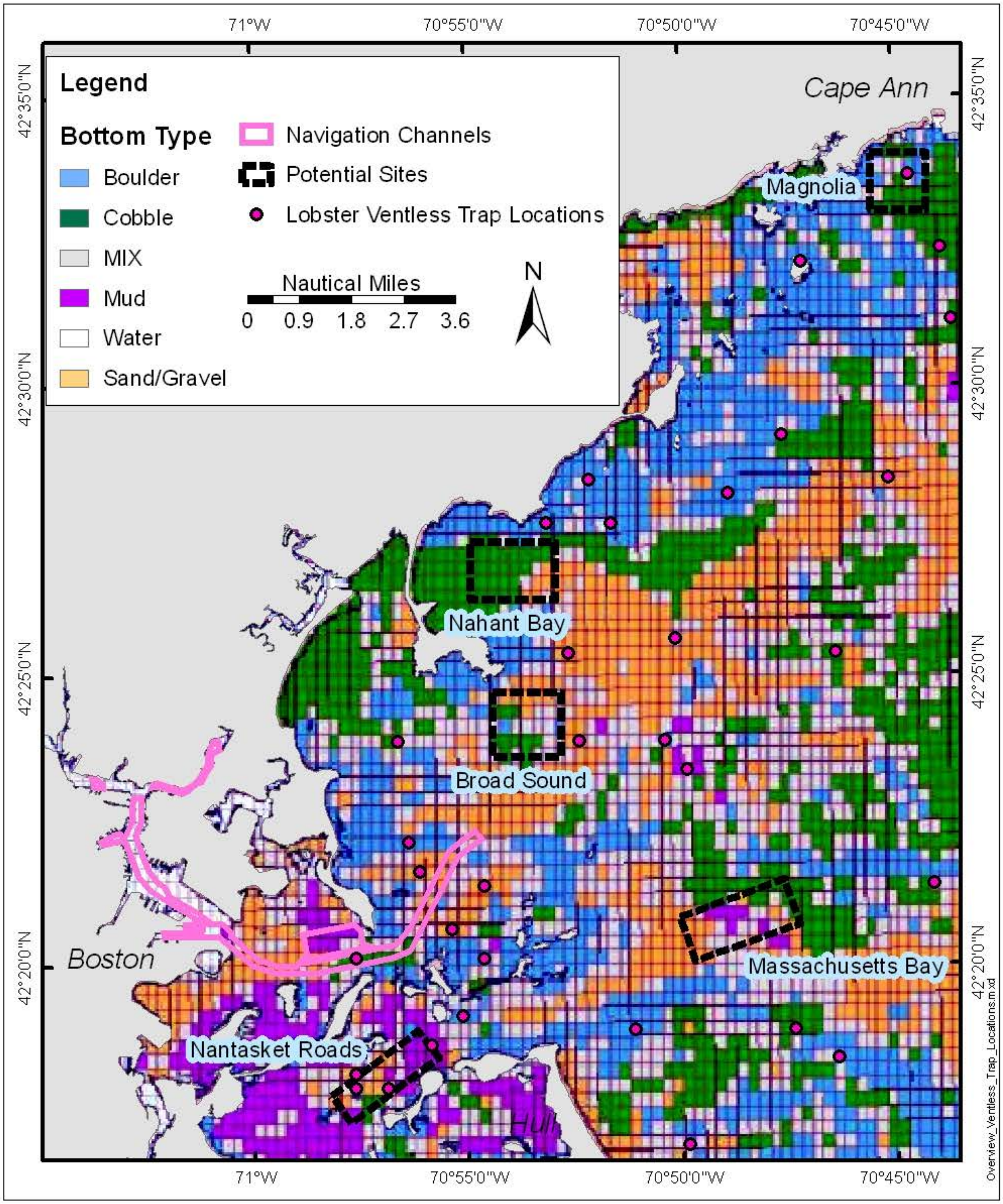
The MADMF, in collaboration with the Massachusetts Office of Coastal Zone Management (CZM) and the NOAA Coastal Services Center (CSC), developed a map of shellfish suitability areas that shows the approximate locations of potential habitats suitable for ten species of shellfish along the coast of Massachusetts. These areas were determined to be suitable for shellfish based on the expertise of the MADMF, the opinion of local Massachusetts Shellfish Constables, and information contained in maps and studies of shellfish in Massachusetts. These areas include sites where shellfish have historically been sighted but may not currently support any shellfish.

2.3.4 Ventless Trap Lobster Survey

In an ongoing ventless trap study conducted by MADMF, efforts are underway to characterize the importance of substrate type and depth to lobster abundance and size distribution (Glenn *et al.*, 2005). Fixed stations within Massachusetts Bay, including stations within the Nantasket Roads and Magnolia sites, were sampled during a pilot study in 2004 and are currently being sampled for a multi-year survey (Figure 6). Sampling occurs aboard commercial vessels, twice monthly from May through November, using a six-trap haul, on which vented and ventless traps are alternately strung on the trawl line. The sampling involves 80 randomly selected, but fixed stations in Massachusetts Bay with each stratum (depth and substrate) represented by at least seven stations.

2.4 Site Ranking

The site ranking process involved the review and evaluation of available biological and physical data, as well as considerations of other uses of the waters within the five potential sites. The following sections describe the criteria and methods used to rank the potential sites in order of suitability for hard-bottom enhancement.



Source: Glenn *et al.*, 2005

Figure 6. Ventless Trap Lobster Sampling Locations and Bottom Type Characteristics.

2.4.1 Criteria

Five criteria were used to perform an initial ranking of the five potential enhancement sites in order of suitability, based on the biological productivity, bottom type, capacity, other uses, and navigable distance of the sites. Each criterion is described below.

1. The first criterion was the biological productivity of each site. Sites with lower productivity, as determined by benthic habitat community or the OSI, were given higher priority for hard-bottom enhancement. Successional stage, OSI, and rarefaction data collected during the SPI and benthic surveys were used to rank the benthic communities at the five potential sites relative to one another. Since changes in the bottom substrate through the placement of rock/cobble material would likely impact species other than benthic infauna, data describing the fish, shellfish, and lobster populations within the sites were used to supplement the benthic infauna data in determining the suitability of each of the sites for hard-bottom enhancement.

2. The second criterion was the existing bottom type for each site. During the disposal, rock and/or cobble will be placed on soft substrate, not on existing rock bottoms. Sites with abundant existing rock bottom habitat were given lower priority. Sites were still considered if they contained some rock bottom that did not significantly reduce the volume of area available for disposal of rock and/or cobble. If the location of the existing rock bottom was in the middle of the site, the site was eliminated from further consideration.

3. The third criterion is the capacity of each site to accommodate the dredged rock/cobble from the navigation channel. Site capacity (cubic yards [cy]) was calculated as the area of soft bottom (in square yards [yd^2]) multiplied by a maximum rock/cobble height of 3 ft (i.e., 1 yd) (C. Rogers, personal communication, 2005). Water depth within the sites was also considered when evaluating site capacity. Priority was given to sites that can receive all of the rock/cobble so that disposal at more than one site will not be necessary.

4. The fourth criterion evaluated the potential for the interference of disposal with other uses, such as fishing or navigation. The site selected for placement of rock/cobble cannot interfere with these activities.

5. The fifth criterion is proximity to the navigation channel. If no significant difference was found between sites, based on the previous four criteria, then the site(s) closest to the navigation channel were given higher priority.

Based on the results of the initial ranking presented in this report, additional investigations will then be conducted on the most suitable site(s) to determine the load bearing capacity of the substrate to support disposal of rock and cobble.

2.4.2 Ranking Method

During the site ranking, all available data were assembled, reviewed, and summarized (see Section 3 of this report) according to the five criteria listed above. The five criteria and corresponding values at each of the potential sites were then compiled into a table, and the sites were ranked from most suitable to least suitable by criterion (see Section 4).

To assist in the ranking, three levels of quantitative ranking values were developed based on the OSI and rarefaction data used to rank the benthic communities at the five potential sites. The natural break method was used to derive the ranking criteria values for the benthic community by identifying breakpoints between classes of data using a statistical formula (Jenk's optimization). Jenk's method minimizes the sum of the variance within each of the classes. Natural Breaks finds groupings and patterns inherent in the data. These natural breakpoints serve to rank the benthic community productivity at each of the five potential enhancement sites in relation to one another.

The results of the site ranking by criteria were listed in a table, and because no one site was consistently ranked as the most suitable across the ranking criteria, four ranking classes (from most suitable [1] to least suitable [4]), were assigned to the list of sites within each criterion. To determine the most suitable site overall, based on the rankings using individual criteria, the occurrence of each site within the top two suitability classes (Class 1 and Class 2) was counted. The site(s) that was ranked within Classes 1 and 2 the most times was determined to be the most suitable site for hard-bottom enhancement. Likewise, the site that was listed in those classes the least number of times was determined to be the least suitable. The key biological, physical, and site use data used in determining the final site ranking were also presented and discussed. The site ranking results are presented in Section 4 of this report.

3.0 SITE DESCRIPTIONS

Data collected from each of the biological resource surveys, and other available data, were used to describe the physical and biological setting, as well as the current use, of each of the five potential enhancement sites.

3.1 Physical Setting

3.1.1 Nantasket Roads

The Nantasket Roads site is rectangular, measuring approximately 2 miles by 0.7 miles enclosing an area of 1.47 square miles (mi^2). This site is relatively shallow, with depths ranging from zero (ledge outcrops) to approximately 50 ft (Corps, 2004a).

The dominant substrate texture classes were (in decreasing order of dominance): coarse sand and gravel, sand, ledge/rock, and mud (Figure 7). Soft bottom (i.e., sand or softer) covered 0.38 mi^2, or 26% of the site. Sand was located along the northern edge of the site, with the majority of the bottom consisting of coarse sand and gravel. Anthropogenic debris and fixed fishing gear (e.g., lobster traps) were widespread at this site (Corps, 2004a). All the SPI stations at Nantasket Roads were silty (Corps, 2004b) (Figure 7). The three infaunal stations within Nantasket Roads (NR2, NR4, NR7) were located in small patches of soft substrates interspersed among broad stretches of sandy gravel (and shell) pavement (Corps, 2004c). Sediments generally were evenly mixed coarse and fine textures, although the fine fraction was predominant at NR2. TOC content was moderate, ranging from 1.2% to 2.3%.

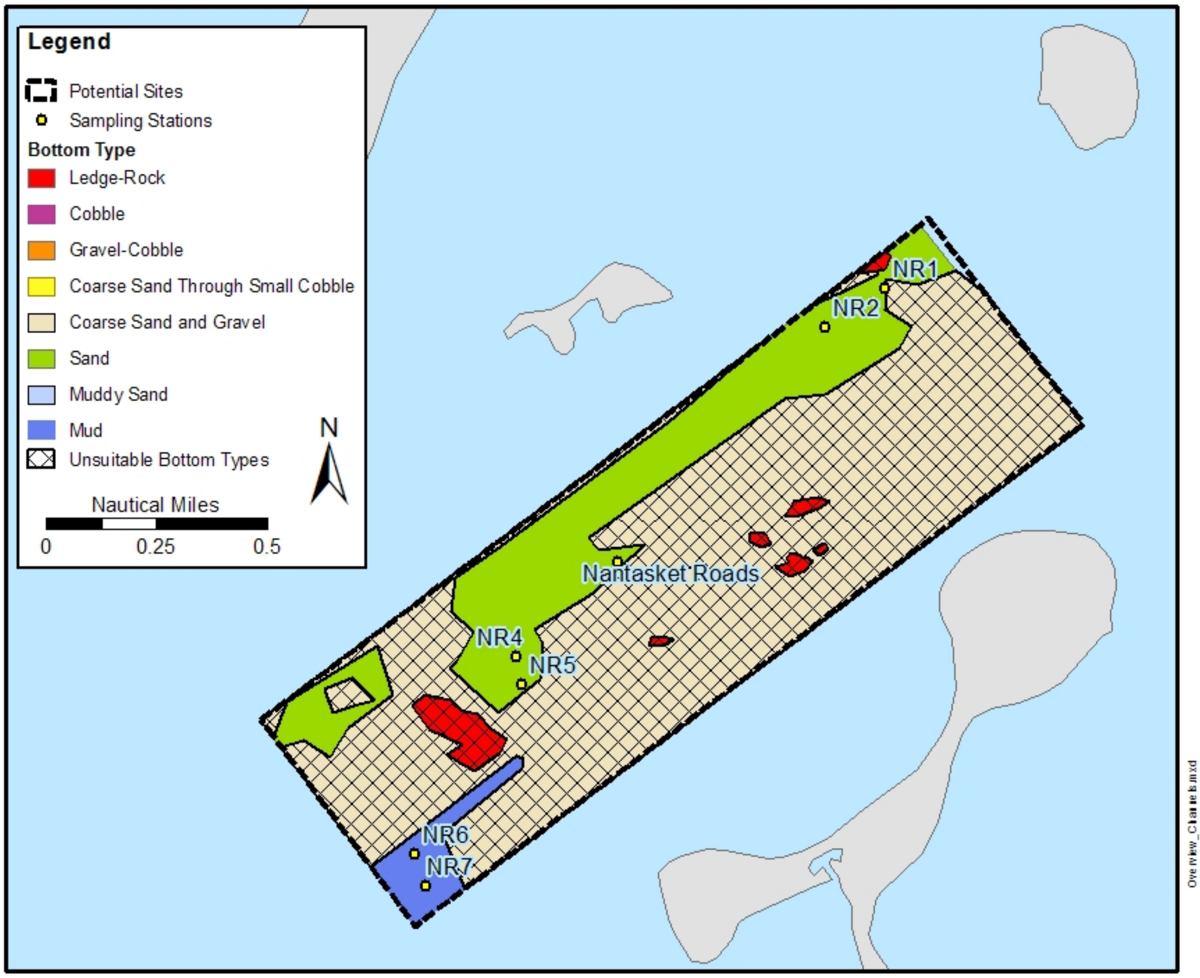


Figure 7. Dominant Substrate Classes at the Nantasket Roads Site.

3.1.2 Massachusetts Bay

The Massachusetts Bay site is rectangular, measuring approximately 2.2 miles by 1 mile enclosing an area of 2.12 mi^2. This site was the deepest of the survey areas, with depths ranging from approximately 75 ft to 110 ft (Corps, 2004a).

The dominant substrate texture classes were (in decreasing order of dominance): sand, coarse sand and gravel, mud, and cobble (Figure 8). A wide area of mud was located in the center of the site, surrounded by extensive areas of hard bottom to the east and southwest. Soft bottom covered 1.06 mi^2, or 50% of the site. Anthropogenic debris and fixed fishing gear (e.g., lobster traps) were widespread at this survey area (Corps, 2004a). Side-scan sonar imagery identified many ring-shaped features, interpreted to be small mounds of disposed coarse material (e.g., construction debris). Sand waves of varying size were also widespread at the Massachusetts Bay site (Corps, 2004a). SPI stations at the Massachusetts Bay were sandy or silty (Corps, 2004b) (Figure 8). The three infaunal stations within the Massachusetts Bay site (MB1, MB4, MB7) were located within a broad area of fine to medium sand or very fine sandy mud surrounded by extensive areas of hard bottom (Corps, 2004c). Sediments generally were evenly mixed coarse and fine textures at stations MB1 and MB4, but were predominantly fine at station MB7. TOC content was low at stations MB1 and MB4, just less than 1%, and moderate at station MB7, about 3%.

Figure 8. Dominant Substrate Classes at the Massachusetts Bay Site.

3.1.3 Broad Sound

The Broad Sound site is square, measuring approximately 1.4 miles by 1.3 miles, enclosing an area of 1.73 mi^2. This site was of intermediate depth, with depths ranging from approximately 45 ft to 90 ft (Corps, 2004a).

The dominant substrate texture classes were (in decreasing order of dominance): muddy sand and a gravel/cobble mix (Figure 9). The coarser gravel/cobble mix roughly bisected the site along an east/west orientation. Soft bottom covered 0.99 mi^2, or 57% of the site. SPI stations at the Broad Sound site were both sandy and silty (Corps, 2004b) (Figure 9). The northern sampling stations were separated from southern stations by a broad swath of hard bottom, including coarse gravel and small cobbles (Corps, 2004c). The three infaunal stations within the Broad Sound site (BR1, BR3, BR6) were located in two large areas of sand or muddy sand.

Sediments were moderately coarse at station BR1 (61% sand + gravel) and fine at stations BR3 and BR6 (66% and 78% silt + clay). TOC content was very low at station BR1 (0.5%) and low at stations BR3 and BR6 (1.3%– 1.9%).

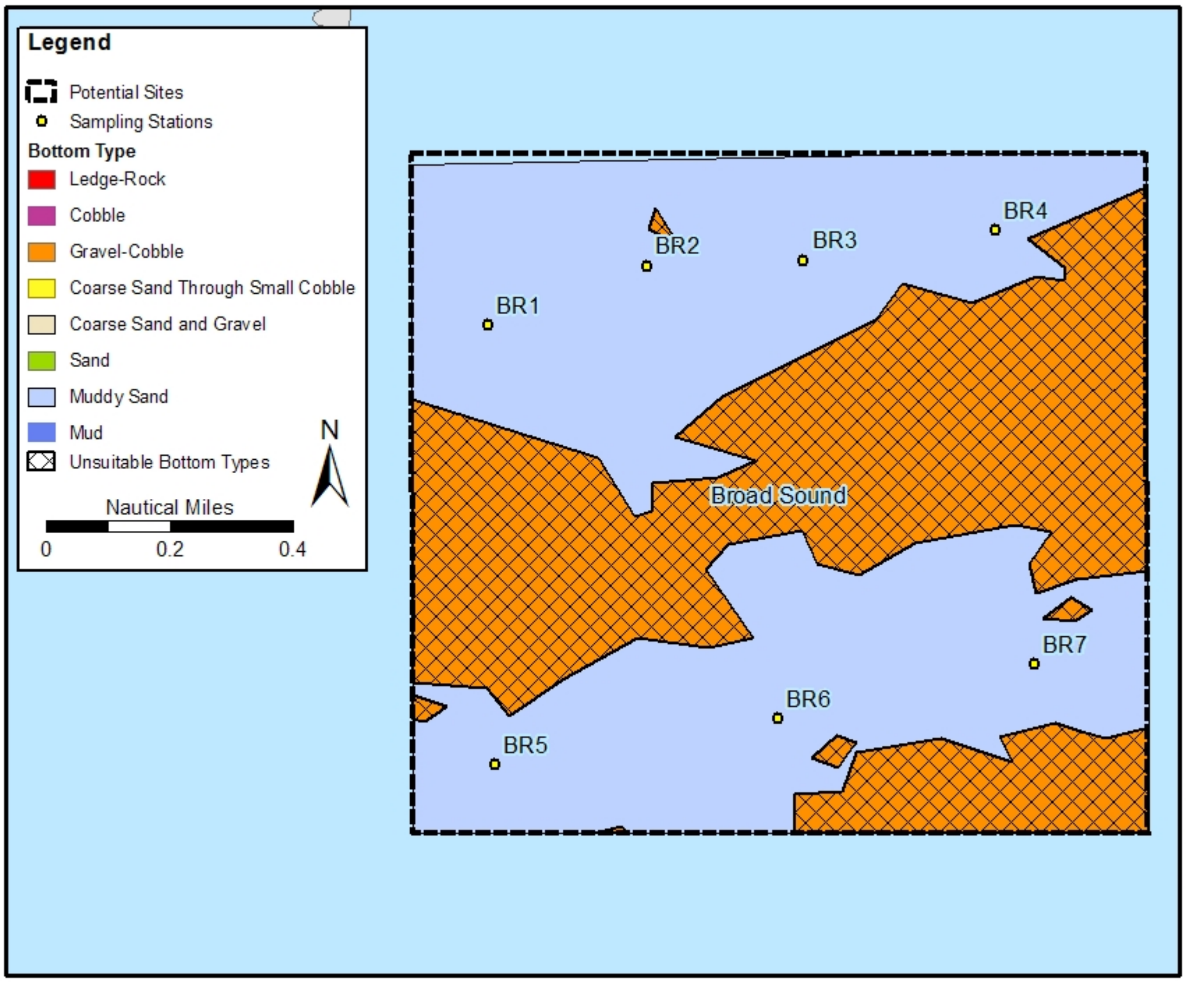


Figure 9. Dominant Substrate Classes at the Broad Sound Site.

3.1.4 Nahant Bay

The Nahant Bay site is rectangular, measuring approximately 1.7 miles by 1.1 miles, enclosing an area of 1.92 mi^2. This site was of intermediate depth, with depths ranging from approximately 30 ft to 75 ft (Corps, 2004a).

The dominant substrate texture classes were (in decreasing order of dominance): sand and a mixture of coarse sand to small cobble (Figure 10). Coarser material appeared to be concentrated along the northern, southern, and western site boundaries. Soft bottom covered 1.34 mi^2, or 70% of the site. Bottom type at all of the SPI stations within Nahant Bay was fine- and medium-sand to very fine sand (Corps, 2004b). The three infaunal stations within the Nahant Bay site (NB3, NB5, NB7) were located within a broad area of soft bottom with many small patches of hard-bottom material separating the northwestern station (NB3) from the other two (Corps, 2004c) (Figure 10). Sediments were predominantly coarse at stations NB3 and NB7 (80%– 97% sand + gravel) and mixed at station NB5 (43% silt + clay). TOC content was very low at stations NB3 and NB7 (<0.5%) and low at station NB5 (1.2%).

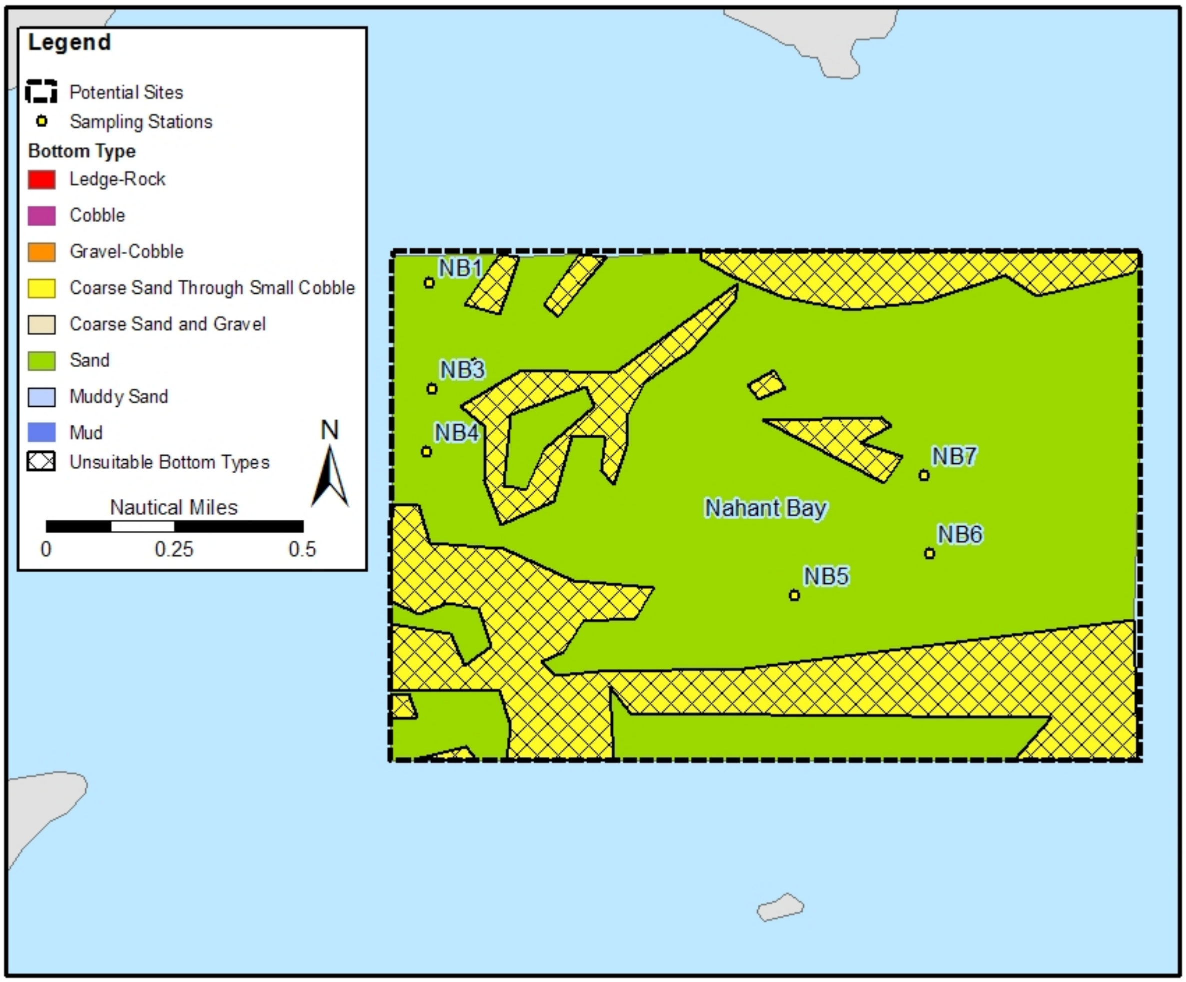


Figure 10. Dominant Substrate Classes at the Nahant Bay Site.

3.1.5 Magnolia

The Magnolia site is square, measuring approximately 1.1 miles by 1.1 miles, enclosing an area of 1.28 mi^2. This site was of shallow to intermediate depth, with depths ranging from approximately zero (ledge outcrops) to 95 ft (Corps, 2004a).

The dominant substrate texture classes were (in decreasing order of dominance): sand (generally smooth and well-sorted), ledge/rock, and a coarse sand/gravel mix (Figure 11). Areas of ledge/rock and coarse sand and gravel were concentrated in the northern half of the site. Soft bottom covered 0.83 mi^2, or 65% of the site. The bottom type at all of the SPI stations was sand, mostly very fine sand (Corps, 2004b) (Figure 11). The three infaunal stations within the Magnolia site (MA1, MA3, MA7) were located within a broad reach of soft-bottom substrate partially surrounded by patches of hard-bottom material (Corps, 2004c). Sediments were predominantly coarse at all three stations, ranging form 76% to 89% sand + gravel. TOC content was very low at all three stations, 0.2%.

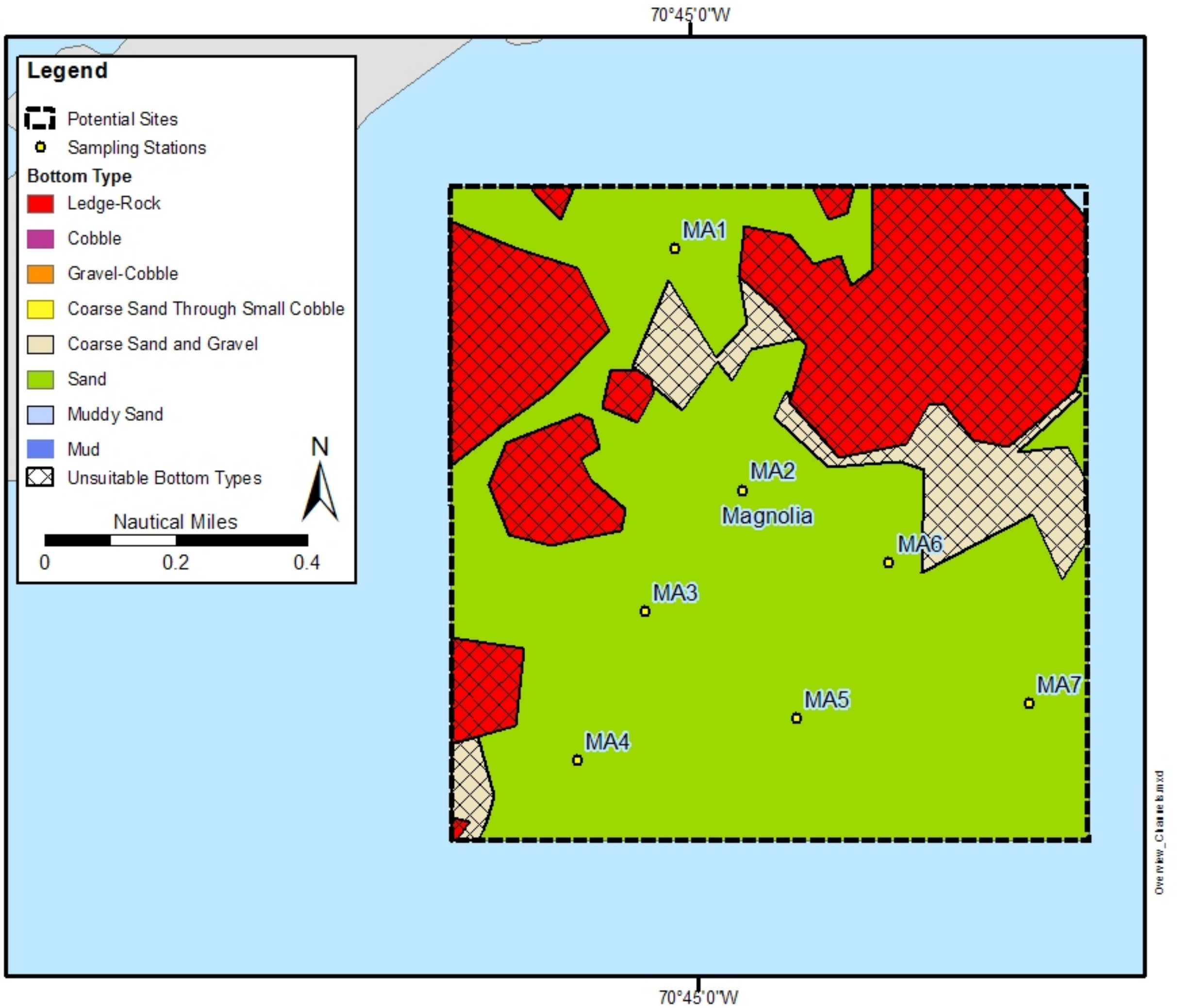


Figure 11. Dominant Substrate Classes at the Magnolia Site.

3.2 Biological Setting

The biological setting of the five potential enhancement sites is characterized using data regarding the benthic, finfish, shellfish, and lobster populations present within these sites.

3.2.1 Benthos

The quality of benthic habitat was characterized using a number of parameters listed in Section 2.2.3, namely successional stage, OSI, and rarefaction data. Other measures of benthic quality include benthic infauna abundance and variability.

Nantasket Roads

OSI at the Nantasket Roads SPI stations ranged from 5.5 to 10. Infaunal abundance varied almost three-fold across the three Nantasket Roads stations, ranging from 892 to 2,361 individuals per sample, or approximately 22,000 to 59,000/m^2 (Corps, 2005). Variability (coefficient of variation, CV) among the samples collected within each station ranged from 19 to 54%. The number of species occurring at each station also varied considerably, ranging from 13 to 24 species per sample. Variability in species numbers at each station was moderately low (12% to 22%). Species diversity among the Nantasket Roads stations was low with log-series alpha ranging from 2.1 to 3.7 and Shannon's H' ranging from 2.0 to 2.9. Variability in species diversity within each station was moderately low, with CVs for log-series alpha ranging from 10% to 20%.

The predominant taxa present at each of the three Nantasket Roads stations varied. At two of the stations, the three most abundant taxa were the same; the annelid worms *Aricidea catherinae* (polychaete), Tubificidae (oligochaete), and *Scoletoma hebes* (polychaete). These three taxa accounted for about 86% of the species-level infaunal abundance at those stations. The amphipods *Leptocheirus pinguis* and *Ampelisca abdita* were relatively uncommon, accounting for only about 1% to 3% of the species level infaunal abundance at the two stations. At the third station, the predominant species were the amphipod *Leptocheirus pinguis* and *Ampelisca abdita*, which accounted for about 28% and 17%, respectively, of the species-level infaunal abundance at the station. The three worms that were most abundant at the first two stations were also common at the third station, but only accounted for about 38% of the species-level infaunal abundance there.

Moon snails, sulfur sponge, cerianthid anemones, and hydroids were observed in the video drifts from this site (Corps, 2004a). Many amphipod tubes were also observed in the mud bottom.

Massachusetts Bay

OSI at the Massachusetts Bay SPI stations ranged from 6.0 to 9.0 (Corps, 2004b). Infaunal abundance varied slightly more than two-fold across the three Massachusetts Bay stations, ranging from 438 to 1067 individuals per sample, or approximately 11,000 to 27,000/m^2 (Corps, 2005). Variability was moderate to high (CV = 22 to 103%) among the samples collected at each of the three Massachusetts Bay stations. The number of species occurring at each station also varied moderately, ranging from 21 to 31 species per sample. Variability in species numbers within each station was moderately low (19 to 26%). Species diversity among the Massachusetts Bay stations was moderately low and consistent among all three stations with log-series alpha ranging from 5.5 to 6.7 and Shannon's H' ranging from 3.3 to 3.5. Variability in species diversity within each station was moderately low (15% to 26%).

Most of the numerically dominant taxa at the three Massachusetts Bay stations were polychaete worms. All of these worms, especially *Prionospio steenstrupi*, *Tharyx acutus*, *Mediomastus californiensis*, *Levinsenia gracilis*, and *Spio limicola*, are typically among the predominant species in Massachusetts Bay (Kropp *et al*., 2002; Maciolek *et al*., 2003). The small deposit-feeding clam, *Nucula delphinodonta*, also was relatively abundant and is a common taxon among Massachusetts Bay samples (Kropp *et al*., 2002; Maciolek *et al*., 2003).

Several seastars and sand shrimp were observed at the soft-bottom video transects. On the gravel and cobble bottom, and in areas of sand waves, hydroids and sulfur sponge were observed.

Broad Sound

OSI at the Broad Sound SPI stations ranged from 4.0 to 7.5 (Corps, 2004b). Infaunal abundance varied less than two-fold across the three Broad Sound stations, ranging from 1,367 to 2,429 individuals per sample, or about 34,000 to 61,000/m^2 (Corps, 2005). Variability was low to high among the samples collected in Broad Sound (CVs = 15% to 78%). The number of species occurring at each station was relatively consistent, ranging from 28 to 35 species per sample. Variability in species numbers within each station was moderately low (13% to 23%). Species diversity among the Broad Sound stations was moderately low and consistent among all three stations with log-series alpha ranging from 4.5 to 6.7 and Shannon's H' ranging from 2.9 to 3.9. Variability in species diversity within each station was low to moderate, with CVs for log-series alpha ranging from 12% to 33%.

The species composition of the samples from the three Broad Sound stations was also typical for Massachusetts Bay sediments. Polychaete worms again accounted for the largest proportion of the species-level infaunal abundance. *Prionospio steenstrupi*, *Tharyx acutus*, *Mediomastus californiensis*, *Levinsenia gracilis*, and *Spio limicola* characterized the samples from two of the stations. Despite the numerical importance of *Prionospio steenstrupi* and *Mediomastus californiensis* at the third station, the fauna at that station differed from the other two in that the polychaete *Owenia fusiformis* accounted for 22% of the species-level infaunal abundance there. Additionally, the isopod crustacean, *Edotia montosa*, was among the ten most abundant taxa at one station, but was uncommon or not found at the other two stations. The small bivalve mollusc *Nucula delphinodonta* was third or fourth most abundant species among the Broad Sound stations.

Northern starfish were also observed in the video transects from within this site (Corps, 2004a).

Nahant Bay

OSI at the Nahant Bay SPI stations ranged from 5.0 to 8.0 (Corps, 2004b). Infaunal abundance varied twelve-fold across the three Nahant Bay stations, ranging from 172 to 2,066 individuals per sample, or about 4,300 to 52,000/m^2 (Corps, 2005). Variability was low to moderate (CV = 9% to 44%) among the samples collected at all three stations. The number of species occurring at each station varied, ranging from 15 to 31 species per sample. Variability in species numbers within each station was moderately low (18% to 31%). Species diversity among the Nahant Bay stations was moderately low and consistent among all three stations with log-series alpha ranging from 4.2 to 5.3 and Shannon's H' ranging from 2.2 to 2.9. Variability in species diversity within each station was low to moderate, with CVs for log-series alpha ranging from 13% to 44%.

As might be expected by the differences in depth, grain-size regime, and distance between NB3 and the other two Nahant Bay stations, the fauna at station NB3 differed substantially from that at the other two stations. The predominant species at NB3 were those typically associated with sandy substrates, amphipods (*Psammonyx nobilis*, *Unciola irrorata*, and *Protohaustorius* sp. B), sand dollars (*Echinarachnius parma*), and bivalve molluscs (*Tellina agilis*, *Spisula solidissima*, and *Siliqua costata*). The most abundant species at the station, the polychaete *Spiophanes bombyx*, inhabits a variety of substrate types. A more typical Massachusetts Bay fauna comprised the deeper stations, NB5 and NB7. Characteristic species included the polychaete worms *Prionospio steenstrupi*, *Owenia fusiformis*, *Aricidea catherinae*, *Mediomastus* *californiensis*, and the nut clam *Nucula delphinodonta*. *Spiophanes bombyx* also was among the ten most abundant taxa at the two deeper stations.

At one of the video drifts, sand dollars were extremely abundant on the fine hard sand bottom type. Also observed at the Nahant site were seastars and sulfur sponge (Corps, 2004a).

Magnolia

OSI at the Magnolia SPI stations ranged from >3.5 to 7.0 (Corps, 2004b). Infaunal abundance varied about two-fold across the three Magnolia stations, ranging from 385 to 826 individuals per sample, or about 9,600 to 26,600/m^2 (Corps, 2005). Variability was low to moderate (CV = 22% to 32%) among the samples collected at all three stations. The number of species occurring at each station was fairly consistent, ranging from 25 to 35 species per sample, and variability in species numbers within each station was low (13% to 21%). Species diversity among the Magnolia stations was moderately low and consistent among all three stations with log-series alpha ranging from 5.4 to 7.7 and Shannon's H' ranging from 2.5 to 3.5. Variability in species diversity within each station was low, with CVs for log-series alpha ranging from 18% to 25%.

Many of the most abundant taxa among the Magnolia stations, especially station MA1, are characteristic of very sandy substrates. Although several species of polychaete worms were numerically important at station MA1, sand-dwelling crustaceans, such as *Crassicorophium crassicorne* (amphipod), *Tanaissus psammophilus* (tanaid), and *Eudorella pusilla* (cumacean), were relatively abundant. Sand dollars (*Echinarachnius parma*) accounted for 10% of the species-level infaunal abundance there. The polychaete worm *Spiophanes bombyx* was numerically predominant at all three Magnolia stations; and the worm *Prionospio steenstrupi, Owenia fusiformis,* and *Aricidea catherinae* were common at stations MA3 and MA7. The small clam *Nucula delphinodonta* and the isopod crustacean *Edotia montosa* were relatively abundant the two deeper stations (MA3, MA7).

3.2.2 Fish

Species having EFH designated in the four 10 x 10 minute squares that encompass the five potential enhancement sites include 2 shellfish species (see Section 3.2.3 for discussion of shellfish resources), 2 squid species, and 24 finfish species (NOAA, 2005a) (Table 3). Skates, such as little skate (juvenile and adult), thorny skate (juvenile), and winter skate (juvenile) also have EFH in coastal Massachusetts waters which include all five of the potential sites. In addition, several species of finfish were observed in the video-drift footage collected within the five potential sites (Corps, 2004a) and in EMAP trawls collected within the Nahant Bay site.

Table 3. Species with EFH within the Five Potential Enhancement Sites.

Species	**Nantasket Roads** (Square 4)	**Massachusetts Bay** (Square 6)	**Broad Sound** (Square 3)	**Nahant Bay** (Square 3)	**Magnolia** (Square 5)
Finfish					
Atlantic cod *(Gadus morhua)*	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A
haddock *(Melanogrammus aeglefinus)*	E,L	E,L,J	E,L	E,L	E,L,J
pollock *(Pollachius virens)*	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A
whiting *(Merluccius bilinearis)*	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A
red hake *(Urophycis chuss)*	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A
white hake *(Urophycis tenuis)*	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A
redfish *(Sebastes fasciatus)*		L,J,A			L,J,A
witch flounder *(Glyptocephalus cynoglossus)*		E,L,A			
winter flounder *(Pseudopleuronectes americanus)*	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A
yellowtail flounder *(Pleuronectes ferruginea)*	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A
windowpane flounder *(Scophthalmus aquosus)*	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A
American plaice *(Hippoglossoides platessoides)*	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A
ocean pout *(Macrozoarces americanus)*	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A
Atlantic halibut *(Hippoglossus hippoglossus)*	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A
Atlantic sea herring *(Clupea harengus)*	L,J,A	L,J,A	L,J,A	L,J,A	L,J,A
monkfish *(Lophius americanus)*		E,L			
bluefish *(Pomatomus saltatrix)*	J,A	J,A	J,A	J,A	J,A
Atlantic butterfish *(Peprilus triacanthus)*	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A
Atlantic mackerel *(Scomber scombrus)*	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A
summer flounder *(Paralichthys dentatus)*	A		A	A	A
scup *(Stenotomus chrysops)*	J,A	J,A	J,A	J,A	J,A
spiny dogfish *(Squalus acanthias)*		J,A			
bluefin tuna *(Thunnus thynnus)*	J,A	J,A	J,A	J,A	J,A
black sea bass *(Centropristis striata)*	J,A		A	A	A
Squid					
long-finned squid *(Loligo pealei)*	J,A	J,A	J,A	J,A	J,A
short-finned squid *(Illex illecebrosus)*	J,A	J,A	J,A	J,A	J,A

Table 3 (cont.). Species with EFH within the Five Potential Enhancement Sites.

Species	**Nantasket Roads** (Square 4)	**Massachusetts Bay** (Square 6)	**Broad Sound** (Square 3)	**Nahant Bay** (Square 3)	**Magnolia** (Square 5)
Shellfish					
Atlantic sea scallop *(Placopecten magellanicus)*	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A	E,L,J,A
surf clam *(Spisula solidissima)*	J,A	J,A	J,A	J,A	J,A
Skates					
little skate (*Raja erinacea*)	J,A (in coastal Massachusetts water)				
thorny skate (*Amblyraja radiata*)	J (in coastal Massachusetts water)				
winter skate (*Raja ocellata*)	J (in coastal Massachusetts water)				

Source: NOAA, 2005a
E = eggs; L = larvae; J = juvenile; A = adult

These species included flounders, sculpin, hakes, cunner, ocean pout, skates, sea raven, and alewife.

In general, sediments within the five potential enhancement sites consisted mostly of sand, coarse sand and gravel, cobble, and rock, with isolated areas of fine sediments (i.e, mud). In the areas of finer sediment, demersal species including the American plaice, Atlantic halibut, summer flounder, winter flounder, windowpane flounder, witch flounder, red and white hake, and yellowtail flounder may be present (NOAA, 2005b). Other demersal species (black sea bass, cod, haddock, ocean pout, pollock, redfish, and scup) prefer more structured hard-bottom areas and may be present in areas with rocky or gravelly bottom. Pelagic species, such as Atlantic butterfish, Atlantic sea herring, juvenile bluefish, and monkfish, are likely to be present in areas with sand and/or gravel bottom. Atlantic mackerel, bluefin tuna, and long- and short-finned squid are pelagic species that are associated with all substrate types. Forage and shore species, such as cunner, sculpin, skates, and spiny dogfish, may also be present within the five potential sites. Little skate and juvenile thorny and winter skate prefer sandy, gravelly, or muddy substrates.

Nantasket Roads

EFH for 20 finfish species is designated within Square 4, which encompasses the Nantasket Roads site. Juvenile flounders and sculpins were observed during the video transects within this site (Corps, 2004a).

Massachusetts Bay

EFH for 22 finfish species is designated within Square 6, which encompasses the Massachusetts Bay site (Table 3). Of the four squares, Square 6 is the only one that contains EFH for witch flounder (*Glyptocephalus cynoglossus*), monkfish (*Lophius americanus*), and spiny dogfish (*Squalus acanthias*). Several red hake were observed at the soft-bottom video transects within this site (Corps, 2004a). In the gravel and cobble bottom and in areas of sand waves, cunner, flounder, sculpin, and ocean pout were observed.

Broad Sound

EFH for 20 finfish species is designated within Square 3, which encompasses the Broad Sound site (Table 3). Flounder, red hake, and sculpin were observed in the video transects from within this site (Corps, 2004a).

Nahant Bay

EFH for 20 finfish species is designated within Square 3, which encompasses the Nahant Bay site (Table 3). Red hake, juvenile sculpin, ocean pout, and flounder were observed in the video drifts within this site (Corps, 2004a). During the September 2000 EMAP NCA fish trawl survey, 1,053 individuals from 10 taxa were collected in one trawl from the sampling station (MA00-0093-A) within the Nahant Bay site, and 374 individuals from 7 taxa were collected in one trawl from the sampling station (MA00-0091-A) just outside of the Nahant Bay site (EPA, 2005). The species and number of individuals collected are listed in Table 4.

Table 4. EMAP Trawl Data from Within the Nahant Bay Site.

Species	Total Abundance (#)	
	MA00-0093-A	MA00-0091-A
Atlantic butterfish (*Peprilus triacanthus*)	700	67
little skate (*Raja erinacea*)	237	189
winter flounder (*Pseudopleuronectes americanus*)	48	25
windowpane flounder (*Scophthalmus aquosus*)	35	13
winter skate (*Raja ocellata*)	28	9
scup (*Stenotomus chrysops*)	1	0
sea raven (*Hemitripterus americanus*)	1	0
silver hake (*Merluccius bilinearis*)	1	0
spotted hake (*Urophycis regia*)	1	0
white hake (*Urophycis tenuis*)	1	0
alewife (*Alosa pseudoharengus*)	0	1
summer flounder (*Paralichthys dentatus*)	0	3

Magnolia

EFH for 21 finfish species is designated within Square 5, which encompasses the Magnolia site (Table 3). Fish recorded in the video drifts at this site included juvenile and adult flounders and skates (Corps, 2004a).

3.2.3 Shellfish

MADMF potential shellfish habitats for sea scallops, blue mussels (*Mytilus edulis*), and ocean quahog (*Arctica islandica*) occur within at least one of the five potential enhancement sites (Figure 12), which are discussed in more detail below. Sea scallops (all life stages) and surf clams (*Spisula solidissima)* (juvenile and adults only) have EFH designated within all four of the 10 x 10 minute squares, which encompass the five potential sites (Table 3). Sea scallops, rock crabs (*Cancer* spp.), and hermit crabs were observed in the video drift footage from at least one of the five potential sites (Corps, 2004a).

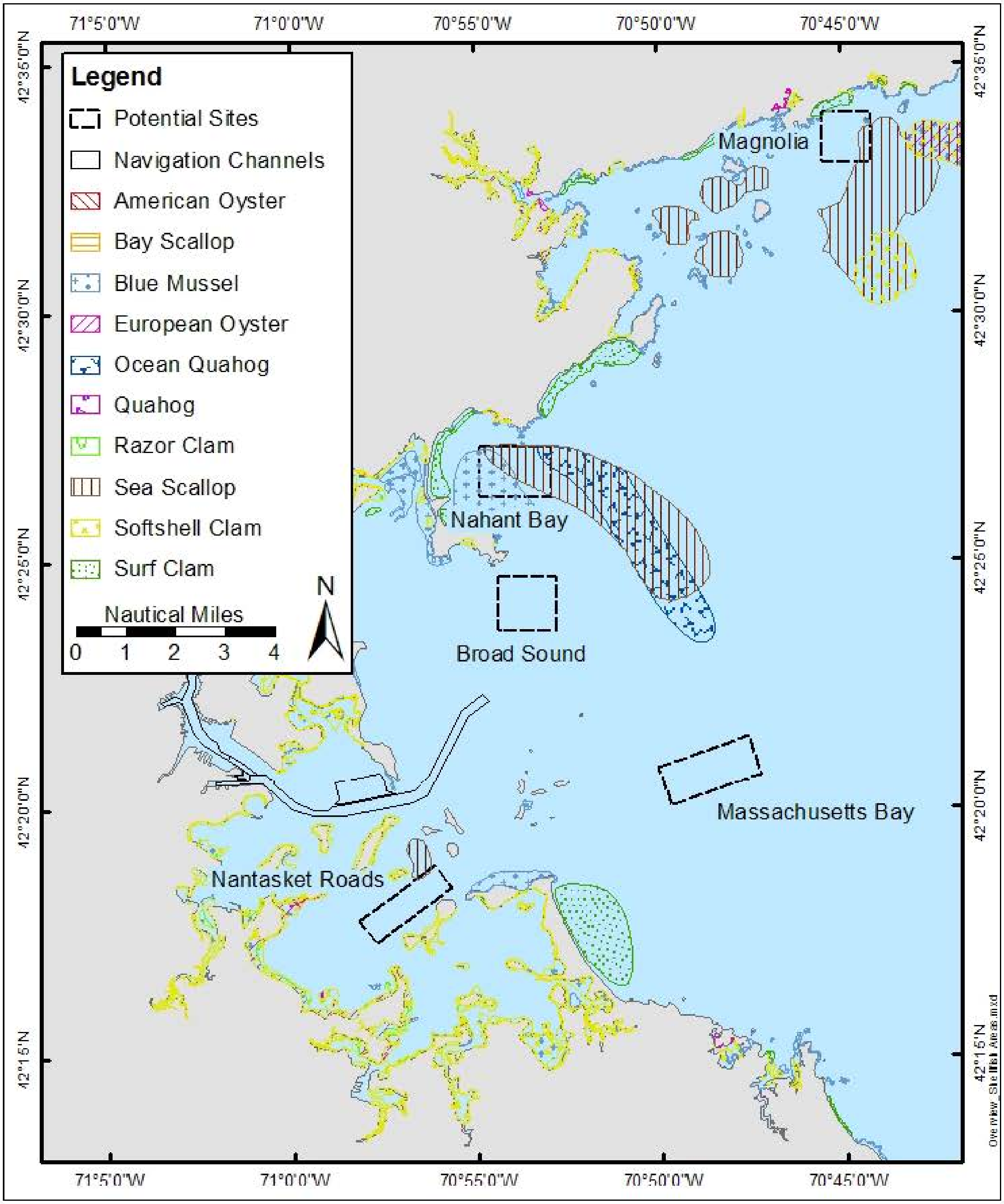


Figure 12. Shellfish Suitability Areas in Relation to the Five Potential Sites (MADMF, 2004).

North of Cape Cod, sea scallop populations are generally scattered in shallow water less than 66 feet deep and are most often associated with sandy sediments (Hart, 2001). Blue mussels are most abundant in the intertidal and shallow subtidal zones and are attached to rocks, pilings, and other solid objects (Canada Department of Fisheries and Oceans, 2003a). Ocean quahogs typically live in fine-sand sediments at depths of 30 to 480 feet (Abbott, 1974). The largest concentrations of surf clams usually occur in well-sorted, medium sand, but may also occur in fine sand and silty-fine sand (Cargnelli *et al*., 1999). Rock crabs prefer rocky habitat but can be found on all types of bottoms (Gosner, 1978; Estrella, 2003).

Nantasket Roads

An area of potential sea scallop habitat exists near the northern corner of the Nantasket Roads site (Figure 12), and sea scallops were the predominant marine organism observed in the drift video footage within this site (Corps, 2004a). They were plentiful in the coarse sand and gravel bottom.

Massachusetts Bay

None of the potential shellfish habitats identified by MADMF occur within the Massachusetts Bay site (Figure 12). Rock crabs (*Cancer* spp.) were predominant in the mud/sand bottom drift video footage within this site (Corps, 2004a).

Broad Sound

None of the potential shellfish habitats identified by MADMF occur within the Broad Sound site (Figure 12). Rock crabs were the predominant marine biota at the muddy/sand and gravel/cobble bottom video transects (Corps, 2004a). Many sea scallops were noted at the gravel bottom areas. Hermit crabs were also observed.

Nahant Bay

Potential habitats for sea scallop, blue mussel, and ocean quahog occur within the Nahant Bay site (Figure 12). Rock crabs and small hermit crabs were the predominant invertebrates along most of the Nahant Bay video transects (Corps, 2004a).

Magnolia

Potential habitats for blue mussel and sea scallop occur within the Magnolia site (Figure 12). Many rock crabs were observed in burrows in the coarse sand bottom video transect (Corps, 2004a).

3.2.4 Lobster

Data from the October through November 2004 ventless trap pilot study (16 sampling trips, 40 stations, 3 depth strata, 4 substrate strata for 936 trap hauls) provided initial information on the size distribution of lobsters in various types of bottom habitats in the Massachusetts Bay/Boston Harbor area. As expected from previous studies, juvenile (30-58 mm) and adolescent (59-70 mm CL) lobsters were more common in the shelter-providing habitats of boulder and cobble than in sand/gravel or mud (Figure 13), and were more common in shallow waters (0-15 m depth) (Figure 14). Again, these data reflect the needs of smaller juveniles for shelter-providing habitats that offer protection against predators. In contrast, sublegal-sized adult lobsters (71-82 mm CL) were nearly equally distributed in all habitats at all depths sampled, and were more

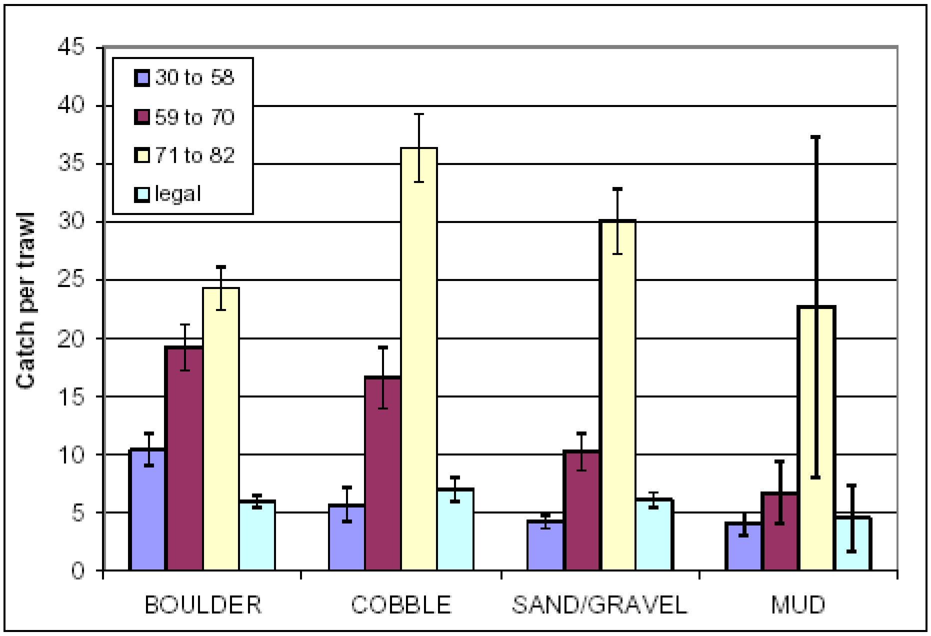


Figure 13. Catch-per-trawl during the ventless trap study of four size classes of lobster by sediment type: juveniles (30-58 mm CL), adolescents (59-70 mm CL), sub-legals (71-82 mm CL), and legal (>83 mm CL). Bars represent ± one standard error.

Source: Glenn *et al.*, 2005.

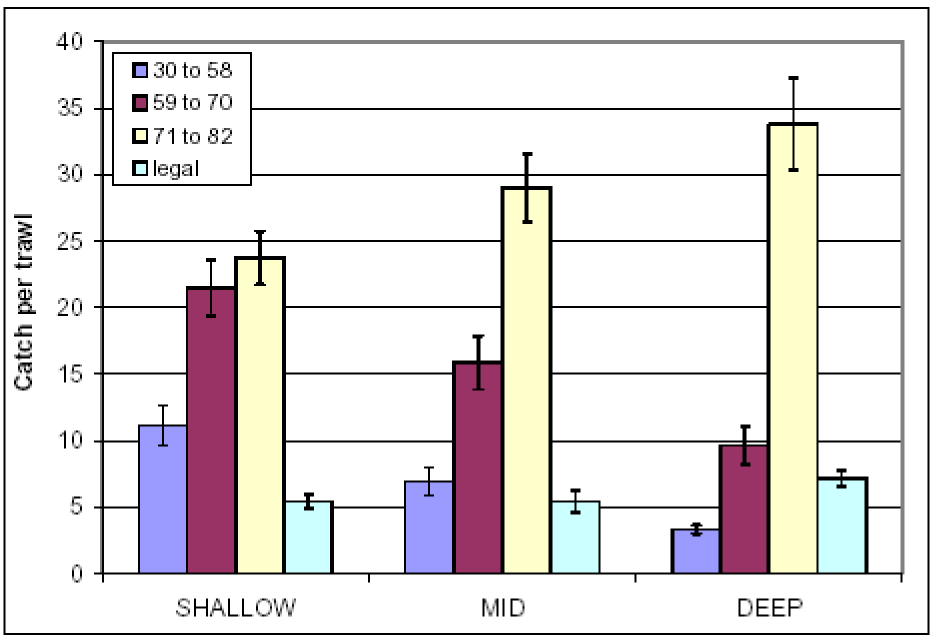


Figure 14. Catch-per-trawl during the ventless trap study of four size classes of lobster by depth: juveniles (30-58 mm CL), adolescents (59-70 mm CL), sub-legals (71-82 mm CL), and legal (>83 mm CL); Shallow, 0-15 m; Mid, 16-30 m; Deep, >30 m. Bars represent ± one standard error.

Source: Glenn *et al.*, 2005.

abundant than legal-sized adult lobsters (> 83 mm CL), indicative of the highly exploited nature of this resource (Glenn *et al.*, 2005). Both of these larger size classes of lobsters have fewer inshore predators than do the smaller size class lobsters and, thus, fewer restrictions in habitat usage.

The results of the ventless trap program can be used to generally describe the expected distribution of lobster within the five potential enhancement sites based on the substrate present and depth of these sites. Based on the substrate classifications identified by the ventless trap study, juvenile and adolescent lobsters are expected to be more abundant at the Magnolia, Nahant Bay, and Broad Sound sites, which were characterized as containing predominantly boulder, cobble, and sand/gravel substrate (Figure 6). Conversely, the Massachusetts Bay and Nantasket Roads sites, which contain mostly sand/gravel and mud, would be expected to contain less juvenile and adolescent lobsters relative to the other three sites. However, based on water depth, Nantasket Roads, which falls into the “Shallow” category (Figure 14), is more likely to have greater numbers of juvenile and adolescent lobsters and less sublegal-sized adults than the other five sites. In addition, the Massachusetts Bay site, which falls into the “Deep” category, is expected to have fewer juvenile and adolescent lobsters and more sublegal-sized adults.

3.3 Site Use

The ranking criteria state that site(s) selected for placement of rock/cobble cannot interfere with other human uses, such as fishing or navigation. Because potential sites were selected by lobstermen as areas that are not readily used by them or by fishermen, it is assumed that these sites do not contain significant areas of commercial fishing or lobstering. However, fixed fishing gear (e.g., lobster traps) was widespread within the Nantasket Roads and Massachusetts Bays sites (Corps, 2004a). The HubLine natural gas pipeline, operated by Algonquin Gas Transmission Company, runs through most of the Nantasket Roads site (Figure 15). A majority of the pipeline that occurs within the site is buried to a depth of greater than 10 feet. However, a portion of the pipeline was laid on the surface and armored with concrete mat at the southwest end where it exits the site (TRC Environmental, personal communication, 2005). No shipwrecks were located in any of the potential sites (Figure 15) (NOAA, 2003).

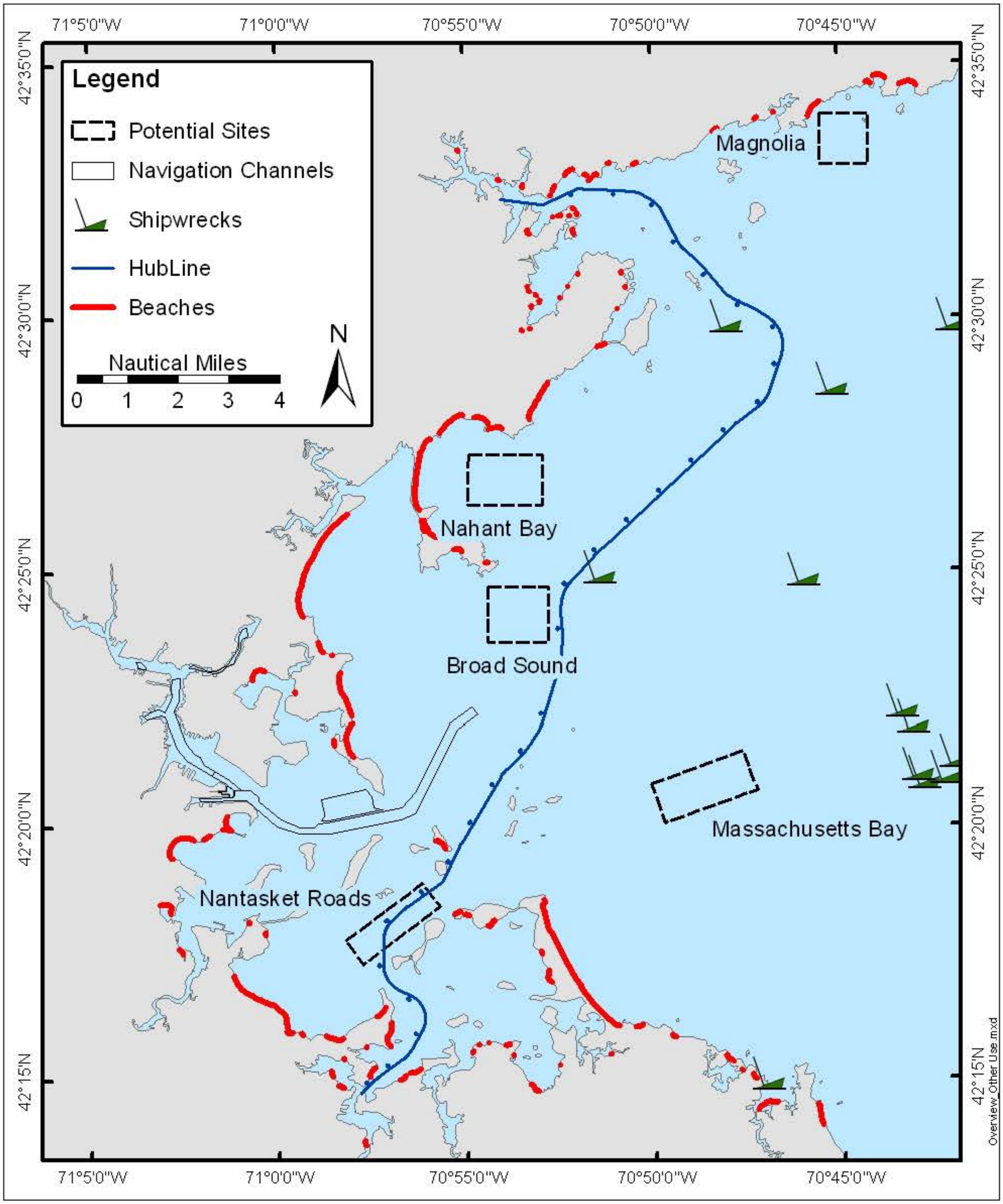


Figure 15. Other Human Uses.

4.0 RANKING

This section integrates information presented in Section 3.0 with the five ranking criteria described in Section 2.4 to allow a comparison among the five potential enhancement sites. Table 5 summarizes the key information for each site. The site comparisons and ranking are described in detail below.

Table 5. Ranking Criteria Summary Table.

Ranking Criteria	**Nantasket Roads** Depth: 0 - 50 ft	**Massachusetts Bay** Depth: 75 - 110 ft	**Broad Sound** Depth: 45 - 90 ft	**Nahant Bay** Depth: 30 - 75 ft	**Magnolia** Depth: 0 - 95 ft
Benthic Habitat Quality	Mainly Stage II & III species present, higher OSI, lower expected no. of species/sample	Mainly Stage II & III species present, higher OSI and expected no. of species/sample	Mix of successional stages, lower OSI, higher expected no. of species/sample	Mainly Stage I & II species present, intermediate OSI, intermediate expected no. of species/sample	Mainly Stage I species present, lower OSI, higher no. of expected species/sample
Fish	EFH for long-finned and short-finned squid, skates, and 20 finfish species Juvenile flounder and sculpin observed	EFH for long-finned and short-finned squid, skates, and 22 finfish species Red hake observed on soft bottom. Cunner, flounder, sculpin, and ocean pout observed on gravel/cobble bottom and sand waves.	EFH for long-finned and short-finned squid, skates, and 20 finfish species Flounder, red hake, and sculpin observed	EFH for long-finned and short-finned squid, skates, and 20 finfish species Red hake, juvenile sculpin, ocean pout, and flounder observed 1053 individuals from 10 taxa collected in one EMAP trawl	EFH for long-finned and short-finned squid, skates, and 21 finfish species Juvenile and adult flounder and skates observed
Shellfish	EFH for sea scallop and surf clam Potential sea scallop habitat Sea scallops observed, plentiful on the coarse sand and gravel bottom	EFH for sea scallop and surf clam Rock crabs dominant in the mud/sand bottom	EFH for sea scallop and surf clam Rock crabs dominant at muddy/sand and gravel/cobble bottom. Many sea scallops at gravel bottom. Hermit crabs observed.	EFH for sea scallop and surf clam Potential habitats for blue mussel, sea scallop, ocean quahog Rock crabs and small hermit crabs dominant invertebrates	EFH for sea scallop and surf clam Potential habitats for blue mussel, sea scallop Numerous rock crabs observed in burrows in the coarse sand.

Table 5 (cont.). Ranking Criteria Summary Table.

Ranking Criteria	**Nantasket Roads**	**Massachusetts Bay**	**Broad Sound**	**Nahant Bay**	**Magnolia**
Lobster	Less juvenile and adolescent lobsters based on substrate present. More juveniles and adolescents and less sublegals adults based on water depth.	Less juvenile and adolescent lobsters based on substrate present and water depth. More sublegal adults based on water depth.	More juvenile and adolescent lobsters based on substrate present. Intermediate numbers of juveniles, adolescents, and sublegals based on water depth.	More juvenile and adolescent lobsters based on substrate present. Intermediate numbers of juveniles, adolescents, and sublegals based on water depth.	More juvenile and adolescent lobsters based on substrate present. Intermediate numbers of juveniles, adolescents, and sublegals based on water depth.
Bottom Type Quality	Predominantly coarse sand and gravel, with 26% soft bottom	Predominantly sand, with 50% soft bottom	Predominantly muddy sand, with 57% soft bottom	Predominantly sand, with 70% soft bottom	Predominantly sand, with 65% soft bottom
Capacity of Soft Bottom (cy) - 500,000 to 1.4 M cy of rock/cobble will be generated	1.2 M cy	3.3 M cy	3.1 M cy	4.2 M cy	2.6 M cy
Other Human Uses	fixed fishing gear (e.g., lobster traps) was widespread HubLine passes through site	fixed fishing gear (e.g., lobster traps) was widespread	None	None	None
Navigable Distance from Navigation Channel (mi)	6.6	10.8	7.6	10.8	21.6

4.1 Biological Productivity

The first criterion to consider in the site ranking is the biological productivity of each site. Sites with lower productivity, as determined by benthic habitat community or the OSI, were given higher priority for hard-bottom enhancement. Since changes in the bottom substrate through the placement of rock/cobble material would likely impact organisms other than benthic infauna, data describing the fish, shellfish, and lobster populations within the sites were used to supplement the benthic infauna data in determining the suitability of each of the sites for hard-bottom enhancement. Sites where placement of rock/cobble would not be likely to negatively impact these other organisms were given higher priority for hard-bottom enhancement.

4.1.1 Benthos

The infaunal communities found among the five sites sampled in September 2004 were very well developed and were comprised primarily of species typically found in Massachusetts Bay or Boston Harbor infaunal communities. None of the communities appeared to be severely stressed and showed little influence of anthropogenic impacts. The infaunal communities found among the five potential sites were distinguished primarily by the differences in geographic location and physical parameters, primarily sediment texture, of the stations. The fauna at the Nantasket Roads stations within Boston Harbor clearly separated from the open-water stations and was characterized by estuarine taxa. Most of the open-water stations were relatively similar faunistically, with differences among them primarily related to sediment grain-size regime. Two shoreward sandy stations (MA1, NB3) were very different from all other stations.

Biogenic activity was higher at stations within Nantasket Roads, Massachusetts Bay, and Broad Sound sites, and lower at stations within the Nahant Bay and Magnolia sites (Corps, 2004b). The distribution of OSI between sites was related primarily to the distribution of sediment types and level of bioturbation, with higher OSI values (8 and greater) typically being associated with intermediate Stage II or equilibrium Stage III fauna and biologically dominated stations.

The three levels of quantitative values for each of the benthic community ranking criteria (successional stage, OSI, and rarefaction data) are presented in Table 6, along with the number of stations within each site that fell into each of the criteria classes. Most of the stations (four of seven) at the Massachusetts Bay and Nantasket Roads sites had intermediate Stage II assemblages at or near the sediment surface, and all seven stations had equilibrium Stage III fauna at depth in the sediments. The Magnolia and Nahant Bay stations, however, had pioneering Stage I species present at all the SPI stations, with Stage II species present at depth in the sediments at some of the stations. The Massachusetts Bay site had the most stations (6) in the upper OSI class (7.6–10), followed by Nantasket Roads, which had four stations in the upper class. Most of the Magnolia stations (5) were in the lowest OSI class (3.5–5.5). The rarefaction analysis indicates that Broad Sound and Magnolia generally had more expected number of species per sample than the other three sites. Two of the three Nantasket Roads stations fell in the lower expected species class. Considering these data, the most suitable sites (i.e., those with the lowest benthic productivity) are the physically dominated Magnolia and Nahant Bay sites, followed by Broad Sound, Nantasket Roads, and Massachusetts Bay.

4.1.2 Fish

The Massachusetts Bay site contains EFH for the most number of fish species (22), followed by the Magnolia site (21). The other three sites (Nantasket Roads, Broad Sound, and Nahant Bay) each contain EFH for 20 fish species. Of the five sites, the Massachusetts Bay site contained the largest area (0.5 mi^2) of fine sediment substrate (i.e. mud), which is important habitat for spawning adults of several species, such as American plaice, Atlantic halibut, various flounder species, and red hake. The only other area of mud within the five sites was a small patch (0.05 mi^2) in the Nantasket Roads site. Based on the relative importance of the existing substrate within the five potential sites to fish productivity, the most suitable sites for hard-bottom enhancement are Nantasket Roads, Broad Sound, and Nahant Bay. The least suitable site is Massachusetts Bay.

Table 6. Benthic Community Ranking Criteria.

Benthic Ranking Criteria	Classes	Nantasket Roads	Massachusetts Bay	Broad Sound	Nahant Bay	Magnolia
		Number of Stations				
Successional Stage[1]	I			1		5
	I – II			3	6	2
	I - III	3	3	1	1	
	II – III	4	4	2		
OSI	3.5 - 5.5	1		2	2	5
	5.6 - 7.5	2	1	5	4	2
	7.6 - 10	4	6		1	
Rarefaction Analysis[2]	<15	2				
	15 – 29	1	2	1	3	1
	30 – 35		1	2		2

[1] Stage I-III refers to the presence of pioneering Stage I species present on or near the sediment surface and equilibrium Stage III species present below the sediment surface. Stage II-III is the presence of intermediate successional stage species at the surface with equilibrium species at depth in the sediments.

[2] The rarefaction analysis is the expected number of species in a sample size of 410 organisms, the largest common abundance for all samples collected.

4.1.3 Shellfish

Potential shellfish habitat identified by MADMF is located within the boundaries of the Nantasket Roads, Nahant Bay, and Magnolia sites, with most of the Nahant Bay covered by potential shellfish habitat. Sea scallops were also present on the coarse sand/gravel bottom in the Nantasket Roads and Broad Sound sites. The placement of rock/cobble should avoid areas that contain shellfish beds, since they would be destroyed by this activity. Therefore, the site with lower shellfish productivity, and thus those that are more suitable for hard-bottom enhancement, is the Massachusetts Bay site, followed by Broad Sound. The Nantasket Roads, Nahant Bay, and Magnolia sites are least suitable based on the potential and observed presence of shellfish habitat in these sites.

4.1.4 Lobster

Nantasket Roads is expected to contain more juvenile and adolescent lobsters than the other four sites based on water depth within the site. However, the identified substrate within the site (i.e., sand/gravel and mud, with small isolated areas of hard bottom) does not provide as much shelter (i.e., protection against predators) as rock or cobble substrate. In addition, sublegal-sized adults, which are less abundant in shallow waters, are most abundant on cobble substrate. Therefore, it is anticipated that the lobster population within the Nantasket Roads site would benefit the most from hard-bottom enhancement. The Magnolia, Nahant Bay, and Broad Sound sites contain predominantly boulder, cobble, and sand/gravel substrates (based on the ventless trap bottom type characterization) and are generally deeper than the Nantasket Roads site. The lobster populations within these sites may not benefit as much from the placement of rock/cobble as would the lobsters within the Nantasket Roads site. The deepest site, Massachusetts Bay, is likely to contain fewer juveniles and adolescents and more sublegal- and legal-sized adults, which are less restricted by habitat usage. This lobster population within this site would be expected to have the least positive impact from hard-bottom enhancement. Therefore, Nantasket Roads was ranked as the most suitable for enhancement using the lobster productivity criteria, and Massachusetts Bay as the least suitable.

4.2 Bottom Type

The second criterion to consider is the existing bottom type for each site. Rock and/or cobble will be placed on soft substrate and not on existing rock bottom. Sites with abundant existing rock bottom habitat are given lower priority. Sites may contain some rock bottom if 1) it does not significantly reduce the volume of area available for disposal of rock and/or cobble or 2) the location of the existing rock bottom does not preclude the site from further consideration (i.e. rock bottom is located in the middle of the site).

The predominant bottom type at the five sites ranges from coarse sand and gravel (Nantasket Roads), to sand (Massachusetts Bay, Nahant Bay, Magnolia) to muddy sand (Broad Sound). The Massachusetts Bay, Nahant Bay, and Magnolia sites all have areas of soft bottom (i.e., mud or sand) in the center of each site. The Broad Sound site has two large areas of muddy sand at the northern and southern sides of the site, with a broad swath of hard bottom (including coarse gravel and small cobbles) running through the center from east to west. In the Nantasket Roads site, soft bottom (i.e., sand) is located in a narrow swath along the northern edge of the site. Therefore, based on bottom type within the site and the location of the soft bottom, Massachusetts Bay, Nahant Bay, and Magnolia are the most suitable sites, followed by the Broad Sound site. Nantasket Roads is the least suitable site because of the small area and location of soft bottom present.

4.3 Capacity

An extension of the second criterion above is the capacity of each site to accommodate the dredged rock/cobble from the navigation channel. Site capacity (cy) was calculated as the area of soft bottom (yd^2) multiplied by a maximum rock/cobble height (i.e., 1 yd) (C. Rogers, personal communication, 2005). Water depth within the sites was also considered when evaluating site capacity. Priority was given to sites that can accept all of the rock/cobble, with the possibility of using more than one site if no site had adequate capacity.

The blasting or dredging within the Boston Harbor navigation channels, which is necessary to increase the channel depths from -40 ft up to -50 ft MLLW, is expected to generate between 500,000 and 1.4 M cy of rock and cobble. All of the potential sites have enough soft bottom area to accommodate the minimum estimated amount of rock/cobble. The Nahant Bay site has the largest capacity (4.2 M cy) based on the area of soft bottom within the site. Massachusetts Bay, Broad Sound, and Magnolia have similar site capacities (3.3 – 2.6 M cy), and Nantasket Roads has the least capacity (1.2 M cy), which is slightly less than the maximum anticipated volume of rock/cobble material (1.4 M cy). In addition, rocky outcroppings and water depths of less than 16 ft occur within portions of the Nantasket Roads and Magnolia sites. Therefore, some soft bottom areas within these sites may not be deep enough to allow the placement of rock/cobble without interfering with navigation and other human activities within the site. Based on site capacity and depth, the Nahant Bay site is the most suitable, and the Nantasket Roads site is the least suitable.

4.4 Other Uses

The fourth ranking criterion states that site(s) selected for placement of rock/cobble cannot interfere with other uses, such as fishing or navigation. The presence of widespread lobster traps within the Nantasket Bay and Massachusetts Bay sites indicate that these are areas of lobstering. Also, the HubLine natural gas pipeline runs through most of the length of the Nantasket Roads site and placement of rock/cobble over the buried or armored portions of the pipeline within the site may interfere with the maintenance and repair activities. Therefore, based on other human uses, the Magnolia, Nahant Bay, and Broad Sound sites are the most suitable, and the Massachusetts Bay, and Nantasket Roads sites are the least suitable.

4.5 Distance to Navigation Channel

If no significant differences were found among sites based on the above criteria, then the site(s) closest to the navigation channel was given higher priority. The navigable distance from the blasting and dredging location to each of the potential sites was calculated by using the hypothetical routes presented in Figure 16. Nantasket Roads is the site with the shortest navigable distance (6.6 mi) from the blasting site, followed by the Broad Sound site (7.6 mi), the Nahant Bay and Massachusetts Bay sites (10.8 mi), and the Magnolia site (21.6 mi).

4.6 Final Ranking Results

The ranking of the potential sites by criterion, in order of most suitable to least suitable, are summarized in Table 7. If no major differences were determined between sites, then the sites are listed within the same ranking class in the table. For example, for the benthic habitat criterion, the Magnolia and Nahant Bay sites were both determined to be most suitable, and the Massachusetts Bay site was least suitable.

The Broad Sound site was ranked within Class 1 or 2 most often (8 times), followed by the Nahant Bay and Magnolia sites (6 times), and the Nantasket Roads and Massachusetts Bay sites (4 times) (Table 7). The Nahant Bay site was ranked as the most suitable site for five of the screening criteria, but because most of the site is covered by potential shellfish habitat, it is not recommended as a suitable site for hard bottom enhancement. Though the Magnolia site also contains potential scallop habitat, the habitat is confined to a small area along the eastern boundary of the site and could be avoided during rock/cobble placement. The Nantasket Roads site is the least suitable, since it contains primarily coarse sand and gravel and does not have enough capacity to receive all of the dredged rock/cobble. The presence of the HubLine within this site also precludes it from being a suitable enhancement site.

Based on the initial site ranking performed in this report, the list of potential enhancement sites in the order of most suitable to least suitable is:

- Broad Sound
- Magnolia
- Nahant Bay
- Massachusetts Bay
- Nantasket Roads

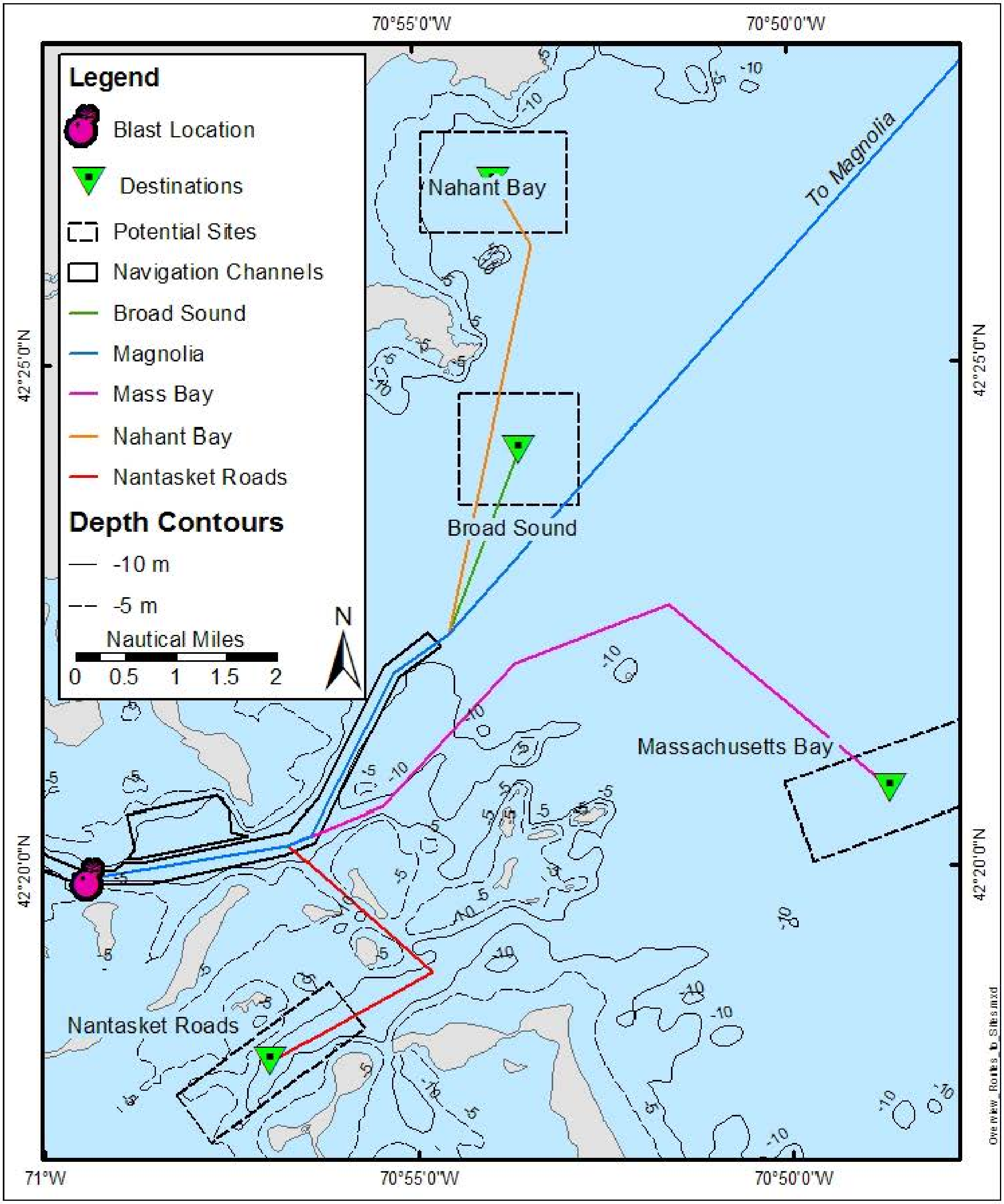


Figure 16. Hypothetical Routes Used to Calculate Navigable Distance to Potential Sites.

Table 7. Final Site Ranking by Criteria.

Ranking	Ranking Class	Benthic Habitat Quality	Fish	Shellfish	Lobster	Bottom Type Quality	Capacity of Soft Bottom	Other Human Uses	Navigable Distance
Most suitable	**1**	MA, NB	NR, BS, NB	MB	NR	MB, NB, MA	NB	BS, NB, MA	NR
	2	BS	MA	BS	MA, NB, BS	BS	MB, BS, MA	MB, NR	BS
	3	NR	MB	NR, MA, NB	MB	NR	NR		NB, MB
Least suitable	**4**	MB							MA

NR = Nantasket Roads; BS = Broad Sound, NB = Nahant Bay, MB = Massachusetts Bay, MA = Magnolia

S-38

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BOSTON HARBOR
MASSACHUSETTS

DEEP DRAFT
NAVIGATION IMPROVEMENT STUDY

FINAL FEASIBILITY REPORT
AND FINAL SUPPLEMENTAL
ENVIRONMENTAL IMPACT STATEMENT
AND MASSACHUSETTS
FINAL ENVIRONMENTAL IMPACT REPORT

APPENDIX T

ESSENTIAL FISH HABITAT EVALUATION

(THIS APPENDIX UNCHANGED FROM JULY 2008 DRAFT)

BOSTON HARBOR ESSENTIAL FISH HABITAT

The 1996 amendments to the Magnuson-Stevens Fishery Conservation Management Act strengthen the ability of the National Marine Fisheries Service and the New England Fishery Management Council to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. This habitat is termed "essential fish habitat", and is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Managed species listed for the 10' x 10' square of latitude and longitude which includes Boston Harbor are: Atlantic cod, haddock, pollock, whiting, red hake, white hake, winter flounder, yellowtail flounder, windowpane flounder, American plaice, ocean pout, Atlantic halibut, Atlantic sea scallop, Atlantic sea herring, long finned squid, short finned squid, Atlantic butterfish, Atlantic mackerel, summer flounder, scup, black sea bass, surf clam, and bluefin tuna. The same species are listed for the 10’ x 10’ square of latitude and longitude which includes the Massachusetts Bay Disposal Site (MBDS), except for: pollock, summer flounder, scup, black sea bass, and surf clam. Species listed in the MBDS square that are not listed for Boston Harbor include redfish, witch flounder, and monkfish.

The following lists the managed species and their appropriate life stage history for the designated 10' x 10' square for Boston Harbor and the MBDS.

<u>Atlantic cod (*Gadus morhua*)</u>

Eggs: Surface waters around the perimeter of the Gulf of Maine, George's Bank, and the eastern portion of the Continental Shelf off southern New England. Generally, the following conditions exist where cod eggs are found: sea surface temperatures below 12^0 C, water depths less than 110 meters, and a salinity range from 32-33‰. Cod eggs are most often observed beginning in the fall, with peaks in the winter and spring.

Larvae: Pelagic waters of the Gulf of Maine, Georges Bank, and the eastern portion of the Continental Shelf off of southern New England. Generally, the following conditions exist where cod larvae found: sea surface temperatures below 10^0 C, water depths from 30 to 70 meters, and a salinity range from 32-33‰. Cod larvae are most often observed in the spring.

Juveniles: Bottom habitats with a substrate of cobble or gravel in the Gulf of Maine, Georges Bank, and the eastern portion of the Continental Shelf off southern New England. Generally, the following conditions exist where cod juveniles found: water temperatures below 20^0 C, water depths from 25 to 75 meters, and a salinity range from 30-35‰.

Adults: Bottom habitats with a substrate of rocks, pebbles, or gravel in the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Delaware Bay. Generally, the following conditions exist where cod adults are found:

water temperatures below 10^0 C, water depths from 10 to 150 meters, and a wide range of oceanic salinities.

Spawning Adults: Bottom habitats with a substrate of smooth sand, rocks, pebbles, or gravel in the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Delaware Bay. Generally, the following conditions exist where spawning cod adults are found: water temperatures below 10^0 C, water depths from 10 to 150 meters, and a wide range of oceanic salinities. Cod are most often observed spawning during fall, winter, and early spring.

<u>Haddock (*Melanogrammus aeglefinus*)</u>

Eggs: Surface waters over Georges Bank southwest to Nantucket Shoals and the coastal areas of the Gulf of Maine. Generally, the following conditions exist where haddock eggs are found: sea surface temperatures below 10^0 C, water depths from 50 to 90 meters, and salinity ranges from 34 – 36‰. Haddock eggs are most often observed during the months from March to May, April being most important.

Larvae: (Just Boston Harbor) Surface waters over Georges Bank southwest to the middle Atlantic south to Delaware Bay. Generally, the following conditions exist where haddock larvae are found: sea surface temperatures below 14^0 C, water depths from 30 to 90 meters, and salinity ranges from 34 – 36‰. Haddock larvae are most often observed during the months from January through July with peaks in April and May.

<u>Pollock (*Pollachius virens*)</u>

Eggs: Pelagic waters of the Gulf of Maine and Georges Bank. Generally, the following conditions exist where pollock eggs are found: sea surface temperatures below 17^0 C, water depths from 30 to 270 meters, and salinity ranges from 32 – 32.8‰. Pollock eggs are most often observed from October through June with peaks from November to February.

Larvae: Pelagic waters of the Gulf of Maine and Georges Bank. Generally, the following conditions exist where pollock larvae are found: sea surface temperatures below 17^0 C, water depths from 10 to 250 meters. Pollock larvae are often observed from September to July with peaks from December to February.

Juveniles: Bottom habitats with aquatic vegetation or a substrate of sand, mud or rocks in the Gulf of Maine and Georges Bank. Generally, the following conditions exist where pollock juveniles are found: water temperatures below 18^0 C, water depths from 0 to 250 meters, and salinities between 29-32‰.

Adults: Bottom habitats in the Gulf of Maine and Georges Bank and hard bottom habitats (including artificial reefs) off southern New England and the middle Atlantic south to New Jersey. Generally, the following conditions exist where pollock adults are found: water temperatures below 14^0 C, water depths from 15 to 365 meters, and salinities between 31-34‰.

Spawning Adults: Bottom habitats with a substrate of hard, stony or rocky bottom in the Gulf of Maine and hard bottom habitats (including artificial reefs) off southern New England and the middle Atlantic south to New Jersey. Generally, the following conditions exist where pollock adults are found: water temperatures below 8^0 C, water depths from 15 to 365 meters, and salinities between 32-32.8‰. Pollock are most often observed spawning during the months September to April with peaks from December to February.

Whiting (*Merluccius bilinearis*)

Eggs: Surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally the following conditions exist where most whiting eggs are found: sea surface temperatures below 20^0 C, water depths between 50 to 150 meters. Whiting eggs are observed all year, with peaks from June through October.

Larvae: Surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally the following conditions exist where most whiting larvae are found: sea surface temperatures below 20^0 C, water depths between 50 to 130 meters. Whiting larvae are observed all year, with peaks from July through September.

Juveniles: Bottom habitats of all substrate types in the Gulf of Maine, on Georges Bank, the Continental Shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where most whiting juveniles are found: water temperatures below 21^0 C, water depths from 20 to 270 meters, and salinities greater than 20‰.

Adults: Bottom habitats of all substrate types in the Gulf of Maine, on Georges Bank, the Continental Shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where most whiting juveniles are found: water temperatures below 21^0 C, water depths from 20 to 270 meters, and salinities greater than 20‰.

Spawning Adults: Bottom habitats of all substrate types in the Gulf of Maine, on Georges Bank, the Continental Shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where most spawning whiting adults are found: water temperatures below 13^0 C and water depths from 30 to 325 meters.

Red hake (*Urophycis chuss*)

Eggs: Surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally the following conditions exist where hake eggs are found: sea surface temperatures below 10^0 C along the inner continental shelf with salinity less than 25‰. Hake eggs are most often observed during the months from May to November, with peaks in June and July.

Larvae: Surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally the following conditions exist where red hake larvae are found: sea surface temperatures below 19^0 C, water depths less than 200 meters and salinity greater than 0.5‰. Red hake larvae are most often observed from May through December, with peaks September to October.

Juveniles: Bottom habitats with a substrate of shell fragments, including areas with an abundance of live scallops, in the Gulf of Maine, on Georges Bank, the Continental Shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where red hake juveniles are found: water temperatures below 16^o C, depths less than 100 meters and a salinity range from 31 - 33‰.

Adults: Bottom habitats in depressions with a substrate of sand and mud in the Gulf of Maine, on Georges Bank, the Continental Shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where red hake adults are found: water temperatures below 12^o C, depths from 10 to 130 meters, and a salinity range from 33 - 34‰.

Spawning Adults: Bottom habitats in depressions with a substrate of sand and mud in the Gulf of Maine, the southern edge of Georges Bank, the Continental Shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where spawning red hake adults are found: water temperatures below 10^o C, depths less than 100 meters, and salinity less than 25‰. Red hake are most often observed spawning during the months from May – November, with peaks in June and July.

White hake (*Urophycis tenuis*)

Eggs: Surface waters of the Gulf of Maine, Georges Bank, and southern New England. White hake eggs are most often observed in August and September.

Larvae: Pelagic waters of the Gulf of Maine, the southern edge of Georges Bank, and southern New England to the middle Atlantic. White hake larvae are most often observed in May in the mid-Atlantic area and August and September in the Gulf of Maine and Georges Bank.

Juveniles: *Pelagic stage* **–** Pelagic waters of the Gulf of Maine, the southern edge of Georges Bank, and southern New England to the middle Atlantic. White hake juveniles in the pelagic stage are most often observed from May through September. *Demersal stage* **–** Bottom habitats with seagrass beds or a substrate of mud or fine-grained sand in the Gulf of Maine, the southern edge of Georges Bank, and southern New England to the middle Atlantic. Generally, the following conditions exist where white hake juveniles are found: water temperatures below 19 ^{o} C and depths from 5 - 225 meter.

Adults: Bottom habitats with a substrate of mud or fine-grained sand in the Gulf of Maine, the southern edge of Georges Bank, and southern New England to the middle Atlantic. Generally, the following conditions exist where white hake adults are found: water temperatures below 14 ^{o} C and depths from 5 - 325 meter.

Spawning Adults: Bottom habitats with a substrate of mud or fine-grained sand in deep water in the Gulf of Maine, the southern edge of Georges Bank, and southern New England to the middle Atlantic. Generally, the following conditions exist where white hake adults are found: water temperatures below 14 ^{o}C and depths from 5 - 325 meter. White hake are most often observed spawning during the months April – May in the southern portion of their range and August – September in the northern portion of their range.

Redfish (*Sebastes fasciatus*)

Larvae: Pelagic waters in the Gulf of Maine and southern Georges Bank. Generally, the following conditions exist where redfish larvae are found: sea surface temperatures below 15 ^{o}C and water depths between 50 and 270 meters. Redfish larvae are most often observed from March through October, with a peak in August.

Juveniles: Bottom habitats with a substrate of silt, mud or hard bottom in the Gulf of Maine and on the southern edge of Georges Bank. Generally, the following conditions exist where redfish juveniles are found: water temperatures below 13^{o}C, depths from 25 – 400 meters, and a salinity range from 31 - 34‰.

Adults: Bottom habitats with a substrate of silt, mud or hard bottom in the Gulf of Maine and on the southern edge of Georges Bank. Generally, the following conditions exist where redfish adults are found: water temperatures below 13^{o}C, depths from 50 – 350 meters, and a salinity range from 31 - 34‰.

Spawning Adults: Bottom habitats with a substrate of silt, mud or hard bottom in the Gulf of Maine and on the southern edge of Georges Bank. Generally, the following conditions exist where redfish adults are found: water temperatures below 13^{o}C, depths from 50 – 350 meters, and a salinity range from 31 - 34‰. Redfish females are most often observed spawning (larvae) during the months from April through August.

<u>Witch flounder (*Glyptocephalus cynoglossus*)</u>

Eggs: Surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where witch flounder eggs are found: sea surface temperatures below 13 ^{o}C over deep water with high salinities. Witch flounder eggs are most often observed during the months from March through October.

Larvae: Surface waters to 250 meters in the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where witch flounder larvae are found: sea surface temperatures below 13 ^{o}C over deep water with high salinities. Witch flounder larvae are most often observed from March through November, with peaks in May to July.

Juveniles: Bottom habitats with a fine-grained substrate in the Gulf of Maine and along the outer continental shelf from Georges Bank south to Cape Hatteras. Generally, the following conditions exist where witch flounder juveniles are found: water temperatures below 13 ^{o}C, depths from 50 – 450 meters, although they have been observed as deep as 1500 meters, and a salinity range from 34 - 36‰.

Adults: Bottom habitats with a fine-grained substrate in the Gulf of Maine and along the outer continental shelf from Georges Bank south to Chesapeake Bay. Generally, the following conditions exist where witch flounder adults are found: water temperatures below 13 ^{o}C, depths from 25 – 300 meters, and a salinity range from 32 - 36‰.

Spawning Adults: Bottom habitats with a fine-grained substrate in the Gulf of Maine and along the outer continental shelf from Georges Bank south to Chesapeake Bay. Generally, the following conditions exist where spawning witch flounder adults are found: water temperatures below 15 ^{o}C, depths from 25 – 360 meters, and a salinity range from 32 - 36‰. Witch flounder are most often observed spawning during the months from March through November, with peaks in May to August.

<u>Winter flounder (*Pseudopleuronectes americanus*)</u>

Eggs: Bottom habitats with a substrate of sand, muddy sand, mud, and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where winter flounder eggs are found: water temperatures below 10 ^{o}C, salinities between 10 - 30‰ and water depths less than 5 meters. On Georges Bank, winter flounder eggs are generally found in water less than 8 ^{o} C, and less than 90 meters deep. Winter flounder eggs are often observed from February to June with a peak in April on Georges Bank.

Larvae: Pelagic and bottom waters of Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay.

Generally, the following conditions exist where winter flounder larvae are found: sea surface temperatures less than 15^0 C, salinities between 4 - 30‰, and water depths less than six meters. On Georges Bank, winter flounder larvae are generally found in water less than 8^o C, and less than 90 meters deep. Winter flounder larvae are often observed from March to July with peaks in April and May on Georges Bank.

Juveniles: *Young-of-the-Year*: Bottom habitats with a substrate of mud or fine-grained sand on Georges Bank, the inshore areas of the Gulf of Maine, southern New England and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where winter flounder young-of-the-year are found: water temperatures below 28^o C, and depths from 0.1 – 10 meters, and salinities between 5 - 33‰. *Age 1 + Juveniles*: Bottom habitats with a substrate of mud or fine-grained sand on Georges Bank, the inshore areas of the Gulf of Maine, southern New England and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where juvenile winter flounder are found: water temperatures below 25^o C, and depths from 1 – 50 meters, and salinities between 10 - 30‰.

Adults: Bottom habitats including estuaries with a substrate of mud, sand and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where adult winter flounder are found: water temperatures below 25^o C, and depths from 1 – 100 meters, and salinities between 15 - 33‰.

Spawning Adults: Bottom habitats including estuaries with a substrate of sand, muddy sand, mud, and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where spawning adult winter flounder are found: water temperatures below 15^o C, depths less than 6 meters, except on Georges Bank where they spawn as deep as 80 meters, and salinities 5.5 - 36‰. Winter flounder are most often observed spawning during the months of February to June.

<u>**Yellowtail flounder (*Pleuronectes ferruginea*)**</u>

Eggs: Surface waters of Georges Bank, Massachusetts Bay, Cape Cod Bay, and the southern New England continental shelf south to Delaware Bay. Generally, the following conditions exist where yellowtail eggs are found: sea surface temperatures below 15^0 C, water depths from 30-90 meters and a salinity range from 32.4-33.5‰. Yellowtail flounder eggs are most often observed during the months from mid-March to July, with peaks in April to June in southern New England.

Larvae: Surface waters of Georges Bank, Massachusetts Bay, Cape Cod Bay, the southern New England shelf and throughout the middle Atlantic south to the Chesapeake Bay. Generally, the following conditions exist where yellowtail larvae are found: sea surface temperatures below 17^0C, water depths from 10 – 90 meters, and a salinity range from 32.4 – 33.5‰. Yellowtail flounder larvae are most often observed from March through April in the New York bight and from May through July in southern New England and southeastern Georges Bank.

Juveniles: Bottom habitats with a substrate of sand or sand and mud on Georges Bank, the Gulf of Maine, and the southern New England shelf south to Delaware Bay. Generally, the following conditions exist where yellowtail flounder juveniles are found: water temperatures below 15^0 C, depths from 20 to 50 meters and a salinity range from 32.4 – 33.5‰.

Adults: Bottom habitats with a substrate of sand or sand and mud on Georges Bank, the Gulf of Maine, and the southern New England shelf south to Delaware Bay. Generally, the following conditions exist where yellowtail flounder adults are found: water temperatures below 15^0 C, depths from 20 to 50 meters and a salinity range from 32.4 – 33.5‰.

Spawning Adults: Bottom habitats with a substrate of sand or sand and mud on Georges Bank, the Gulf of Maine, and the southern New England shelf south to Delaware Bay. Generally, the following conditions exist where spawning yellowtail flounder adults are found: water temperatures below 17^0 C, depths from 10 to 125 meters and a salinity range from 32.4 – 33.5‰.

Windowpane flounder (*Scopthalmus aquosus*)

Eggs: Surface waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where windowpane flounder eggs are found: sea surface temperatures less than 20^0 C, water depths less than 70 meters. Windowpane flounder eggs are often observed from February to November with peaks in May and October in the middle Atlantic and July through August on Georges Bank.

Larvae: Pelagic waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where windowpane flounder larvae are found: sea surface temperatures less than 20^0 C, water depths less than 70 meters. Windowpane flounder larvae are often observed from February to November with peaks in May and October in the middle Atlantic and July through August on Georges Bank.

Juveniles: Bottom habitats with a substrate of mud or fine-grained sand around the perimeter of the Gulf of Maine, on Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where windowpane flounder juveniles are found: water temperatures below 25^0 C, water depths from 1 – 100 meters, and a salinity range from 5.5 – 36‰. (Just Boston Harbor)

Adults: Bottom habitats with a substrate of mud or fine-grained sand around the perimeter of the Gulf of Maine, on Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border. Generally, the following conditions exist where windowpane flounder adults are found: water temperatures below 26.8^0 C, water depths from 1 – 75 meters, and salinities between 5.5 – 36‰. (Just Boston Harbor)

Spawning Adults: Bottom habitats with a substrate of mud or fine-grained sand in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border. Generally, the following conditions exist where spawning windowpane flounder adults are found: water temperatures below 21^0 C, water depths from 1 – 75 meters, and salinities between 5.5 – 36‰. Windowpane flounder are most often observed spawning during the months February – December with a peak in May in the middle Atlantic. (Just Boston Harbor)

American plaice (*Hippoglossoides platessoides*)

Eggs: Surface waters of the Gulf of Maine and Georges Bank. Generally, the following conditions exist where most American plaice eggs are found: sea surface temperatures below 12^0 C, water depths between 30 and 90 meters and a wide range of salinities. American plaice eggs are observed all year in the Gulf of Maine, but only from December through June on Georges Bank, with peaks in both areas in April and May.

Larvae: Surface waters of the Gulf of Maine, Georges Bank and southern New England. Generally, the following conditions exist where most American plaice larvae are found: sea surface temperatures below 14^0 C, water depths between 30 and 130 meters and a wide range of salinities. American plaice larvae are observed between January and August, with peaks in April and May.

Juveniles: Bottom habitats with fine-grained sediments or a substrate of sand or gravel in the Gulf of Maine and Georges Bank. Generally, the following conditions exist where most American plaice juveniles are found: water temperatures below 17^0 C, water depths between 45 and 150 meters, and a wide range of salinities.

Adults: Bottom habitats with fine-grained sediments or a substrate of sand or gravel in the Gulf of Maine and Georges Bank. Generally, the following conditions exist where most American plaice adults are found: water temperatures below 17^0 C, water depths between 45 and 175 meters, and a wide range of salinities.

Spawning Adults: Bottom habitats of all substrate types in the Gulf of Maine and Georges Bank. Generally, the following conditions exist where most spawning American plaice adults are found: water temperatures below 14^0 C, water depths less than 90 meters, and a wide range of salinities. Spawning begins in March and continues through June.

Ocean Pout (*Macrozoarces americanus*)

Eggs: Bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay. Due to low fecundity, relatively few eggs (<4,200) are laid in gelatinous masses, generally in hard bottom sheltered nests, holes, or crevices where they are guarded by either female or both parents. Generally, the following conditions exist where ocean pout eggs are found: water temperatures below 10^0 C, depths less than 50 meters, and a salinity range from 32-34‰. Ocean pout egg development takes two to three months during late fall and winter.

Larvae: Bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay. Larvae are relatively advanced in development and are believed to remain in close proximity to hard bottom nesting areas. Generally, the following conditions exist where ocean pout larvae are found: sea surface temperatures below 10^0 C, depths less than 50 meters, and salinities greater than 25‰. Ocean pout larvae are most often observed from late fall through spring.

Juveniles: Bottom habitats, often smooth bottom near rocks or algae in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay. Generally, the following conditions exist where ocean pout juveniles are found: water temperatures below 14^0 C, depths less than 80 meters, and salinities greater than 25‰.

Adults: Bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay. Generally, the following conditions exit where ocean pout adults are found: water temperatures below 15^0 C, depths less than 110 meters, and a salinity range from 32-34‰.

Spawning Adults: Bottom habitats with a hard bottom substrate, including artificial reefs and shipwrecks, in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay. Generally, the following conditions exist where spawning ocean pout adults are found: water temperatures below 10^0 C, depths less than 50 meters, and a salinity range from 32-34‰. Ocean pout spawn from late summer through early winter, with peaks in September and October.

Atlantic halibut (*Hippoglossus hippoglossus*)

Eggs: Pelagic waters to the sea floor of the Gulf of Maine and Georges Bank. Generally, the following conditions exist where Atlantic halibut eggs are found: water temperatures between 4 and 7^0 C, water depths less than 700 meters, and salinities less than 35‰. Atlantic halibut eggs are observed between late fall and early spring, with peaks in November and December.

Larvae: Surface waters of the Gulf of Maine and Georges Bank. Generally, the following conditions exist where Atlantic halibut larvae are found: salinities between 30 and 35‰.

Juveniles: Bottom habitats with a substrate of sand, gravel, or clay in the Gulf of Maine and Georges Bank. Generally, the following conditions exist where Atlantic halibut juveniles are found: water temperatures above 2^0 C, water depths from 20 - 60 meters.

Adults: Bottom habitats with a substrate of sand, gravel, or clay in the Gulf of Maine and Georges Bank. Generally, the following conditions exist where Atlantic halibut adults are found: water temperatures below 13.6^0 C, water depths from 100 - 700 meters, and salinities between 30.4 – 35.3‰.

Spawning Adults: Bottom habitats with a substrate of soft mud, clay, sand, or gravel in the Gulf of Maine and Georges Bank, as well as rough or rocky bottom locations along the slopes of the outer banks. Generally, the following conditions exist where spawning Atlantic halibut adults are found: water temperatures below 7^0 C, water depths less than 700 meters, and salinities less than 35‰. Atlantic halibut are most often observed spawning between late fall and early spring, with peaks in November and December.

Atlantic sea scallop (*Placopecten magellanicus*)

Eggs: Bottom habitats in the Gulf of Maine, Georges Bank, southern New England the middle Atlantic south to the Virginia-North Carolina border. Eggs are heavier than seawater and remain on the seafloor until they develop into the first free-swimming larval stage. Generally, sea scallop eggs are thought to occur where water temperatures are below 17^0 C. Spawning occurs from May through October, with peaks in May and June in the middle Atlantic area and in September and October on Georges Bank and in Gulf of Maine.

Larvae: Pelagic waters and bottom habitats with a substrate of gravelly sand, shell fragments, and pebbles, or on various red algae, hydroids, amphipod tubes and bryozoans in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border. Generally, the following conditions exist where sea scallop larvae are found: sea surface temperatures below 18^0 C and salinities between 16.9‰ and 30‰.

Juveniles: Bottom habitats with a substrate of cobble, shells and silt in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border that support the highest densities of sea scallops. Generally, the following conditions exist where most sea scallop juveniles are found: water temperatures below 15^0 C, and water depths from 18-110 meters and salinities above 16.5‰.

Adults: Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand in the Gulf of Maine, Georges Bank, southern New England and middle Atlantic south to the Virginia-North Carolina border that support the highest densities of sea scallops. Generally, the following conditions exist where most sea scallop adults are found: water temperatures below 21^0 C, water depths from 18-110 meters, and salinities above 16.5‰.

Spawning Adults: Bottom habitats with a substrate of cobble, shells, coarse/gravelly sand, and sand in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border that support the highest densities of sea scallop adults are found: water temperatures below 16^0 C, depths from 18-110 meters, and salinities above 16.5‰. Spawning occurs from May through October, with peaks in May and June in the middle Atlantic area, and in September and October on Georges Bank and in the Gulf of Maine.

Atlantic sea herring (*Clupea harengus*)

Larvae: Pelagic waters in the Gulf of Maine, Georges Bank, and southern New England that comprise 90% of the observed range of Atlantic herring larvae. Generally, the following conditions exist where Atlantic herring larvae are found: sea surface temperatures below 16^0 C, water depths from 50 - 90 meters, and salinities around 32‰. Atlantic herring larvae are observed between August and April, with peaks from September through November.

Juveniles: Pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where Atlantic herring juveniles are found: water temperatures below 10^0 C, water depths from 15 - 135 meters, and salinity range from 26 to 32‰.

Adults: Pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where Atlantic herring adults are found: water temperatures below 10^0 C, water depths from 20 - 130 meters, and salinities above 28‰.

Spawning Adults: Bottom habitats with a substrate of gravel, sand, cobble and shell fragments, but also on aquatic macrophytes, in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay. Generally, the following conditions exist where spawning Atlantic herring adults are found: water temperatures below 15^0 C, water depths from 20 - 80 meters, and salinity range from 32 to 33‰. Herring eggs are spawned in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots. Atlantic herring are most often observed spawning during the months from July through November.

Monkfish (*Lophius americanus*)

Eggs: Surface waters of the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where monkfish egg veils are found: sea surface temperatures below 18^0 C and water depths from 15 – 1000 meters. Monkfish egg veils are most often observed during the months from March to September.

Larvae: Pelagic waters of the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where monkfish larvae are found: water temperatures 15^0 C and water depths from 25 – 1000 meters. Monkfish larvae are most often observed during the months from March to September.

Juveniles: Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud along the outer continental shelf in the middle Atlantic, the mid-shelf off southern New England, and all areas of the Gulf of Maine. Generally, the following conditions exist where monkfish juveniles are found: water temperatures below 13^0 C, depths from 25 – 200 meters, and a salinity range from 29.9 – 36.7‰.

Adults: Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud along the outer continental shelf in the middle Atlantic, the mid-shelf off southern New England, along the outer perimeter of Georges Bank, and all areas of the Gulf of Maine. Generally, the following conditions exist where monkfish adults are found: water temperatures below 15^0 C , depths from 25 – 200 meters, and a salinity range from 29.9 – 36.7‰.

Spawning Adults: Bottom habitats with substrates of a sand-shell mix, algae covered rocks, hard sand, pebbly gravel, or mud along the outer continental shelf in the middle Atlantic, the mid-shelf off southern New England, along the outer perimeter of Georges Bank, and all areas of the Gulf of Maine. Generally, the following conditions exist where spawning monkfish adults are found: water temperatures below 13^0 C , depths from 25 – 200 meters, and a salinity range from 29.9 – 36.7‰. Monkfish are observed spawning most often during the months from February to August.

Bluefish *(Pomatomus saltatrix)*

Juveniles: Pelagic waters over the continental shelf and all major estuaries. Generally juvenile bluefish occur in North Atlantic estuaries from June through October within the "mixing" and "seawater" zones. Distribution of juveniles by temperature, salinity, and depth over the continental shelf is un-described.

Adults: Pelagic waters over the continental shelf and all major estuaries. Generally adult bluefish occur in North Atlantic estuaries from June through October within the "mixing" and "seawater" zones. Bluefish adults are highly migratory and distribution varies seasonally and according to the size of the individuals comprising the schools. Bluefish are generally found in normal shelf salinities (> 25 parts per trillion (ppt)).

Long finned squid (*Loligo pealei*)

Juveniles: Pelagic waters found over the continental shelf, from the Gulf of Maine through Cape Hatteras in areas that encompass the highest 75% of the catches where juvenile squid were collected. Generally, juvenile long finned squid are collected from shore to 700 feet and in temperatures between 4^0 F and 27^0 F.

Adults: Pelagic waters found over the continental shelf, from the Gulf of Maine through Cape Hatteras in areas that encompass the highest 75% of the catches where adult squid were collected. Generally, adult long finned squid are collected from shore to 1000 feet and in temperatures between 39^0 F and 81^0 F.

Short finned squid (*Illex illecebrosus*)

Juveniles: Pelagic waters found over the continental shelf, from the Gulf of Maine through Cape Hatteras in areas that encompass the highest 75% of the catches where juvenile squid were collected. Generally, juvenile short finned squid are collected from shore to 600 feet and in temperatures between 36^0 F and 73^0 F.

Adults: Pelagic waters found over the continental shelf, from the Gulf of Maine through Cape Hatteras in areas that encompass the highest 75% of the catches where adult squid were collected. Generally, adult short finned squid are collected from shore to 600 feet and in temperatures between 39^0 F and 66^0 F.

Atlantic butterfish (*Peprilus triacanthus*)

Eggs: Pelagic waters found over the continental shelf, from the Gulf of Maine through Cape Hatteras in areas that encompass the highest 75% of the catches where butterfish eggs were collected. The “mixing” and/or “seawater” portions of all the estuaries where butterfish are “common”, “abundant”, or “highly abundant” on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, butterfish eggs are collected from shore to 6000 feet and in temperatures between 52^0 F and 63^0 F.

Larvae: Pelagic waters found over the continental shelf, from the Gulf of Maine through Cape Hatteras in areas that encompass the highest 75% of the catches where butterfish larvae were collected. The “mixing” and/or “seawater” portions of all the estuaries where butterfish are “common”, “abundant”, or “highly abundant” on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, butterfish larvae are collected from 33 feet to 6000 feet and in temperatures between 48^0 F and 66^0 F.

Juveniles: Pelagic waters found over the continental shelf, from the Gulf of Maine through Cape Hatteras in areas that encompass the highest 75% of the catches where butterfish juvenile were collected. The “mixing” and/or “seawater” portions of all the estuaries where butterfish are “common”, “abundant”, or “highly abundant” on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, butterfish larvae are collected from 33 feet to 1200 feet and in temperatures between 37^0 F and 82^0 F.

Adults: Pelagic waters found over the continental shelf, from the Gulf of Maine through Cape Hatteras in areas that encompass the highest 75% of the catches where butterfish adults were collected. The “mixing” and/or “seawater” portions of all the estuaries where butterfish are “common”, “abundant”, or “highly abundant” on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, adult butterfish are collected in depths from 33 feet to 1200 feet and in temperatures between 37^0F and 82^0F.

Atlantic mackerel (*Scomber scombrus*)

Eggs: EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina; in areas that encompass the highest 75% of the catch where Atlantic mackerel eggs were collected. EFH is also the "mixing" and/or "seawater" portions of all the estuaries where Atlantic mackerel are "common", "abundant", or "highly abundant" on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, Atlantic mackerel eggs are collected from shore to 50 feet and temperatures between 41^0 F and 73^0 F.

Larvae: EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina; in areas that encompass the highest 75% of the catch where juvenile Atlantic mackerel were collected in NEFSC trawl surveys. EFH is also the "mixing" and/or "seawater" portions of all the estuaries where Atlantic mackerel are "common", "abundant", or "highly abundant" on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, Atlantic mackerel larvae are collected in depths between 33 feet to 425 feet and temperatures between 43^0 F and 72^0 F.

Juveniles: EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina; in areas that encompass the highest 75% of the catch where juvenile Atlantic mackerel were collected in NEFSC trawl surveys. EFH is also the "mixing" and/or "seawater" portions of all the estuaries where Atlantic mackerel are "common", "abundant", or "highly abundant" on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, juvenile Atlantic mackerel are collected from shore to 1,050 feet and temperatures between 39^0 F and 72^0 F.

Adults: EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina; in areas that encompass the highest 75% of the catch where adult Atlantic mackerel were collected in NEFSC trawl surveys. EFH is also the "mixing" and/or "seawater" portions of all the estuaries where Atlantic mackerel are "common", "abundant", or "highly abundant" on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, adult Atlantic mackerel are collected from shore to 1,250 feet and temperatures between 39^0 F and 61^0 F.

Summer flounder (*Paralicthys dentatus*)

Adults: North of Cape Hatteras, EFH is the demersal waters over the continental shelf from the Gulf of Maine to Cape Hatteras, in the highest 90% of the area where adult summer flounder were collected. Generally, summer flounder inhabit shallow coastal and estuarine waters during the warmer months and move offshore on the outer continental shelf at depths of 500 feet in colder months. Inshore, EFH is the estuaries where summer flounder were identified as being common, abundant, or highly abundant for the “mixing” and “seawater” salinity zones.

Scup (*Stenotomus chrysops*)

Juveniles: North of Cape Hatteras, EFH is the demersal waters over the continental shelf from the Gulf of Maine to Cape Hatteras, in the highest 90% of the area where juvenile scup were collected. Generally, juvenile scup are found in water temperatures greater than 45^0 F and where salinities are greater than 15 ppt. Inshore, EFH is the estuaries where scup were identified as being common, abundant, or highly abundant for the “mixing” and “seawater” salinity zones. Juvenile scup are generally found in water temperatures greater than 45^0 F and where salinities are greater than 15 ppt. Juvenile scup, in general during the summer and spring are found in estuaries and bays between Virginia and Massachusetts. They are found in association with various sands, mud, mussel and eelgrass bed type substrates.

Adults: North of Cape Hatteras, EFH is the demersal waters over the continental shelf from the Gulf of Maine to Cape Hatteras, in the highest 90% of the area where adult scup were collected. Wintering adults (November through April) are usually offshore, south of New York to North Carolina, in waters above 45^0 F. Inshore, EFH is the estuaries where scup were identified as being common, abundant, or highly abundant for the “mixing” and “seawater” salinity zones.

Black sea bass (*Centropristus striata*)

Juveniles: North of Cape Hatteras, EFH is the demersal waters over the continental shelf from the Gulf of Maine to Cape Hatteras, in the highest 90% of the area where juvenile black sea bass were collected. Temperature preference is for areas warmer than 6^0 F with salinities greater than 18 ppt. Juvenile black sea bass are found in association with rough bottom, shellfish, and eelgrass beds, man-made structures in sandy-shelly areas; offshore clam beds and shell patches may also be used during the winter. They are found in coastal areas between Massachusetts and Virginia, but they winter offshore from New Jersey and south. Inshore, EFH is the estuaries where black sea bass were identified as being common, abundant, or highly abundant for the “mixing” and “seawater” salinity zones. Juveniles are found in the estuaries in the summer and spring.

Adults: North of Cape Hatteras, EFH is the demersal waters over the continental shelf from the Gulf of Maine to Cape Hatteras, in the highest 90% of the area where adult black sea bass were collected. Wintering adults (November through April) are usually offshore, south of New York to North Carolina. Temperatures above 6^0 F seem to be the minimum requirements. Structured habitats (natural and man-made), sand and shell are the substrate preference. Inshore, EFH is the estuaries where adult black sea bass were identified as being common, abundant, or highly abundant for the "mixing" and "seawater" salinity zones. Black sea bass are generally found in estuaries from May through October.

Surf clam (*Spisula solidissima*)

Juveniles and adults: Throughout the substrate to a depth of three feet within Federal waters from the eastern edge of Georges Bank and the Gulf of Maine throughout the Atlantic EEZ, in areas that encompass the top 90% of the area where surf clams were caught. Surf clams generally occur from the beach zone to depth of about 200 feet, but beyond about 125 feet abundance is low.

Spiny Dogfish (*Squalus acanthias*)

Juveniles: EFH ranges from the Gulf of Maine through Cape Hatteras, North Carolina. Generally, dogfish are collected in depths between 33 feet and 1,280 feet and temperatures between 37^0F and 68^0F. EFH is also the "seawater" portions of all the estuaries where dogfish are common or abundant on the Atlantic coast, from Passamaquoddy Bay, Maine to Cape Cod Bay, generally in water temperatures ranging between 37^0F and 82^0F.

Adults: EFH ranges from the Gulf of Marine through Cape Hatteras, North Carolina across the continental shelf. Generally, dogfish are collected in depths between 33 feet and 1,476 feet and temperatures between 37^0F and 66^0F. EFH is also the "seawater" portions of all estuaries where dogfish are common o abundant on the Atlantic coast, from Passamaquoddy Bay, Maine to Cape Cod Bay generally in water temperatures ranging between 37^0F and 82^0F.

Bluefin tuna (*Thunnus thynnus*)

Juveniles and subadults: All inshore and pelagic surface waters warmer than 12^0 C of the Gulf of Maine and Cape Cod Bay from Cape Ann, east including waters of the Great South Channel; continuing south to and including Nantucket Shoals to off Cape Hatteras. In pelagic surface waters warmer than 12^0 C between the 25 to 200 meter isobaths.

BOSTON HARBOR
MASSACHUSETTS

DEEP DRAFT
NAVIGATION IMPROVEMENT STUDY

FINAL FEASIBILITY REPORT
AND FINAL SUPPLEMENTAL
ENVIRONMENTAL IMPACT STATEMENT
AND MASSACHUSETTS FINAL
ENVIRONMENTAL IMPACT REPORT

APPENDIX U

BENTHIC RESOURCE DATA
FOR BOSTON HARBOR

(THIS APPENDIX UNCHANGED FROM JULY 2008 DRAFT)

BOSTON HARBOR BENTHIC RESOURCE DATA

The samples collected by MWRA provide information about the general faunal communities present and the changes that they have undergone since the EIS was issued in 1995. However, it is important to note that there is one major sampling difference between the MWRA program and the other studies (Pellegrino, 2003; Massport, 2003) discussed in this section. The MWRA infaunal samples are rinsed in the field over a 300-μm-mesh sieve, whereas samples from the other two studies were rinsed over 500-μm-mesh sieves. This difference means that MWRA samples will contain more individuals than the other studies' samples and very likely will also be comprised of more species. Therefore, the data for MWRA stations are not directly comparable to data from the other two studies, although they are presented here to provide background information, especially concerning temporal trends in the communities.

One of the important revelations from the MWRA program is that infaunal abundance can vary tremendously from year-to-year. Annual fluctuations in abundance appeared to be largest from 1992 through about 1998 and seem to have lessened within the last four to five years (Maciolek *et al*., 2005). However, some changes have still been relatively large (*e.g.*, a 13-fold change in abundance at station T05A from 2002 to 2003) and often are related to large fluctuations in abundance of colonizing species such as the amphipod *Ampelisca abdita* and the polychaete worm *Polydora cornuta*. Infaunal abundances have ranged as high as 500,000/m^2 since 1991, but most stations have had abundances much less than half that number within the last five years for which data are available (1999–2003). These data emphasize that an abundance value for a station that is determined for one year only should be considered only relative to other values determined for stations also sampled that year. The one-year abundance value does not necessarily provide a reliable estimate of the infaunal abundance at a particular location for any other year.

The information presented in this section is derived from two sampling approaches: the collection of sediment profile images (SPI) and the collection of grab samples from which infaunal animals were removed, identified, and counted. SPI data provide information about key habitat characteristics and processes, whereas grab samples allow for the description of infaunal community structure. The two techniques provide different types of information about the benthos and are best used as complementary data sources (Rumohr and Karakassis, 1999). Brief summaries of each approach and descriptions of the types of data described in this section are included in the two text boxes.

Sections of the Mystic River, Chelsea River, and the Reserved Channel and Turning Basin were dredged between May 1998 and September 2000. Portions of the outer harbor region, the lower Main Ship Channel, and the Presidents Roads Anchorage area were dredged between August 2004 and June 2005. Dredging of the Lower and Inner Harbor will begin in 2008. The implications of this dredging on the benthic characterizations are discussed within the following sections for each harbor area.

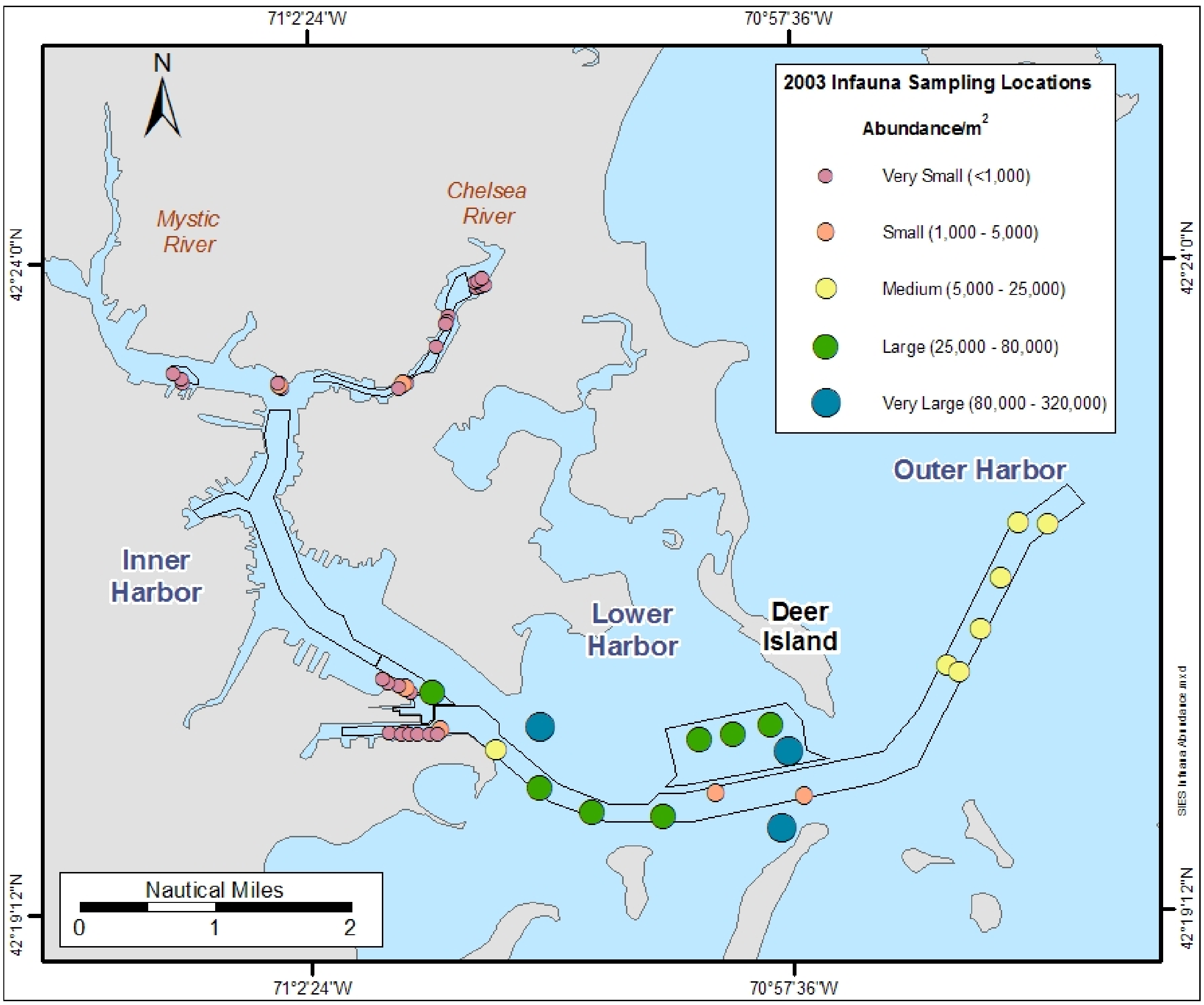
Mystic River - The only information available, since 1995, about the benthos in the Mystic River portion of the affected environment is from a Corps survey conducted in September 2003 (Pellegrino, 2003) (Figure 3-4 in SEIS/EIR). Three stations were sampled in an area of the Mystic River that is about -35 feet deep MLLW. Sediment data for areas near the stations showed mud or silt present. The three samples showed extremely low infaunal abundances, ranging from 75 to 100 indivduals/m^2; one sample had no animals (Figure U-1). Only five species were found among the three samples (Figure U-2), which were dominated by polychaete worms (*Aricidea catherinae*, *Nephtys incisa*, *Tharyx acutus*). Species diversity could only be estimated for one sample, and Shannon's *H′* was 1.8. Rarefaction analysis was not performed on samples from the Mystic River because the sample sizes were too small to yield meaningful curves.

The stations sampled in 2003 were in an area that was not dredged between 1998 and 2000. Therefore, no direct impact of the dredging on the benthos was found in 2003 and the faunal community is certainly representative of that portion of the Mystic River. Indirect dredging impacts, such as increased turbidity, would not be expected to have an impact on the community that would be detectable at least three years after dredging.

Chelsea River - Information about the benthos in the Chelsea River is derived from the Corps (Pellegrino, 2003) and Massport surveys (Massport, 2003). The Upper Chelsea River was sampled at seven stations by the Corps along the length of the river, and at three stations by Massport at each of four berth areas (Irving Oil, Gulf Oil, Conoco Phillips, Global Petroleum) (Figure 3-4 in SEIS/EIR). Sediments in the upper Chelsea River were mostly gravel and sand (Figure 3-1 in SEIS/EIR). Water depths generally ranged from about -33 to -38 feet MLLW.

At the four Corps stations that were located upstream of the Chelsea Street Bridge, infaunal abundance was very low, ranging from 25 to 125 individuals/m^2 (Figure U-1). Species numbers were also low, with only one to three species found at each station (Figure U-2). Only polychaete worms (*Nephtys incisa*, *Prionospio steenstrupi*, *Pectinaria gouldii*, *Aricidea catherinae*) were present among the samples. Downstream of the Chelsea Street Bridge infaunal abundances were higher than in samples taken upstream of the bridge but were still very low, ranging from 525 to 1,550 individuals/m^2 (Figure U-1). Species numbers were also slightly greater than upstream numbers, ranging from 6 to 10 species per station (FigureU-2). Polychaetes (*Polydora cornuta*, *Tharyx acutus*, *Nephtys incisa*) were the predominant taxonomic group of animals, although the sand shrimp, *Crangon septemspinosa*, and two mollusk species (a snail, *Ilyanassa trivitatta* and a clam, *Nuculana tenuisulcata*) were also present. Species diversity within the Chelsea River was very low to moderate with Shannon's *H′* ranging from 1.7 to 3.1. Rarefaction analysis was not performed on samples from the Chelsea River because the sample sizes were too small to yield meaningful curves.

The Gulf Oil, Global Petroleum, and Irving Oil berth areas are located upstream of the Chelsea St. Bridge (Massport, 2003). Infaunal abundances among the berth-area samples were similar to those from the other upper river samples, with most ranging from 0 to 200 individuals/m^2 (three of the samples had no animals), although two samples (one Irving Oil, one Global Petroleum) approached 1,300 individuals/m^2 (Figure U-1). Species numbers were low, ranging from 1 to 12 species per sample (Figure U-2). Polychaetes (principally *Polydora cornuta* and Cirratulidae spp.) were the predominant organisms among the samples. The Conoco Phillips berth, located just downstream from the Chelsea Street Bridge, showed infaunal abundances (300-2,200 individuals/m^2) that were similar to nearby Corps stations, but were much higher than the upstream berth-area stations (Figure U-1). Species numbers (4-16 per sample) showed a similar pattern (Figure U-2). The predominant taxa were primarily the polychaetes *Polydora cornuta* and Cirratulidae spp., but samples also included the mysid crustacean *Neomysis americana*.



Source: Pellegrino, 2003; Massport, 2003

Figure U-1. Infaunal Abundance from 2003 Sampling

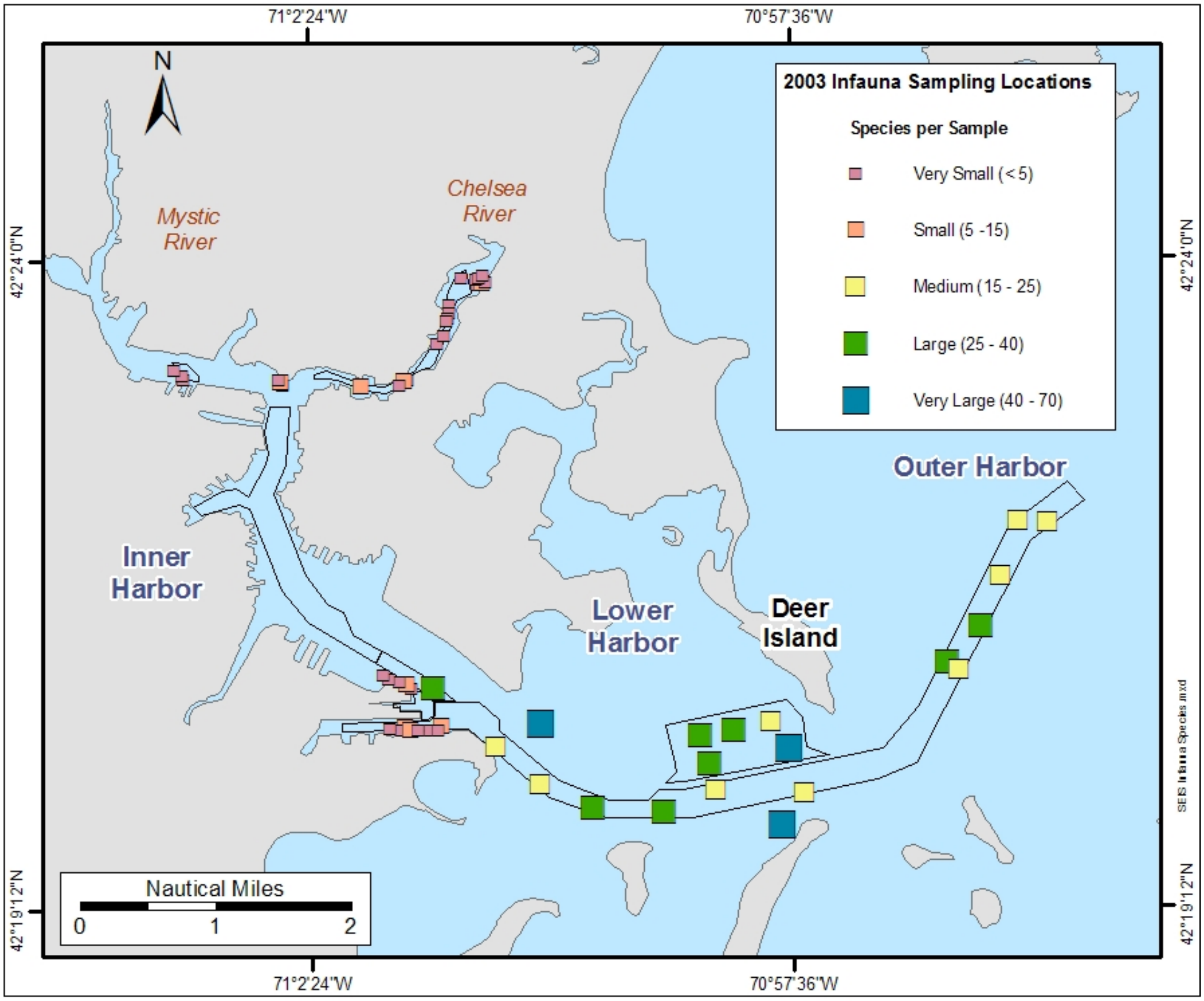


Figure U-2. Number of Species per Sample from 2003 Sampling
Source: Pellegrino, 2003; Massport, 2003

Sediments in the Chelsea-Sandwich berth area, which is within the Inner Confluence (where the Mystic and Chelsea Rivers meet), were mostly sandy (Figure 3-1 in SEIS/EIR). Water depths generally ranged from about -23 to -36 ft MLLW. One of the three samples from the Chelsea-Sandwich Berths area, located where the Chelsea River meets the Mystic River, contained only one snail (*Ilyanassa trivitatta*). The other two samples had infaunal abundances of 2,100 and 5,900 indivduals/m^2 (Massport, 2003) (Figure U-1). The fauna consisted primarily of polychaetes (Cirratulidae spp., *Lepidonotus squamatus*), oligochaete worms, and nematode worms.

Much of the Chelsea River channel and the Inner Confluence were dredged between 1998 and 2000. Most of the stations sampled by the Corps and Massport in 2003 were within the recently dredged channel and, thus, represent benthic communities present at least three years after dredging. Because the rates of recovery from disturbance for communities in this type of habitat are not known, it is not possible to estimate whether or not the communities found in 2003 represent a benthos that has fully recovered from the dredging. Stations at the Irving Oil and Global Petroleum berths were not within the dredged channel and likely represent typical conditions for the area. In the vicinity of the Inner Confluence, three benthic stations were sampled during the Massport (2003) survey. One of these (CS-1), which was probably located on the edge of the dredged area, was found to have only one snail in the grab sample. This could reflect a lingering impact from the dredging, but the sample was noted as possibly not from a full grab sample.

Inner Harbor - The data sets available for the characterization of the Inner Harbor area included the Corps 2003 study (Pellegrino, 2003) that sampled the Reserved and Main Channels, the Massport berth area study that sampled Conley Terminal and the North Jetty, and MWRA SPI studies that sampled the Inner and Lower Harbors (Figure 3-4 in SEIS/EIR). Sediments in the Reserved Channel area have been characterized as predominantly mud; those in the Main Channel have been characterized as primarily mud with scattered areas of sand (Figure 3-1 in SEIS/EIR). Water depths ranged from -39 to -44 feet MLLW in the Reserved Channel and from -29 to -43 ft MLLW in the Main Channel.

In the Reserved Channel, infaunal abundance ranged from 450 to 1,950 individuals/m^2 at the three Corps stations (Pellegrino, 2003) and from 125 to 2,500 individuals/m^2 at Conley Terminal (Massport, 2003) (Figure U-1). Taxon numbers were similar for both studies ranging from four to 14 species at the Reserved Channel stations (Pellegrino, 2003) and 5 to 22 taxa per sample at Conley Terminal (Massport, 2003) (Figure U-2). Diversity among the Reserved Channel samples was very low to moderate with Shannon's H' ranging from 1.1 to 3.4. The fauna within the Reserved Channel was characterized by polychaetes (*Nephtys incisa*, *Scoletoma fragilis*, *Polydora cornuta*, Lumbrineridae), the snail *Ilyanassa trivittata*, and the lophophorate worm *Phoronis architecta*. Rarefaction analysis was not performed on samples from the Inner Harbor because the sample sizes were too small to yield meaningful curves.

Infaunal abundances at the two Corps stations in the Main Channel were relatively high, about 10,000 and 38,000 individuals/m^2 (Pellegrino, 2003) (Figure U-1). Species numbers at the two stations were similar with 20 and 28 species per sample (Figure U-2). Shannon diversity ($H' \approx 3$) was moderate in the channel. The fauna was characterized predominantly by polychaetes (*Aricidea catherinae*, *Tharyx acutus*, *Scoletoma hebes*), although amphipods (*Ampelisca abdita*, *Leptocheirus pinguis*, *Orchomenella minuta*) were also relatively abundant. Rarefaction analysis showed higher diversity than in the Lower and Outer Harbor Main Channel stations, but was considered mid-range when compared with the other harbor stations (Figure U-3). The North Jetty samples were different from the Corps samples. Infaunal abundance at the North Jetty was an order of magnitude lower, ranging from 1,500 to 3,800 individuals/m^2 (Massport, 2003) (Figure U-1). Taxon numbers were generally lower, with 10 to 21 taxa present per sample (Figure U-2). Polychaetes (Lumbrineridae spp., *Marenzellaria viridis*, Capitellidae spp.) were predominant and the snail *Ilyanassa trivittata* was relatively abundant in three of the North Jetty samples. In contrast to the Main Channel stations, crustaceans were rare at the North Jetty stations (Massport, 2003).

Two MWRA stations, R09 and R10, both of which were sampled only by SPI, are located near the Main Channel section of the Inner Harbor (Figure 3-4 in SEIS/EIR). Station R09 is close to the Main Channel station MM. Both MWRA stations have shown relatively consistent indications of stress, as indicated by the Organism Sediment Index (OSI) over about the last 10 years of harbor monitoring (Maciolek *et al*., 2005). Station R10, located off the World Trade Center/Commonwealth Pier, has consistently been one of most stressed stations sampled in the harbor with OSI values around 3.7 from 2000 to 2003. Station R09 has shown slightly higher values for the OSI, but they have been at or just less than 6.0 for four of the last five years. Both stations are dominated by physical, not biological processes, and have silty-fine-sand (R09) or silt-clay (R10) sediments. The infaunal successional stage at each station is usually Stage I or Stage I-II, which is also indicative of frequent stress.

All of the stations sampled during the 2003 Corps survey in the Reserved Channel were within the area dredged between 1998 and 2000. The stations located in the Main Ship Channel were dredged in 2004 to 2007. The Conley Terminal stations (Massport 2003) appear to be on the margin of the dredged channel. The descriptions based on the 2003 data from these sites represent benthic communities present at least three years after dredging. Because the rates of recovery from disturbance for communities in this type of habitat are not known, it is not possible to estimate whether or not the communities found in 2003 represent a benthos that has fully recovered from the dredging. It is expected that the most recently dredged/or soon to be dredged area would not be at full recovery levels for at least a year. The nearby MWRA station (R09) was not within the dredged area.

Lower Harbor - Information about the benthos in the Lower Harbor area is from the Corps 2003 study (Pellegrino, 2003) that sampled the Main Channel and Presidents Roads Anchorage, and the MWRA SPI and infaunal studies that sampled in, and adjacent to, both areas (Figure 3-4 in SEIS/EIR). The Main Channel stations are separated into those northwest of Spectacle Island and those in Presidents Roads for this discussion.

The Main Channel area northwest of Spectacle Island (Corps stations X, U, S) showed moderately high infaunal abundance ranging from 37,000 to 53,000 individuals/m^2 (Pellegrino, 2003) (Figure U-1). Species numbers were moderate, ranging from 24 to 28 species per sample (Figure U-2). Species diversity was moderately low (H' = 2.4 to 2.9). The successional Stage II amphipod, *Ampelisca abdita*, was the predominant species, followed by the polychaetes *Aricidea catherinae, Scoletoma hebes,* and *Tharyx acutus*. Oligochaete sp. A was also common. Rarefaction showed lower diversity in this area than at other Main Channel stations (Figure U-3), but was mid-range compared to other harbor stations. Water depth in the Main Channel was about -40 ft MLLW, and the nearby sediments were classified as sand or sandy mud.

MWRA stations T02, R44, and R08 provide information about the benthos in the area north of the Main Channel. Stations R08 and R44 have been sampled only by SPI. Station R08 has had an average OSI over the last eight years of 4.5, indicative of stress, and the station still showed moderate stress in 2003, with an OSI value of 6.0 (Maciolek *et al*., 2005). The only infaunal community identified at the station has consisted solely of successional Stage I pioneering fauna, which are also indicative of a stressed habitat. Station R44 showed indications of stress from 1996 to 2000, but since 2000 has shown relatively healthier habitat conditions with an OSI reaching 10.0 in 2003 (Maciolek *et al*., 2005). Sediment at R44 also showed improved conditions with successional Stage II-III fauna present in 2003, and biophysical processes dominating.

Station T02, sampled via SPI and grab sampler, was once thought to be in a highly polluted area with an impoverished fauna (Maciolek *et al*., 2005). Conditions at the station have improved as conditions have changed with the modification of discharges into the harbor. Infaunal abundances increased considerably in 1994 and 1995, decreased in 1996, and remained less than 62,500 individuals/m^2 from 1996 to 2002, before increasing to about 127,000 individuals/m^2 in 2003 (Maciolek *et al*., 2005). There has been a shift in predominant species from pioneering taxa and those sometimes associated with stress (*e.g.*, the polychaetes *Streblospio benedicti* and *Polydora cornuta* and the oligochaete *Tubificoides* nr. *Pseudogaster*) to others such as *Aricidea catherinae*, *Nephtys cornuta*, and *Tubificoides apectinatus* that are often indicative of more stable conditions. Species numbers were about 50 per sample in 2003, the highest number at station T02 since 1994. SPI data generally have shown that the station is stressed with OSI values less than 6. However, in 2003 the OSI value (10.0) was the highest calculated in 12 years of monitoring. The fauna at the station consisted of successional Stage II-III taxa (Maciolek *et al*., 2005).

The Presidents Roads Main Channel (Corps Stations O, L) showed low infaunal abundances of about 4,000 individuals/m^2 (Pellegrino, 2003) (Figure U-1). However, because there were about 22 species per sample (Figure U-2), diversity was moderately high, with Shannon H' values of about 3.4 and 3.7. The evenness estimate for these stations was high ($J' \approx 0.8$), which indicates relatively low numerical dominance by any species. The predominant species included polychaetes *Tharyx acutus*, *Scoletoma hebes*, *Harmothoe imbricata*, the snail *Ilyanassa trivittata*, and the brittle star *Amphipholis squamata*. The amphipod *Ampelisca abdita* was rare. Water depths in the Presidents Roads channel were about -50 ft MLLW, and the sediments were primarily sandy (Figure 3-1 in SEIS/EIR). Rarefaction analysis showed that these two channel stations had higher diversity than all but one other harbor sample (Figure U-3), and that infaunal abundances were low.

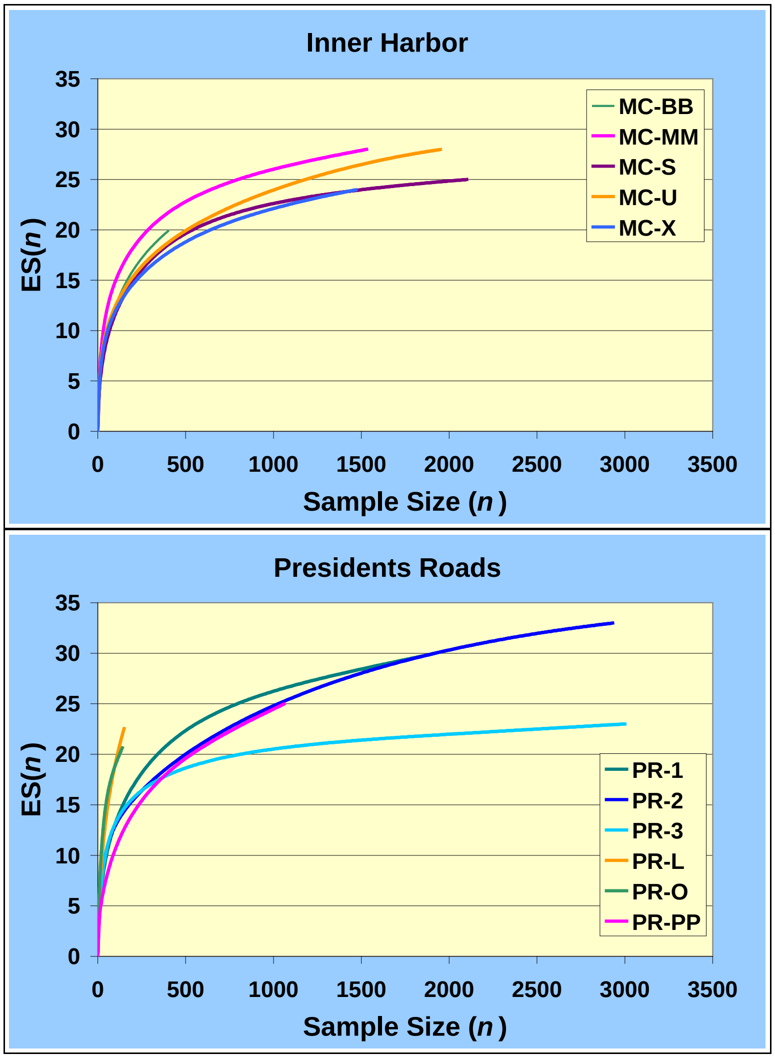
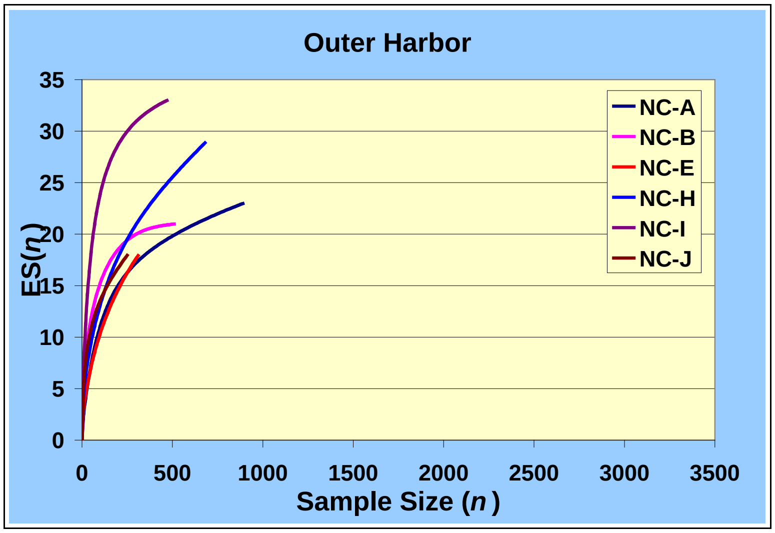


Figure U-3. Rarefaction curves for samples collected from the Boston Harbor study area in September 2003 (prepared from data in Pellegrino, 2003).



ES(*n*) = Expected number of species for sample size n

Figure U-3 (Continued). Rarefaction curves for samples collected from the Boston Harbor study area in September 2003 (prepared from data in Pellegrino, 2003).

The September 2003 survey showed that stations within the Presidents Roads Anchorage (Corps stations PR-1, PR-2, PR-3, PR-PP) had moderate (~26,000 individuals/m^2) to relatively high (~48,000 to 75,000 individuals/m^2) infaunal abundances (Pellegrino, 2003) (Figure U-1). Species numbers were also relatively high (Figure U-2), with 23 to 33 species per sample, and *H'* ~2.2 to 2.8. *Ampelisca abdita* was the predominant organism at stations PR-1, PR-2, and PR-3 with abundances of about 27,000 to 41,000 individuals/m^2; however, the species was absent from station PR-PP. Additional species at stations PR-1, PR-2, and PR-3 included other amphipod species (*Leptocheirus pinguis* and *Orchomenella minuta*), polychaetes (*Tharyx acutus*, *Prionospio steenstrupi*, and two species of *Phyllodoce*), and an oligochaete worm (oligochaete sp. A). At station PR-PP, the predominant taxa included the polychaete worms *Aricidea catherinae, Prionospio steenstrupi*, and *Mediomastus ambiseta*. Water depths within the Presidents Roads Anchorage (about -40 feet MLLW) were similar at all stations. Sediments were sandy to sandy-mud. Rarefaction analysis showed mid-range diversity and relatively high abundance versus other harbor samples (Figure U-3).

Two MWRA stations, R02 and T05A, are located within the Presidents Roads Anchorage (Figure 3-4 in SEIS/EIR). Station R02, located in the northeast corner of the area, has been sampled by SPI since 1992. Habitat quality here has fluctuated considerably from year-to-year with OSI values in some years showing indications of marked stress (OSI < 6), but in other years showing relatively good conditions with an OSI greater than 8 (Maciolek *et al*., 2005). There have been no identifiable annual trends in OSI values. The most recent (2003) data show good habitat quality at station R02 (OSI = 8.3), with a successional Stage II community. The sediments were affected mainly by biological processes. Station T05A, which is characterized annually by SPI and grab samples, is fully exposed to the mouth of the harbor. SPI data show that the benthic habitat at this station has periodically shown signs of stress with OSI values ranging from 2.3 to 7.0 since 1995 (Maciolek *et al*., 2005). In 2003, SPI data showed a relatively good habitat (OSI = 7.0) at station T05A, with a successional Stage II community, and biological processes affecting the sediment. Infaunal community parameters (measured by grab sample analyses) have shown considerable annual variation. Abundances ranged from as high as about 530,000 individuals/m^2 in 1997 to as low as about 25,000 individuals/m^2 in 2000 (Maciolek *et al*., 2005). Annual fluctuations can be as large as a 40-fold increase in one year (1996–1997), followed by an almost four-fold decrease the next year (1997–1998). The periodic high abundances are primarily attributed to sudden increases in populations of the polychaete *Polydora cornuta* and the amphipod *Ampelisca abdita*. In 2003, abundances were the second highest recorded at the station, reaching ~317,000/m^2, with amphipods accounting for more than 90% of the total abundance.

The area of the Lower Harbor south of the Main Ship Channel can be characterized using data collected from MWRA stations R06, R45, and T03. The former two stations were sampled only by SPI. Station R06, located off the northern tip of Long Island, is fully exposed to the mouth of the harbor. Its location probably contributes to the stressed conditions typically shown at the station; OSI values for most years prior to 2003 have been <6.0 (Maciolek *et al*., 2005). In 2003, the OSI value showed an improvement to 8.0. Station R45, however, has consistently been ranked as one of the higher quality habitats in the harbor, with OSI values ranging from 8.3 to 10.0 since 1995 (Maciolek *et al*., 2005). Station T03, which was characterized by SPI and infaunal grab samples, showed high infaunal abundance in 2003 (216,600 individuals/m^2), about half of which was the amphipod *Ampelisca abdita* (Maciolek *et al*., 2005). Sixty-four species were found at this station in 2003, representing the highest mean number reported for the station. *Ampelisca abdita* is often predominant, as are other amphipods, such as *Leptocheirus pinguis*, *Crassicorophium bonelli*, *Unciola irrorata*, and *Photis pollex*. Oligochaete worms of the genus *Tubificoides* are often numerically important, with *T. apectinatus* joining or replacing *T*. nr. *pseudogaster* as the predominant oligochaete. The polychaete *Aricidea catherinae* is also often numerically important. SPI data have shown that this station is generally one of the best with regards to habitat quality in the harbor. The average OSI over the last 12 years is 8.6. In 2003, the OSI was 10.0, with successional Stage II-III fauna present and *Ampelisca abdita* mats common (Maciolek *et al*., 2005).

All of the stations sampled in the Lower Harbor area by the Corps in 2003, and the MWRA stations (R02, T05A) located within the Presidents Roads Anchorage area, were in the area dredged from October 2004 to June 2005. Therefore, the communities that were described above represent those present more than a year prior to a major disturbance to the harbor bottom and are not typical of the communities likely present there now.

Outer Harbor - The data set that best describes the Outer Harbor region is from the September 2003 field program conducted by the Corps and includes stations A, B, E, H, I, and J (Pellegrino, 2003) (Figure 3-4 in SEIS/EIR). Stations sampled by the MWRA and HubLine programs are not close enough to the study area to provide useful descriptions of the habitats. Waters in the outer harbor channel are generally about -35 to -42 feet deep MLLW and the sediments there are poorly characterized. Abundances among the Corps stations were relatively low to moderate, ranging from 6,400 to 22,400 individuals/m^2 (Figure U-1). Species numbers ranged from 18 to 33 species per sample (Figure U-2). Species diversity varied from low to moderately high (H' = 1.3 to 4.1) and evenness fluctuated from low (J' = 0.3) to high (J' = 0.8). There was no noticeable pattern with increasing distance of the stations from the harbor. The predominant taxa in this area included high numbers of the clam *Hiatella arctica* at station NC-A (18,550 individuals/m^2), which accounted for 83% of the abundance there. Predominant taxa at other stations included the polychaetes *Aricidea catherinae* and *Tharyx acutus*, the worm oligochaete sp. A, and an unidentified archiannelid worm at NC-E. This latter species is most likely *Polygordius* sp. A, which is the only archiannelid that has been identified in the Massachusetts Bay area (Maciolek *et al*., 2005). Rarefaction analysis showed high diversity for one sample (NC-I), but mid-range diversity for the other samples (Figure U-3). Abundance at all stations was relatively low.

All of the stations sampled in the Outer Harbor area by the Corps in 2003 were in the area dredged from August 2004 to October 2004. Therefore, the communities that were described above represent those present about a year prior to a major disturbance to the harbor bottom and may not be typical of the communities likely present there now.

BOSTON HARBOR
MASSACHUSETTS

DEEP DRAFT
NAVIGATION IMPROVEMENT STUDY

FINAL FEASIBILITY REPORT
AND FINAL SUPPLEMENTAL
ENVIRONMENTAL IMPACT STATEMENT
AND MASSACHUSETTS FINAL
ENVIRONMENTAL IMPACT REPORT

APPENDIX V

SHELLFISH LIFE HISTORY INFORMATION
FOR BOSTON HARBOR

(THIS APPENDIX UNCHANGED FROM JULY 2008 DRAFT)

BOSTON HARBOR SHELLFISH INFORMATION

The following section describes the life history, landing data and growing areas of the commercially important shellfish that may occur in Boston Harbor.

Softshell Clam: The softshell clam (*Mya arenaria*) is found along the Atlantic coast from Labrador to South Carolina and in bays and sounds in the bottom sediments of intertidal and subtidal waters up to depths of 30 feet (Newell and Hidu, 1986). Fine sediments (soft mud and sand, compact clay) are the preferred substrate of softshell clams, but they also grown in coarse gravel and stones. Spawning peaks in the summer (June through September). The planktonic larval stage of the softshell clam lasts for 12 to 14 days in the water column and then settles to the bottom, where it develops a foot and attaches to the bottom. Juvenile seed clams (5 mm long) may migrate up to several hundred yards toward shore, with movement peaking in the fall. Adult clams live in permanent burrows that are up to 16 inches deep. They feed mainly on plankton (*i.e.*, flagellates and diatoms) but can also feed on bacteria and organic detritus. Predators include birds, fish, shrimp, crabs, snails, and worms.

The softshell clam (*Mya arenaria*) is the most common commercially harvested shellfish within Massachusetts (MA DMF, 2005). Management of the beds is under the jurisdiction of the MA DMF. Most of the productive softshell clam beds within the project area are closed, except for conditionally restricted areas near Logan Airport in North Boston Harbor and areas near the Neponset River and Dorchester Bay (Figure 3-10). The largest landings in Boston Harbor have historically come from the Airport (GBH5.2) and Snake Island (GBH5.5) locations in North Boston Harbor (Table 3-3). The largest landings in the Neponset River and Dorchester Bay area are from Carson Beach (GBH3.6). Clams are harvested and transported by licensed and bonded master diggers to a shellfish purification plant in Newburyport, where they are held for at least three days in a system supplied with clean, flowing seawater. Once the contaminants have been purged, the clams are returned to commercial harvesters for sale and consumption.

Blue mussel: Blue mussels, *Mytilus edulis*, are distributed from the Arctic to South Carolina (Canada Department of Fisheries and Oceans, 2003a). They are found from slightly brackish estuaries to deep offshore waters but are most abundant in the intertidal and shallow subtidal zones. Mussels have fibers called byssal threads (commonly called the “beard”) that are used to anchor to rocks, pilings, or other mussels. Mussels spawn between May and August, with fertilization occurring in the water column (Canada Department of Fisheries and Oceans, 2003a). Embryos become free-swimming planktonic larvae, which are present in the water column for three to four weeks. Between mid-June and late July, the larval mussel metamorphoses into a juvenile and attaches itself to a solid surface. The juvenile mussel can detach itself and change locations (either by crawling with their foot or floating in the water column) until a suitable hard substrate is found at which time the mussel permanently attaches itself and matures to an adult. Mussels can tolerate wide ranges in salinity and temperature. They are filter feeders that feed primarily on phytoplankton, as well as decomposed macrophytes or detritus. Mussel larvae are a food source for zooplankton; juvenile and adult mussels are preyed on mainly by sea ducks, starfish, crabs, and humans. They are harvested commercially from Maine to Long Island, New York (Maine Department of Marine Resources [ME DMR], 2003). Mussels can be harvested year round and are usually taken by hand with a rake or from a boat with a drag.

Razor clam: Razor clams, *Ensis directus*, are generally found in intertidal to subtidal areas from Labrador to Florida (Gosner, 1978). They are very proficient at digging into the sand to avoid predation. Only the top part of the quickly retractable siphon of the clam is exposed to filter food particles from the water. Similar to blue mussels, razor clams do not typically occur in offshore waters. They are harvested both commercially and recreationally.

Atlantic Surf Clam: The Atlantic surf clam, *Spisula solidissima*, inhabits sandy continental shelf habitats from the southern Gulf of St. Lawrence to Cape Hatteras, North Carolina (Cargnelli *et al*., 1999). The largest concentrations of Atlantic surf clams usually occur in well-sorted, medium sand but may also occur in fine sand and silty-fine sand. Surf clams inhabit waters from the surf zone to a depth of 420 ft but are more common at depths less than 240 ft. Areas of coarse grain size (*i.e.*, pebbles or cobbles) are virtually devoid of surf clams (Murawski, 1979). Atlantic surf clams are filter feeders that pump water through their siphons over the gills to trap food, mainly plankton. Their planktonic larvae remain in the water column for about three weeks. Many predators, including snails, shrimp, crabs, and fish (haddock and cod), feed on surf clams (Cargnelli *et al*., 1999). Commercial concentrations in Massachusetts are found primarily on Georges Bank. Recreational fishing is insignificant.

Sea scallop: The sea scallop, *Placopecten magellanicus*, occurs in the western North Atlantic continental shelf waters from Newfoundland to North Carolina (Hart, 2001). North of Cape Cod, populations are generally scattered in shallow water less than 66 feet deep and are most often associated with sandy sediments. Spawning occurs in late summer/early fall, and scallop larvae are present in the water column for four to eight weeks before settling to the bottom. The commercial fishery for scallops occurs year round, with dredges and otter trawls used as the primary harvesting equipment. Sea scallops are most heavily fished on Georges Bank and off the New Jersey coastline between 132 and 330 ft in waters cooler than 20 ºC. Recreational fishing is insignificant.

Cancer Crabs: *Cancer* sp. crabs are one of the most common shallow-water crabs in New England waters (Gosner, 1978). Rock crabs (*Cancer irroratus*) are distributed from Labrador to South Carolina, and north of Cape Cod they are found in intertidal areas. Rock crabs prefer rocky habitat but can be found on all types of bottoms. Jonah crabs (*Cancer borealis*) are usually found deeper than rock crabs and prefer exposed, rocky habitat, though they are common on muddy substrates in deeper waters (Gosner, 1978; Estrella, 2003). Egg-bearing females live in pits that they dig in soft sediments (Canada Department of Fisheries and Oceans, 2003b). Breeding occurs in the fall just after the females have mated. Male crabs molt later in the winter.

Table B-1. Life History and Habitat of Shellfish Species in the Project Area

Species	Distribution	Water Depth	Substrate Type	Feeding Strategy	Spawning	Larvae
Softshell clam *Mya arenaria*	Labrador to South Carolina	Intertidal to subtidal (~30 ft)	Fine sediments or coarse gravel and stones	Filter feeder	Summer	Planktonic
Blue mussel *Mytilus edulis*	Artic to South Carolina	Intertidal and shallow sub-tidal to offshore	Attached to rocks, pilings and other solid objects	Filter feeder	Almost year-round with peaks in summer	Planktonic
Razor clam *Ensis directus*	Labrador to Florida	Bays, estuaries, shallow areas	Sand and sandy mud	Filter feeder	Summer through fall	Planktonic
Atlantic surf clam *Spisula solidissima*	Continental shelf waters from Gulf of St. Lawrence to North Carolina	< 240 ft	Medium sand	Filter feeder	Summer and early fall	Planktonic
Atlantic sea scallop *Placopecten magellanicus*	Continental shelf waters from Newfoundland to North Carolina	132-660 ft, <66 ft north of Cape Cod	Sandy	Filter feeder	Late summer and early fall	Planktonic
Rock crab *Cancer irroratus*	Labrador to South Carolina	Intertidal north of Cape Cod, <2,600 ft	All types of bottom types, rocks/crevices	Omnivorous	Summer	Planktonic
Jonah crab *Cancer borealis*	Nova Scotia to Florida	Deeper than rock crab	Rock or mud	Mussels, snails, urchins, crabs	Summer	Planktonic

Table B-2. Softshell Clam Landing Data in Boston Harbor for 1997 thru 2005.

Area	Area Name	Location	Racks								
			1997	1998	1999	2000	2001	2002	2003	2004	2005
GBH5.1	North Boston Harbor	The Shores	2359	2764	5329	2837	3040	1509	62	557	305
GBH5.2	North Boston Harbor	Airport	4579.5	3832.5	2137	3108.5	3213	371.5	4635.5	1784.5	1088.5
GBH5.3	North Boston Harbor	Governors Island	2618	2238	1489	1414	1211	71	985	546	114
GBH5.4	North Boston Harbor	Wood Island	1857	1713	1049	759	175	80	439	550	2452
GBH5.5	North Boston Harbor	Snake Island	4531	4457	3820	1955	1857	505	361	1338	537
GBH5.9	North Boston Harbor	Orient Heights	NA	NA	NA	NA	344	21	0	0	0
GBH3.6	Neponset R./Dorchester Bay	Carson Beach	NA	NA	NA	NA	NA	3650	1225	492	104
GBH3.9	Neponset R./Dorchester Bay	Thompson	NA	NA	NA	NA	NA	1708	339	360	133
GBH3.10	Neponset R./Dorchester Bay	Long Island	NA	NA	NA	NA	NA	350	20	0	25

Source: Glenn Casey, MA DMF, personal communication, 2006.
Rack = industry unit of measurement equivalent to approximately 50 lbs.
NA = not available

Cancer crabs produce hundreds of thousands of eggs, which they lay and keep under their abdomen for about one year. The eggs hatch into planktonic larvae in the summer, which remain in the water column from mid-June to mid-September. In the fall, the larvae molt into small crabs (megalops) and settle both in cobble and sand (Palma *et al*. 1998). Juvenile crabs (less than 0.6 inches carapace width) concentrate in sheltered areas in shallow depths (Canada Department of Fisheries and Oceans, 2003b).

Rock crabs are omnivorous and are an important prey item for lobsters. Cancer crabs are currently a by-catch fishery with modest consumer demand (Estrella, 2003).

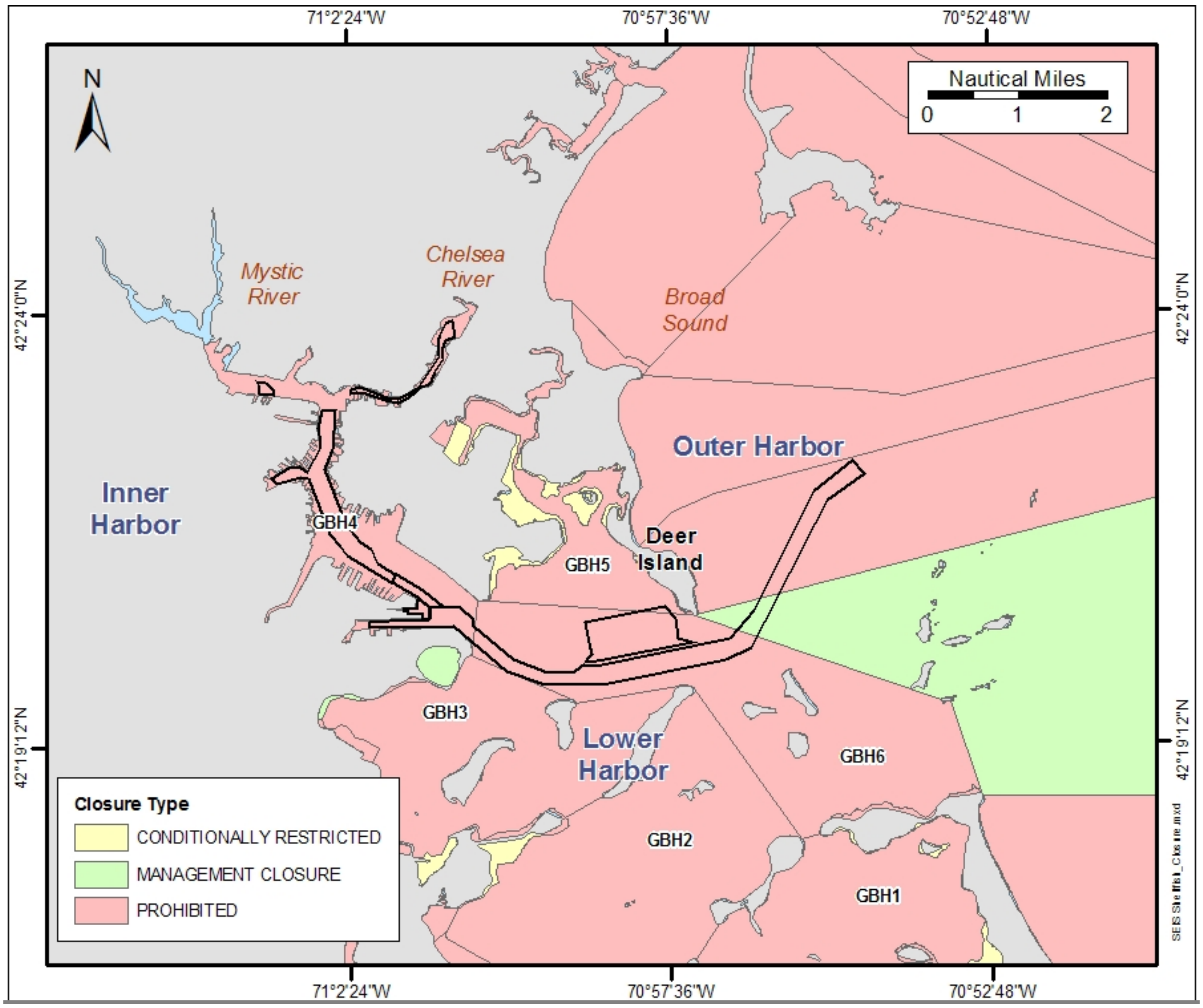


Figure V-1. Designated Shellfish Growing Area (MADMF, 1999).

BOSTON HARBOR
MASSACHUSETTS

DEEP DRAFT
NAVIGATION IMPROVEMENT STUDY

FINAL FEASIBILITY REPORT
AND FINAL SUPPLEMENTAL
ENVIRONMENTAL IMPACT STATEMENT
AND MASSACHUSETTS FINAL
ENVIRONMENTAL IMPACT REPORT

APPENDIX W

COASTAL AND MARINE BIRDS
IN BOSTON HARBOR
AND MASSACHUSETTS BAY

(This Appendix Not Revised Since 2008 Draft)

COASTAL AND MARINE BIRDS IN BOSTON HARBOR AND MASSACHUSETTS BAY

The following is a summary and list of birds that may occur in the project area:

Pelagic birds - Several species of pelagic birds have been identified in the Boston Harbor area, including Wilson's storm-petrel, common murre, the common loon and red-throated loon. These birds are classified as generally open ocean birds during the winter in tropical seas and do not come near the coast except when nesting or breeding in the spring and summer. Prey for pelagic birds include those organisms that may be collected in the open ocean waters, including fish, crustaceans, shellfish, and plankton. Foraging strategies (i.e., feeding techniques) vary from skimming over the surface and plucking small organisms from the water, to diving to great depths for extended periods to gather fish, shrimp, or benthic organisms such as crabs and shellfish. The common loon has been documented as being caught in fishing nets at 200 feet below the water's surface.

Shorebirds - Shorebirds found in the Boston Harbor area not only nest on coastal shore areas, but are unique in that they also forage in these shoreline areas. Shorebirds inhabit coastlines, open beaches, tidal flats, and marshes. The shorebirds in the Boston Harbor area at one time included the piping plover, but it has not been recorded in the area since 1983. Oystercatchers are large, conspicuous birds that were hunted to near-extinction along the Atlantic Coast. Given total protection, they have once again become numerous and now nest in numbers as far north as Massachusetts, where just a few years ago they were very rare. American oystercatchers nest on the Boston Harbor Islands. Shorebirds in general run along the sand or mud and stop to probe the substrate for worms, snails, or small crustaceans living in the substrate. Besides the American oystercatchers, migrating shorebirds, such as black-bellied plovers, semipalmated plovers, greater yellowlegs, lesser yellowlegs, whimbrels, ruddy turnstones, purple sandpipers, sanderlings, semipalmated sandpipers, western sandpipers, and white-rumped sandpipers, have been detected on 16 of the Boston Harbor Islands (Paton *et al*., 2005). These birds tend to feed by sight, preying upon oysters, clams, and mussels or probe for marine worms and other food items in the intertidal zone.

Waterfowl - Many different waterfowl species have been identified and recorded in Boston Harbor area, including bufflehead ducks, the common goldeneye, hooded- and red-breasted merganser, the ruddy duck, the American black duck, the greater scaup, gadwall, Canada goose, brant goose, canvasback, common eider, harlequin duck, surf scoter, white-winged scoter and black scoter. Waterfowl are migratory and spend the majority of the time on the water searching for food such as invertebrates, plants, and small fish. Most of these species breed in coastal waters of northern Canada and winter along the Atlantic coast and have been recorded in the Boston Harbor area. Waterfowl come ashore to breed in inland regions or along the coastlines. Many of these species have been observed diving and swimming at great depths underwater for prey. Diving ducks, such as scaup, can dive to 25 feet to forage for clams, invertebrates, fish, and underwater plants. Sea ducks, such as scoters and eiders, have been observed diving to depths over 100 feet to feed on shellfish such as mussels and crustaceans.

Colonial Water Birds - This category of birds is characterized by the colonies of nests that they build along the coasts. Colonial water birds generally inhabit sandy or rocky islands, coastal beaches, salt marshes, bays, and estuaries. These birds have a variety of feeding techniques ranging from wading through the water grabbing fish and invertebrates to hovering over the water surface and diving into the water to catch fish. Most of the colonial water birds feed in the coastal areas with shallow water depths in search small fish. The diet of most coastal water birds includes fish, various crustaceans, mollusks, and plankton. Several colonial water birds have been observed in the coastal areas of Boston Harbor, including the common tern, least tern, sooty shearwater, northern gannet, double-crested cormorant, great cormorant, great blue heron, green heron, great egret, snowy egret, black crowned night heron, Bonaparte's gull, herring gull, laughing gull, great black-backed gull, ring-billed gull, blacked-legged kittiwake, and razor bill.

Raptors - Raptors are birds of prey that are classified as hunting birds that search for food while in flight. Their diet may consist of fish, other birds, and even small mammals. The bald eagle and peregrine falcon are two examples of raptors that can be observed in the Boston Harbor area. These birds generally nest and perch in the upland habitat of tall trees to survey their area and use the shoreline and open ocean for feeding. The bald eagle is listed threatened on the Federal list and both birds are listed as endangered on the state list. They are discussed in Section 3.5.6 of the SEIS.

Marsh Birds - Marsh birds are found in shallow estuaries, coastal bays, and marshes where they feed and breed. Examples of marsh birds observed in the coastal areas of the Boston Harbor area include the horned grebe, red-necked grebe, mute swan, pie-billed grebe, eared grebe, and American bittern. Many of these species move to the coastal areas during the fall and winter. Marsh birds exhibit a variety of feeding techniques, including swimming and diving or wading and grabbing prey. Diets for these birds generally consist of fish, crustaceans, and aquatic plants. Marsh birds are also common in freshwater ponds and rivers.

Table W-1 (Continued) List of Coastal and Marine Birds Recorded in the Boston Harbor and Massachusetts Bay Areas						
Common Name	**Scientific Name**	**Classifi-cation**	**Habitat**	**Prey**	**Feeding Technique**	**Status**
Common Loon	*Gavia immer*	Pelagic	Shoreline in spring to breed and nest; in winter, open ocean and bays along coast from Maine to Texas	Principal food source is fish, also shellfish, frogs, aquatic insects	Dives deeply in pursuit of prey; have been caught in nets as much as 200 ft below the water's surface	Species of Special Concern in Massachusetts
Red throated Loon	*Gavia stellata*	Pelagic	Winters along ocean coast during migration; breeds mostly on fresh water	Small or medium sized fish (cod, herring, sprat, sculpins); occasionally crustaceans, mollusks, frogs, fish spawn and insects	Dives recorded at 7–30 ft and average for 1 minute. Prefer clear water for foraging and don't fish at night	No special status
Wilson's Storm-petrel	*Oceanites oceanicus*	Pelagic	Offshore waters	Feeds on small crustaceans, fish and oil from carcasses	Picks prey from the surface of the water while hovering	No special status
Common Murre	*Uria aalge*	Pelagic	Migrate along the coast in the fall to areas where winter food is plentiful	Feed on fish, squid, krill	Dive by flapping their half-open wings, as if flying underwater. Dives to 100 m are common	No special status
Ruddy turnstone	*Arenaria interpres*	Shorebird	Winters on coasts; mudflats, sandbars, sandy or muddy shores, beaches and rocky coasts	Aquatic invertebrates and insects	Uses bill to open barnacles, dig holes, and flip aside stones, shells, and seaweed in pursuit of food	No special status

Table W-1 (Continued) List of Coastal and Marine Birds Recorded in the Boston Harbor and Massachusetts Bay Areas

Common Name	Scientific Name	Classifi-cation	Habitat	Prey	Feeding Technique	Status
Sander-Ling	*Calidris alba*	Shorebird	During migration and in winter: Sandy ocean beaches, mudflats, sandy edges of inland lakes and rivers	Small crustaceans and mollusks	As waves come roaring in, the birds run up on the beach just ahead of the breaker, then sprint after the retreating water to feed on exposed organisms	No special status
White rumped sandpiper	*Calidris fuscicollis*	Shorebird	During migration, found in mudflats, flooded fields, shallow marshes, beaches, sandbars	Insects, marine worms, mollusks, crustaceans, leaches, seeds, and vegetation	Picks food from the ground and by methodically probes the sediments with its bill	No special status
Purple sandpiper	*Calidris maritime*	Shorebird	Rocks in coastal areas	Insects, small mollusks, seeds, berries, and algae	Forages for food by picking from the surface or probing sediment with bill	No special status
Semi-palmated sandpiper	*Calidris pusilla*	Shorebird	Winters on and migrates along coastal beaches, mudflats and salt marshes	Aquatic invertebrates and seeds	Picking up food by sight	No special status
Semi-palmated plover	*Charadrius semi-palmatus*	Shorebird	During migration and in winter it can be found on mudflats, salt marshes & lakeshores	Crustaceans and mollusks	Forages from the surface, running and scanning for food in short bursts	No special status
Whimbrel	*Numenius phaeopus*	Shorebird	Winters on coastal marshes, prairies, shores, and mud flats	Feeds on crabs, shrimps, mollusks, and worms	Probe deeply into mud with bill, may also pick off food found on the surface	No special status

Table W-1 (Continued) List of Coastal and Marine Birds Recorded in the Boston Harbor and Massachusetts Bay Areas						
Common Name	**Scientific Name**	**Classifi-cation**	**Habitat**	**Prey**	**Feeding Technique**	**Status**
Black bellied plover	*Pluvialis squatarola*	Shorebird	Winters on the beaches, mudflats, and coastal marshes	Small crabs, worms, mollusks, and crustaceans.	Forages for food by run, stop and peck	No special status
Lesser yellowlegs	*Tringa flavipes*	Shorebird	In the winter can be found along the shores of lakes and rivers, in marshy ponds and in coastal marshes and mudflats	Aquatic invertebrates and terrestrial insects, also small fish	Forage by pecking and grabbing up prey	No special status
Greater yellowlegs	*Tringa melanoleuca*	Shorebird	Marshes, mudflats, and flooded fields	Small fish, aquatic and terrestrial invertebrates, and berries	Forages by probing its bill into the substrate, but also skims the surface	No special status
American Oystercatcher	*Haematopus palliatus*	Shorebird	Coastal waters	Marine invertebrates (mollusks, crabs and worms), and occasionally fish	Probes the sand, rocks, and other substrates in the coastal waters	No special status
Bufflehead	*Bucephala albeola*	Waterfowl	Winters on salt bays and estuaries	Freshwater and saltwater aquatic invertebrates (insects, crustaceans, mollusks)	Feed in open, shallow water; dives for food and swallows while underwater	No special status
Common Goldeneye	*Bucephala clangula*	Waterfowl	Winters on coastal bays and estuaries	Mollusks, aquatic plants and insects	Dives for prey	No special status
Hooded Merganser	*Lophodytes cucullatus*	Waterfowl	Winters on coastal marshes and inlets	Small fish, frogs, aquatic insects	Dives for fish in long, rapid, underwater dives	No special status
Red-breasted Merganser	*Mergus serrator*	Waterfowl	Winters mainly on salt water	Fish	Swift, underwater dives	No special status

Table W-1 (Continued) List of Coastal and Marine Birds Recorded in the Boston Harbor and Massachusetts Bay Areas

Common Name	Scientific Name	Classification	Habitat	Prey	Feeding Technique	Status
Ruddy Duck	*Oxyura jamaicensis*	Waterfowl	Winters on marshes and in shallow coastal bays	Pondweeds and other aquatic plants, midge larvae	Surface diver; excellent underwater swimmer; strains bottom material through bill	No special status
American Black Duck	*Anas rubripes*	Waterfowl	Marshes, lakes, streams, coastal mudflats, estuaries. Outside of breeding season, lives on open lagoons and on the coast, even in rough sea waters	Aquatic plants, also invertebrates (insects, mollusks, crustaceans)	Grazing, probing, dabbling for prey; occasionally dives	No special status
Gadwall	*Anas strepera*	Waterfowl	Lakes, reservoirs and estuaries	Aquatic vegetation & invertebrates	Dabbles for prey	No special status
Greater Scaup	*Aythya marila*	Waterfowl	Brackish lakes, bays, and ponds; in winter, often on salt water bays and estuaries of the Atlantic coast	Green plant matter, seeds, mollusks	Grazing and probing for prey; dives for mollusks	No special status
Canvasback	*Aythya valisineria*	Waterfowl	Bays and estuaries in the winter	Aquatic vegetation & invertebrates	Dives for prey	No special status
Brant Goose	*Branta bernicla*	Waterfowl	Saltwater bays and estuaries in the winter	Submerged vegetation	Feed during low tide, pull plants up from bottom	No special status
Canada Goose	*Branta canadensis*	Waterfowl	Usually inland but sometimes in coastal waters, particularly in spring and fall	Plants	Grazing and dabbling for prey	No special status

Table W-1 (Continued) List of Coastal and Marine Birds Recorded in the Boston Harbor and Massachusetts Bay Areas

Common Name	Scientific Name	Classification	Habitat	Prey	Feeding Technique	Status
Common Eider	*Somateria mollissima*	Waterfowl	Rocky coasts; breeds from Canada to Massachusetts ; winters south to Long Island; Most sea going of all waterfowl, never leaving the salt water	Mussels and other shellfish	Dives for prey	No special status
Harlequin Duck	*Histrionicus histrionicus*	Waterfowl	Rocky wave-lashed coasts and jetties in winter; prefers the rugged seacoast	Loose snails, limpets, barnacles, small shrimp, crabs, small fish	Diving for fish or pulling prey off rocks	No special status
Surf Scoter	*Melanitta perspicillata*	Waterfowl	Winters almost entirely on the ocean and in large coastal bays	Mollusks and crustaceans	Diving for food	No special status
White-winged Scoter	*Melanitta fusca*	Waterfowl	Winters mainly on ocean and large coastal bays	Mollusks, crabs, starfish, sea urchin, some fish	Dives for mussels at depths of 15-40 ft	No special status
Black Scoter "Common Scoter"	*Melanitta nigra*	Waterfowl	Winters on ocean and in large salt bays	Mussels and other mollusks, barnacles, chitins, limpets	Feeds off rocks and reefs	No special status
Common Tern	*Sterna hirundo*	Colonial water bird	Sandy or rocky islands, sand dunes or barrier beaches; breeds along Atlantic coastline	Primarily sand lance (up to 22 cm) but also other small fish, crustaceans, invertebrates	Feeds close to shore in water less than 15 inches deep; sometimes in deeper water over schools of predatory fish; dives and dips for prey	Species of special concern in Massa-chusetts
Least Tern	*Sterna antillarum*	Colonial water bird	Coastal beaches and barrier islands	Fish less than 8-94 cm; minnows, sand lance, herring, hake	Hover, dive, skim the surface of the water	Species of special concern in Massachusetts

Table W-1 (Continued) List of Coastal and Marine Birds Recorded in the Boston Harbor and Massachusetts Bay Areas						
Common Name	**Scientific Name**	**Classification**	**Habitat**	**Prey**	**Feeding Technique**	**Status**
Sooty Shearwater	*Puffinus griseus*	Colonial water bird	Open ocean; arrive on east coast in May as part of great migration; one of most abundant birds in the world	Fish	Dives from surface and swims underwater with wings	No special status
Northern Gannet	*Morus bassanus*	Colonial water bird	Open seas	Fish	Dives into sea after fish, sometimes plunging headlong from heights as great as 50 ft or more	No special status
Double-crested Cormorant	*Phalacrocorax auritus*	Colonial water bird	Coastlines; marine and inland waters	Fish, crustaceans, amphibians from fresh water	Swims low in water to feed; dives and catches their prey underwater	No special status
Great Cormorant	*Phalacrocorax carbo*	Colonial water bird	Sea cliffs, rocky coasts, and inshore waters; winters from Maine to New Jersey	Fish; in coastal waters during breeding season, herring and eel	Dives for fish	No special status
Great Blue Heron (Blue form)	*Ardea herodias*	Colonial water bird	Lakes, ponds, rivers, marshes	Fish or frogs primarily; occasionally small mammals, reptiles, and birds	Fishes day and night but prefer dawn and dusk; wades in shallow water and spears the food	No special status
Green Heron	*Butorides virescens*	Colonial water bird	Marshes	Food consists Primarily of fish and insects but also crustaceans, mollusks, other invertebrates, amphibians and reptiles	Seizes the prey with a jab of its bill	No special status

Table W-1 (Continued) List of Coastal and Marine Birds Recorded in the Boston Harbor and Massachusetts Bay Areas						
Common Name	**Scientific Name**	**Classifi-cation**	**Habitat**	**Prey**	**Feeding Technique**	**Status**
Great Egret	*Casmerodius albus*	Colonial water bird	Freshwater and salt marshes, tidal flats, nests in colonies	Fish, frogs, snakes, crayfish	Wades in shallow water and spears the prey	No special status
Snowy Egret	*Egretta thula*	Colonial water bird	Marshes, swamps, ponds, lakes, shallow coastal areas and tidal flats; occasionally found in dry fields	Fishes, shrimp, crayfish, fiddler crabs, snakes, snails, aquatic and terrestrial insects, small lizards, young frogs and aquatic vegetation	Use one foot to stir up the bottom, flushing prey into view. Will also hover, then drop to the water to catch prey in their bills	No special status
Black Crowned Night Heron	*Nycticorax nycticorax*	Colonial water bird	Wooded swamps, coastal dune forests, vegetated dredged material islands scrub thickets, or mixed phragmites marshes	Fish, amphibians, reptiles, crayfish, mussels, dragonflies and nymphs, and small rodents	Forages, waits motionless for prey	No special status
Glossy Ibis	*Plegadis falcinellus*	Colonial water bird	Marshy lakeshores and coastal lagoons	Aquatic invertebrates, insects, and snakes	Probes mud and silt with its bill looking for prey	No special status
Willet	*Catoptro-phorus sem-palmatus*	Colonial water bird	Coastal marshes and beaches and mudflats	Aquatic insects, marine worms, small fishes, small crustaceans and mollusks; occasionally seeds and grasses	Forages in mudflats, intertidal areas, and shallow marsh waters; snatches up food from the surface or the water or it probes in the mud with its long bill	No special status

Table W-1 (Continued) List of Coastal and Marine Birds Recorded in the Boston Harbor and Massachusetts Bay Areas						
Common Name	**Scientific Name**	**Classifi-cation**	**Habitat**	**Prey**	**Feeding Technique**	**Status**
Bonaparte's Gull	*Larus philadelphia*	Colonial water bird	Ocean bays, coastal waters, islands, and lakes	Fish, crustaceans, snails, marine worms	Feed by dipping to the surface of the water. Occasionally they drop into the water, take a few deep strokes, then glide to the surface	No special status
Herring Gull	*Larus argentatus*	Colonial water bird	Common in all aquatic habitats	Aquatic and marine animals, clams, shellfish	Scavenger	No special status
Great Black-backed Gull	*Larus marinus*	Colonial water bird	Coastal beaches, estuaries, lagoons	Anything smaller than itself, including, small ducks, fish, shellfish	Scavenger	No special status
Laughing Gull	*Larus atricilla*	Colonial water bird	Salt marshes, bays, estuaries; very rare inland	Insects, fish, shellfish, crabs	Carnivore, scavenger, dives for prey	No special status
Ring-billed Gull	*Larus delawarensis*	Colonial water bird	Lakes and rivers; many move to salt water in winter	Fish, small mammals and rodents	Scavenger	No special status
Black- legged Kittiwake	*Rissa tridactyla*	Colonial water bird	Cliffs and seacoasts; generally spends the entire winter on the open ocean	Small fish and plankton	Only gull that occasionally dives and swims underwater to capture food	No special status
Razorbill	*Alca torda*	Colonial water bird	Coastal waters	Fish, shrimp, and squid	Very adept at diving and have been caught in gill nets as deep as 60 ft	No special status

Table W-1 (Continued) List of Coastal and Marine Birds Recorded in the Boston Harbor and Massachusetts Bay Areas						
Common Name	**Scientific Name**	**Classifi-cation**	**Habitat**	**Prey**	**Feeding Technique**	**Status**
Bald Eagle	*Haliaeetus leucocephalus*	Raptor	Coastal areas, estuaries, large inland waterways; overwintering along the Atlantic coastlines and islands	Fish, other birds (waterfowl and seabirds), small mammals, carrion	Swooping from a perch or by coursing low over the water and dropping straight down when a fish is spotted	Federal and State listed as threatened
Horned Grebe	*Podiceps auritus*	Marsh bird	Population moves to coast in fall; once on wintering grounds, they seldom fly	Insects, crustaceans, small fish; on wintering grounds, mollusks are also consumed	Excellent swimmer and diver; during dives it may stay submerged for up to three minutes and travel 490-660 ft horizontally in that time	No special status
Red-necked Grebe	*Podiceps grisegena*	Marsh bird	Coastal bays and estuaries during migration and winter	Fish, crustaceans, and aquatic insects	Diving and propelling through the water	No special status
Mute Swan	*Cygnus olor*	Marsh bird	Freshwater ponds, rivers, coastal lagoons, bays; in winter, common on marine waters	Aquatic vegetation, aquatic insects, fish, frogs	Plunge head below water surface	No special status
American Coot	*Fulica americana*	Marsh bird	Open ponds and marshes; winters on coastal bays and inlets; feeds with ducks	Aquatic plants	Swims and dives for food	No special status
Pie-billed Grebe	*Podilymbus podiceps*	Marsh bird	Marshes, ponds; saltwater in winter if freshwater freezes	Fish, crustaceans, aquatic insects, crayfish	Dives for food	No special status

Table W-1 (Continued) List of Coastal and Marine Birds Recorded in the Boston Harbor and Massachusetts Bay Areas						
Common Name	**Scientific Name**	**Classifi-cation**	**Habitat**	**Prey**	**Feeding Technique**	**Status**
Eared Grebe	*Podiceps nigricollis*	Marsh bird	Prefers freshwater wetlands with large expanses of open water; open bays and ocean in winter	Aquatic insects, small crustaceans, and fish	Grazing, probing, dives for prey	No special status
American Bittern	*Botaurus lentiginosus*	Marsh bird	Saltwater marshes during migration and winter; does not nest in colonies	Insects, amphibians, crayfish, small fish and mammals	Forages; waits motionless for prey then catches and shakes or bites to kill	No special status

BOSTON HARBOR
MASSACHUSETTS

DEEP DRAFT
NAVIGATION IMPROVEMENT STUDY

FINAL FEASIBILITY REPORT
AND FINAL SUPPLEMENTAL
ENVIRONMENTAL IMPACT STATEMENT
AND MASSACHUSETTS FINAL
ENVIRONMENTAL IMPACT REPORT

APPENDIX X

MARINE MAMMALS
IN BOSTON HARBOR
AND MASSACHUSETTS BAY

(This Appendix Not Revised Since 2008 Draft)

MARINE MAMMALS IN BOSTON HARBOR AND MASSACHUSETTS BAY

The following is a summary and list of marine mammals that may occur in the project area:

Harbor Seal (*Phoca vitulina concolor*) - The harbor seal, also known as the common seal, is found throughout coastal waters of the Atlantic Ocean from Canada to southern New England, New York, and adjoining seas (Waring *et al*., 2004) above 30° N latitude. Harbor seals spend the late spring, summer, and early fall between New Hampshire and the Arctic, where they breed and care for newly born pups. A general southward movement from the Bay of Fundy to southern New England waters occurs in fall and early winter, mostly consisting of juveniles and subadults. Whitman and Payne (1990) have suggested that this age-related dispersal may reflect the higher energy requirements of younger individuals. After overwintering in southern New England and New York coastal waters, the vast majority of the population migrates to the northern waters of New Hampshire, Maine, and Canada in the spring for the pupping season (mid-May through June). No pupping areas have been identified in the project areas.

The harbor seal is not listed as threatened or endangered under the Endangered Species Act (ESA), and it is not considered a strategic stock (i.e., a stock whose mortality is at a level that will destroy the population) by NMFS.

White-sided Dolphin (*Lagenorhynchus acutus*) - The white-sided dolphin occurs in temperate and polar waters in the North Atlantic Ocean, typically over the continental shelf to the 330-foot depth contour. White-sided dolphins are potential, but rare visitors to the outer project areas in Massachusetts Bay. The white-sided dolphin is not listed as threatened or endangered under the ESA and is not considered a strategic stock by NMFS. The habitat range of the white-sided dolphin is generally in deeper waters of the continental shelf and therefore would rarely be found in the inner Boston Harbor, but have been sighted around the Boston Harbor Islands.

Harbor Porpoise (*Phocoena phocoena*) - The harbor porpoise is primarily an inshore species. During the summer, harbor porpoises are concentrated in the northern Gulf of Maine and the southern Bay of Fundy region, generally in waters less than 490 feet deep. This stock of harbor porpoises migrates south into the mid-Atlantic region during the fall and spring months; they are widely distributed from New Jersey to Maine. Low densities of harbor porpoises are found in waters off New York and north to Canada in the winter. No specific migratory routes to the Gulf of Maine/Bay of Fundy region have been identified. The best estimate for the abundance of the Gulf of Maine/Bay of Fundy population is 89,700 animals, with a minimum population estimate of 74,695 (Waring *et al*., 2004).

During the period of 1994 to 2001, 831 harbor porpoise strandings were reported from Maine to North Carolina, with only 27 strandings in 2000. Massachusetts alone had 219 strandings during this period. No specific information on locations in Massachusetts was available. NMFS considers the Gulf of Maine/Bay of Fundy harbor porpoise stock as a strategic stock, though the stock has preliminarily been removed from the ESA candidate species list by the NMFS (Waring *et al*., 2004). The preferred nearshore habitat of the harbor porpoise makes it a potential species to be found in the Boston Harbor area. The harbor porpoise has been recorded as far into the harbor area as Chelsea Creek (New England Aquarium, per communication Phil Colarusso, U.S. EPA).

Gray Seal (*Halichoerus grypus*) - The gray seal is found on both sides of the North Atlantic. The western North Atlantic population occurs from New England to Labrador (Waring *et al*., 2004). Gray seals inhabit temperate and sub-arctic waters and are found from Maine to Long Island Sound in the United States. There are two breeding concentrations in eastern Canada, one at Sable Island and a second that breeds on the pack ice in the Gulf of St. Lawrence. A small number of animals and pupping have been observed on several isolated islands along the Maine coast and in Nantucket-Vineyard Sound, Massachusetts.

Gray seals are the second most common pinniped along the Atlantic coast of the US, living on remote, exposed islands, shoals, and unstable sandbars. Pupping occurs from late December through mid-February. There are no regular seasonal migrations, but young individuals wander extensively during their first two years of life. Gray seals feed on a wide variety of fish (Lesage and Hammil, 2001) as well as squid, octopus, crustaceans and even a seabird or two. The majority of dives are to depths of 230 to 328 feet, but gray seals can dive to depths greater than 1,312 feet.

Minke Whale (*Balaenoptera acutorostrata*) - Minke whales occur throughout polar, temperate, and tropical waters. The minke whale is the third most abundant great whale in the Atlantic Ocean within 200 nmi of the U.S. coastline (Winn, 1982). Minke whales off the east coast of the Unites States are part of the Canadian east coast population, one of four minke populations recognized in the North Atlantic. The range of this population extends south from Canada to the Gulf of Mexico, but distribution is primarily concentrated in New England waters, with most sightings occurring in the spring and summer months. Based on surveys conducted in 1995 and 1999, the best available current abundance estimate for minke whales in the western North Atlantic is 4,018 animals, with a minimum estimate of 3,515 animals (Waring *et al*., 2004). This species is found in open seas primarily over continental shelf waters, but it occasionally enters bays, inlets, and estuaries. Minke whales may occasionally visit Boston Harbor and Massachusetts Bay, as is made evident by a recent minke whale mortality report. In 2001, a minke whale was found dead in Massachusetts Bay (42º 21'N 70º 43'W) with fairly fresh entanglement marks on the tail stock and across the tail flukes (Waring *et al*., 2004).

The minke whale is not listed as threatened or endangered under the ESA, as depleted under the MMPA, or as a strategic stock by NMFS.

BOSTON HARBOR
MASSACHUSETTS

DEEP DRAFT
NAVIGATION IMPROVEMENT STUDY

FINAL FEASIBILITY REPORT
AND FINAL SUPPLEMENTAL
ENVIRONMENTAL IMPACT STATEMENT
AND MASSACHUSETTS
FINAL ENVIRONMENTAL IMPACT REPORT

APPENDIX Y

FINAL AFTER ACTION REPORT
ON FISHERIES IMPACTS RESULTING FROM
FALL 2007 BLASTING ACTIVITIES
FOR ROCK REMOVAL FROM THE
FEDERAL NAVIGATION PROJECT

THIS APPENDIX REPLACES THE DRAFT VERSION
INCLUDED IN THE JULY 2008 DRAFT

FINAL

AFTER ACTION BLAST REPORT

ON FISH KILLS RESULTING FROM ROCK BLASTING IN THE BOSTON HARBOR FEDERAL NAVIGATION PROJECT -BOSTON, MASSACHUSETTS- (FALL 2007)

PREPARED BY:

U.S. Army Corps of Engineers
New England District

JUNE 2008

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

SUBJECT

AFTER ACTION REPORT

I. Introduction

A. Purpose of the Report

The purpose of this After Action Blast Report (AABR) is to (1) document the project activities that resulted in fish kills, (2) the follow-up actions taken, and (3) the lessons learned during rock removal operations during 2007 from the Federal navigation channel and anchorage area in Boston Harbor, Boston, Massachusetts. The lessons learned from these blast events will be used to prepare a comprehensive blast plan for the upcoming Boston Harbor Deep Draft Navigation Improvement Project. In addition to the lessons learned from the events described in this AABR, a comprehensive blast plan to be developed for the Boston Harbor Deep Draft Project will also incorporate pertinent information obtained through literature reviews, advice from technical experts, lessons learned from other dredging/rock removal projects, results of resource agency coordination, and input from the project technical working group (TWG) sub-committee established specifically for this effort.

B. Project Description

It was discovered during maintenance dredging of the Boston Harbor Federal navigation channels in 2004 and 2005 that several areas of rock extended above the authorized navigation channel depths. These rock areas were located in the Main Ship Channel, President Roads Anchorage, and in the Broad Sound North Channel (see Figure 1). To eliminate this hazard to navigation and achieve authorized depths, it was necessary to remove this rock through blasting. A contract to remove the rock was awarded on March 15, 2007 to RDA Construction Corp. of Quincy, Massachusetts. RDA Construction began work in Boston Harbor in September 2007. They began to drill and blast in the President Roads Anchorage the week of October 1, 2007 and continued work until December 23, 2007 when operations were suspended in the Broad Sound North Channel due to safety concerns resulting from rough winter weather conditions. RDA Construction resumed work in April 2008. A hydraulic ram was used in the Broad Sound North Channel to remove the remaining rock material in the spring and summer of 2008. Table 1 provides the location, volumes of material removed, dates, and rock removal methods, and disposal location from the three harbor rock locations.

Table 1. Information on Rock Removed From Each Section in Boston Harbor

Rock Removal Location	Amount (cy)	Dates	Method of Removal	Disposal Location
President Roads Anchorage	1,029	Oct-Nov 2007	Blast	Ocean
Main Ship Channel	235	November 2007	Blast	CAD cell
Broad Sound North Channel	42 729	December 2007 April–June 2008	Blast Hydraulic Ram	Ocean Ocean

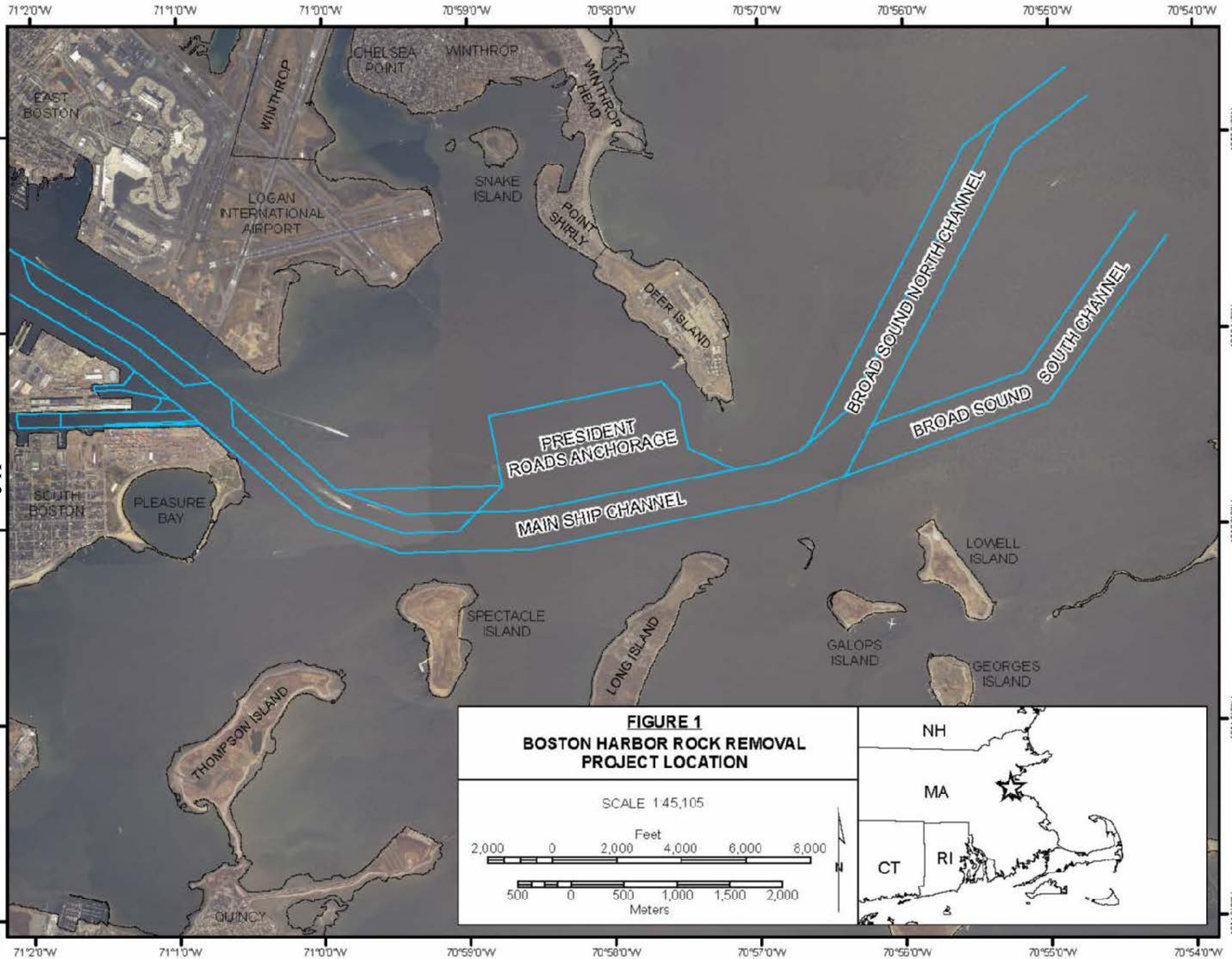


FIGURE 1
BOSTON HARBOR ROCK REMOVAL PROJECT LOCATION

C. Operational and Construction Measures to Reduce Fish Impacts from Underwater Blasting

Blasting generates underwater shock waves which radiate from the point of the blast. These shock waves can injure or kill fish that transit or inhabit the impact area. Injuries can result either directly from the blast or when air bladders of the fish are impaired. To reduce the potential for fishery impacts, blast procedures were established for this project and approved by regulatory agencies prior to construction. These procedures seek to reduce shock waves in the overlying water column and deter schools of fish from the area at the time of blasting. Construction procedures implemented to reduce the shock wave included using inserted delays of a fraction of a second and stemming. Stemming is a method used to deaden the shock wave reaching the over-laying water column by placing stone or similar material into the top of the borehole. Operational procedures implemented to reduce potential impacts to fisheries in the areas of blasting included the use of side scan sonar to detect and avoid passing schools of fish during blasting, a fish startle system to deter fish of the Clupeid family (i.e. blueback herring and alewife) from entering the blast area, and a fish observer to oversee and coordinate these efforts and determine the appropriate blast time to avoid fishery impacts. The credentials of the fish observer, Eric Rydbeck of Normandeau Associates, were approved by the National Marine Fisheries Service (NMFS) on September 25, 2007 and MA Division of Marine Fisheries (MA DMF) on September 28, 2007.

The fish observer used hydroacoustic monitoring (i.e. side-scan sonar) prior to any blasting event to determine that schools of fish were not located within or transiting the blast zone area. In addition to the side-scan sonar, a fish startle system (Sonalysts, Inc.) was employed which is capable of deterring fish from the Clupeid family using high amplitude sound at specific frequencies.

The established procedure implemented by the fish observer during blast events was to first deploy the side scan equipment off a support vessel that navigated around the blast site to check for the presence of fish in the area. However, the presence of blast cords in the water column limited the ability of the vessel to completely circle around the area. As a result, only approximately 320^o to 340^o around the blast site could be monitored using this technique. The side scan sonar covers 150 feet on either side of the vessel. The fish observer made as many passes around the blast site as needed to feel confident there were no fish in the area. A minimum of two passes with no observed fish were conducted prior to approving the initiation of the blasting procedure.

The fish startle system was deployed prior to each blast event, regardless of whether fish were observed in the area, and removed from the water approximately five minutes before the blast for all events regardless if fish were observed in the area. The fish startle system was located on the blast barge and was deployed in the area of blasting to a depth of 10 feet off the seafloor, consistent with operating procedures described in the manufacture’s manual. The fish startle system was removed from the water prior to the blast. The manufacturer of the fish startle system indicated that the fish startle system can be removed from the water column up to 10 minutes before the blast and still be effective.

D. Blasting Specifications, Procedures and Safety Plan

Explosive products manufactured by Orica, USA were 2 or 2 ½” by 16”, 40% gelatin charges. Non-electric delay blasting caps manufactured by Orica, USA were used. The bore holes were a minimum three inches in diameter, spaced a minimum of five feet apart, with a minimum five foot overburden. The average drill depth of the hole was eight feet with a minimum of three feet of stemming utilizing 1/8” peastone.

Drilling was conducted from the barge with a Joy Mini-mustang equipped with a drilling nose to center the drill bit on the channel floor. The drilling nose was advanced to the floor via cable and winch on a drill. The drill steel was advanced to the nose. The diver guided the bit and still into the nose. The diver then surfaced and then the borehole was dug to the proper depth. The diver returned to the floor with a section of a PVC pipe, the nose was lifted and the PVC pipe inserted into the drill hole to keep the hole open and free from bottom silt. This was repeated until the area was completely drilled.

Packages of explosives and cap were assembled on the deck of the barge using 80 foot Nonel caps. Those packages were then lowered to the diver via a tag line weighted to the bottom. The diver inserted the package into the open hole through the PVC sleeve. The peastone was then lowered via a tag line and the hole stemmed. The Blaster marked and secured the surface delay on the deck of the barge. The process was repeated until the shot was fully loaded and stemmed. The circuit was “snapped” together on the deck of the barge in proper sequence to a “shock tube” lead-in-line. Surface delays were attached to plastic jugs with the lead line shock tube beading back to the barge for initiation by the Blaster. After clearing the vessel traffic and barge personnel, the whistle system described below was sounded and the blast fired. There was no drilling during loading operations. Each operation is completed prior to the next operation. The line was run out to a safe distance from the blast site to the Blaster.

Prior to initiating the blast, a whistle signal system was sounded at which time all equipment and personnel were moved from the danger zone. The whistle system began with warning signal of a one-minute series of long whistles five minutes prior to the blast. The second blast signals were identified by a series of short whistles which were sounded one minute to the blast. After the second set of signals and before initiation, the Blaster visually checked with each guard to obtain the final all-clear. The all-clear signal was sounded with one prolonged whistle once the blast was made and the inspection finalized.

After the blast, the Blaster inspected for misfires and then sounded the all-clear. If a misfire was noted, the following OSHA recommendations were followed:

- If a misfire was found, the Blaster provided proper safeguards for excluding all employees from the danger zone.

- No other work began except those necessary to remove the hazard of the misfire and the employees necessary to do the work remained in the danger zone.
- No attempt was made to extract explosives from any charged or misfired hole; a new primer would be installed and the hole re-blasted.
- If there were any misfires while using cap and fuse, all employees would remain away from the charge for at least one hour. Misfires were to be handled under the direction of the Blaster. All wires would be carefully traced and a search made for unexploded charges.
- No drilling, digging, or picking was permitted until all missed holes were detonated or the authorized representative has approved that work could proceed.

No blasting occurred between sunset and sunrise. All blasting was required to be completed 45minutes before sunset. Once blasting was completed for the day, the explosives were returned to the truck and transported back to permanent storage at Orica USA in Templeton, MA. No explosives were stored on site overnight.

II. Information on Blasting in Boston Harbor Fall 2007

Blasting was initiated on October 5, 2007 to remove rock from Boston Harbor. No fish kills were experienced through the first seven blasts in the President Roads Anchorage area. A total of 14 blast events occurred in the fall of 2007 in Boston Harbor, of which four resulted in a fish kill of varying magnitude. The first fish kill event occurred during the eighth blast event on October 24, 2007. Table 2 below provides the location, dates, tidal conditions, and other pertinent information for all blast events. Figure 2 shows the blasting locations and the dates for each location.

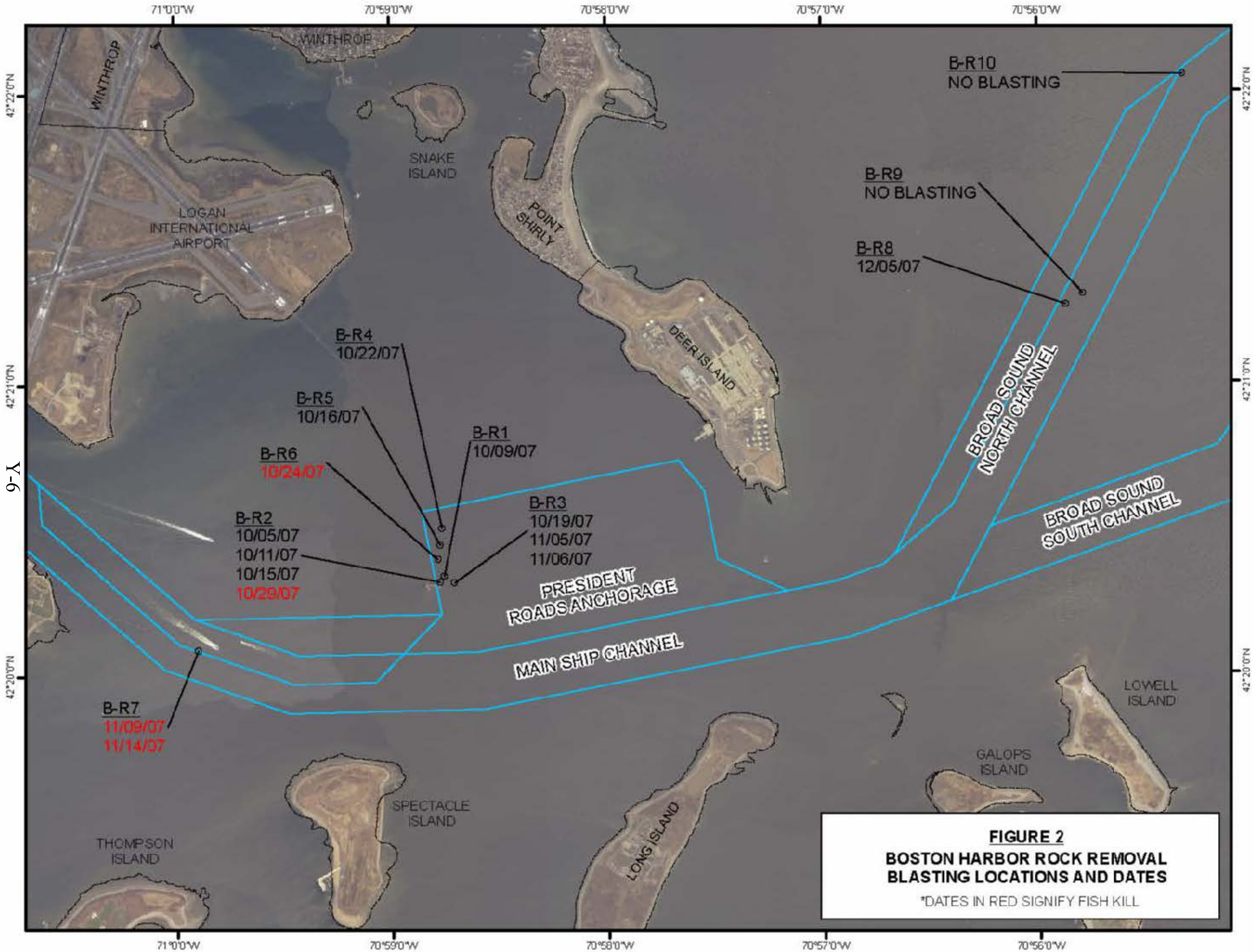


FIGURE 2
BOSTON HARBOR ROCK REMOVAL BLASTING LOCATIONS AND DATES
*DATES IN RED SIGNIFY FISH KILL

Table 2. Information on Each Blast Event

Date (2007)	Location*	Weather Low/High/Rain (^{0}F/inches)	Tide	Time of Blast (PM)	Current Speed (mph)	No. of Bore Holes	Explosive (pounds)	Fish Kill
October 5	PR Anchorage	67/75	2h03m after high tide	3:18	5	34	819	No
October 9	PR Anchorage	52/61	30m before high tide	4:25	15	25	624	No
October 11	PR Anchorage	52/63/.50”	1h21m after high tide	1.23	10	36	897	No
October 15	PR Anchorage	52/66	33m after high tide	2:59	10	34	836	No
October 16	PR Anchorage	52/70	1h08m before high tide	2:00	12	29	702	No
October 19	PR Anchorage	65/70/.50”	2h58m before high tide	2:45	7	30	819	No
October 22	PR Anchorage	65/72	34m before low tide	1:52	10	28	819	No
October 24	**PR Anchorage**	**56/64**	**3h20m before low tide**	**12:54**	**7**	**14**	**351**	**Yes**
October 29	**PR Anchorage**	**37/65**	**12m after high tide**	**2:17**	**10**	**31**	**858**	**Yes**
November 5	PR Anchorage	40/55/.62”	2h08m after low tide	4:05	10	32	858	No
November 6	PR Anchorage	37/51	59m after low tide	3:46	15	34	854.1	No
November 9	**Main Ship Channel**	**32/43**	**45m before low tide**	**4:05**	**5**	**29**	**819**	**Yes**
November 14	**Main Ship Channel**	**37/60**	**3h39m after low tide**	**1:49**	**15/20**	**8**	**214.5**	**Yes**
December 5	North Channel	24/32	55m after low tide	3:11	10	22	565.5	No

*PR Anchorage=President Roads Anchorage

III. Fish Kill Events During Blasting

Despite the construction and operational fish avoidance procedures implemented, as described above in Section C, four fish mortality events were experienced over a three-week period during blast operations in the President Roads Anchorage and Main Ship Channel areas. Table 3 below provides the dates, locations, and information on approximate number of fish observed killed from each blast event. Appendix A provides the number of dead fish species collected for each fish kill event. The length and weight for individuals collected and recorded for three of the four blast events are presented in Appendix B. Length and weights for fish collected during the first blast event, October 24, 2007, were not available. The details for each fish kill event are described below.

Table 3. Date, Location, and Approximate Number of Fish Killed

Date	Location	Approximate Number of Observed Fish Killed
October 24, 2007	President Roads Anchorage	150
October 29, 2007	President Roads Anchorage	1,000
November 9, 2007	Main Ship Channel	900-1,000
November 14, 2007	Main Ship Channel	300

A. Fish Kill Number 1

1. Event Specifics

The first fish kill event occurred on October 24, 2007. The fish observer made two passes on a support vessel with the side scan sonar around the blast zone. The initial sweep identified what was believed to be a school of fish near the surface within the blast area. A second sweep was conducted and no schools of fish were observed. The startle system was removed and the blast sequence initiated. See Section C above. The blast was detonated at 12:54 pm.

After blasting occurred approximately 150 dead or injured fish were observed floating at the surface. The fish observer collected the floating fish, which he counted and identified to species. For this event, 124 rainbow smelt (*Osmerus mordax*), two alewife (*Alosa pseudoharengus*), 23 cunner (*Tautogolabrus adspersus*), three red hake (*Urophycis chuss*), and one butterfish (*Peprilus triacanthus*) were collected.

2. Discussion of a Possible Cause and Corrective Action(s) Taken

The Corps contract specification for rock removal activities required that "If at any time during the implementation of the project, a significant fish kill or significant water quality problem occurs, and can be attributed to the project, all site activities impacting the water shall cease until the source of the problem is identified. Adequate mitigating measures shall be followed as outlined in the contingency plan or upon discussion with the appropriate state and local agencies." Upon observation of the fish kill, the Corps resident engineer directed that all blasting activity cease until a mitigation/contingency plan could be developed through coordination with affected resource agencies (NMFS, MA DMF, and the MA Department of Environmental Protection (MA DEP)). Based on the information received, NMFS stated that they considered this a significant fish kill.

As a follow-up corrective action, the Corps performed a system review to ensure that all equipment was working properly, calibration and monitoring protocols were implemented correctly, and identify corrective measures, if any, to minimize the potential for reoccurrence of a similar event. To verify that the equipment was working properly, a technician from Sonalysts (fish startle system) checked the equipment and confirmed that the system was in fact fully operational and functioning properly.

The fish startle system was located on the blast barge, deployed to a depth of 10 feet off the bottom, and removed from the water approximately one minute prior to the blast, as also outlined in the manufacturer's procedures.

After confirmation that all equipment was properly functioning and that all operational procedures had been followed, it was determined that the fish kill was most likely due to the movement of fish into the blast area after it had been scanned and cleared by the sonar system. Although two passes were made around the blast area and no fish were observed in the second pass, it is probable that fish had moved into the area through a previously scanned and cleared zone while the vessel was completing its sweeping activity of another section of the blast perimeter.

The side scan sonar projects from the vessel down to the bottom at an angle. This could result in a small "inverted cone" of the water column not being scanned as the vessel transits the perimeter of the blast site. To increase the field of vision within the water column, a modified scanning procedure was to be implemented for all future blast events. The fish observer on the sonar vessel was instructed to begin screening for schools of fish as close as possible to the blast center. He then was to move out in a spiral to capture nearly the entire water column from the surface to the bottom throughout the blast area. It was thought that this technique would minimize the potential for fish schools to enter the blast zone undetected.

B. Fish Kill Number 2

1. Event Specifics

The second fish kill occurred during the ninth blast event on October 29, 2007. At approximately 12:30 pm the loading of the charges was completed. At 12:50 pm the fish startle system was deployed from the blast support barge located within the blasting zone. At 1:00 pm the side scan sonar was deployed and activated off a support vessel that moved along the perimeter of the blast zone monitoring for schools of fish. The side scan sonar vessel traversed the majority of the blast zone circumference but avoided that portion of the area where the down tubes are located which could result in severed lines and unexploded charges. The fish observer identified schools of fish transiting the area and subsequently performed additional sweeps (approximately 20) which showed varying amounts of fish within and transiting the area. The fish observer observed and noted that there were unusually high numbers of fish in the area. The side scan sonar had indicated that fish were rapidly moving in and out of the blast area.

As the day progressed, less fish were observed transiting through the area. The fish observer, Contractor and the Corps construction representatives evaluated the situation to try and determine what if any operational conditions might potentially be attracting fish to the blast area and what steps could be taken to discourage fish from entering the project area. Based on the sonar observations it was speculated that the fish were potentially being attracted to the shadow projecting from the barge within the water column. It was also possible that suspended organic debris in the blast area resulting from a nearby dredging operation removing rock from earlier blasts could also be attracting fish to the area. It was generally concluded that moving the barge back from the blast zone as an implementable measure that may serve to reduce fish in the area.

At 2:02 pm the barge started to pull back from the blast zone. Once this was accomplished, the Contractor assumed that it was necessary to commit to initiating the blast sequence within 10 minutes since the fish startle system was relocated beyond the range of effectiveness for the entire blast zone. Vendor specifications state that the startle system should be deployed until 10 minutes before the blast since fish would not return to the area until 15 minutes after deactivation.

In the event blasting does not occur, the barge can not be moved back into the blast area due to the presence of the down tubes that run from the barge to the charges set along the bottom. Moving the blast barge into the area after it is "backed out" would likely entangle the down tubes which could result in an incomplete blast posing a significant safety hazard to both the crew and other vessels.

The charges were set off at approximately 2:17 pm and dead fish were observed floating in the blast zone. The fish observer estimated that approximately 1,000 small bait fish floated to the surface after the blast. He began to collect the fish for analysis and identification. Seagulls were feeding on some of the floating fish during the collection. The fish collected post-blast included 103 alewife, 18 blueback herring (*Alosa aestivalis*), 30 menhaden (*Brevoortia tyrannus*), 38 Atlantic herring (*Clupea harengus harengus*), 16 rainbow smelt, five cunner, and four red hake. The fish were then delivered to MA Division of Marine Fisheries (Ms. Tay Evans). Fish lengths and weights were also recorded and are included in Appendix B.

2. Discussion of a Possible Cause and Corrective Action(s) Taken

The resulting fish kill appears to be the result of a miscommunication between the fish observer and the Contractor who believed he needed to execute the blast within 10 minutes of the removal of the fish startle system from the area and not wait for an “all clear” from the fish observer. As a result of this blast event, the following changes to blast protocols were instituted to minimize the potential for additional fish kills:

- Fish Startle System: The Contractor is to deploy the fish startle system on an alternate and more mobile vessel instead of on the blast barge. This is to allow the fish startle system to remain operational and mobile in the blast area while the blast barge is being pulled back from the area to minimize potential "attraction" to the barge shadow. It will also allow the startle system to be redeployed to the area in the event blasting is not initiated since it will have the ability to enter the area so as to not impact down tubes.
- Dredging at Adjacent Areas: Dredging at adjacent areas will be curtailed if it is determined that it is the source of any detrital plumes impacting the blast area which could potentially be acting as an attractant to fish. Dredging would be allowed to continue only during portions of a tidal cycle that results in a plume trajectory away from the blast zone.
- Improved Communication: All parties will be clearly informed of communication pathways and roles and responsibilities relative to fish observance and blast initiation. It will be emphasized that it is the sole responsibility of the fish observer to give the “all clear” signal to initiate the blasting sequence based on fish observations. The fish observer would not signal for initiation of the blast sequence until he determined, through use of the side scan sonar and any other observations that there were no schools of fish present in the blast area. The only overriding condition would be the need to initiate the blast sequence for safety reasons as directed by the safety officer. One example would be when it would be necessary to initiate a blast sequence to comply with the “45minutes prior to sunset” provision. At this point blasting must be initiated due to safety considerations and to comply with safety regulations. All involved parties are to be made aware of these protocols and the need for clear and constant communication between the fish observer and the blast barge personnel.

It is also noted that the blasting safety officer reserves the right to override the fish observer in the event that a situation develops which could jeopardize human safety. The safety officer would communicate the reasons for the override to the fish observer prior to the initiation of the blast sequence which would be documented in both the blast report and the fish observer report. An additional overriding safety requirement is that once the blast sequence is initiated with the first five minute warning blast, the blast must continue according to safety regulations.

C. Fish Kill Number 3

1. Event Specifics

The third fish kill was observed after the 12th blast event on November 9, 2007. Normal sequencing protocols were followed which incorporated the corrective actions identified after the second fish kill event. The fish startle system was deployed at 3:38 pm and removed at 4:02 pm. Schools of fish were observed sporadically on the side scan sonar transiting through the area. The barge was moved 250 feet outside the blast area. Once it was determined that no fish were in the area, an “all clear” signal was given by the fish observer and the blasting sequence was initiated. Blasting occurred at 4:05pm, approximately 45 minutes before sunset. The corrective actions implemented after fish kill #2 were implemented for this blast event.

After the blast, approximately 900 to 1,000 fish were observed floating on the surface. Less than 100 fish were collected with a dip net until no more fish were observed at the surface. As in previous events seagulls fed on the floating fish. The majority of the fish collected were blueback herring (80) and menhaden (14). The length, weight, and species of fish collected were recorded.

2. Discussion of a Possible Cause and Corrective Action(s) Taken

For safety reasons, blasting needed to be initiated 45 minutes before sunset. Although no fish were observed when the “all clear” signal was given by the fish observer, it is possible that because fish had been previously seen sporadically transiting the project area on the side scan, that some of these fish moved into the blast area after the “all clear” signal was given.

D. Fish Kill Number 4

1. Event Specifics

The fourth and last fish kill event occurred after the 13th blast event on November 14, 2007. Approximately 300 fish were observed floating or being eaten by the seagulls, far less fish than the last fish kill event. About one-fourth the amount of explosives was used for the third fish kill than was used for this blast event. Only six fish were collected, mainly due to gusty winds and wave action which carried the fish out of the area. All the fish collected were menhaden. Lengths and weights were recorded and presented in Appendix B.

2. Discussion of a Possible Cause and Corrective Action(s) Taken

As in Event #3, the corrective actions recommended after Fish Kill Event Number 2 were implemented during this event. The fish startle system was located on a separate boat, no dredge plume from adjacent dredging operations were observed in the area, and the blasting sequence was not initiated until after the fish observer has swept the area and had given an “all clear” signal.

After this event it was agreed that the Corps agreed would prepare an “After Action Report” to document the blasting operations and fish kill events to discuss lessons learned and possible recommendations for consideration in the development of a comprehensive blasting plan for the upcoming Boston Harbor Deep Draft Project.

E. Note

After the last blast event on December 5, 2007, it was noted that one fish, a menhaden (97 mm long and weighing 8 grams), was observed floating at the surface in the Broad

Sound North Channel. There were no other fish observed floating at the surface after the blast.

IV. Lessons Learned and Corrective Actions to be Instituted for Future Blast Events

Based on the events that occurred in 2007 during rock removal operations, the following recommendations should be considered for implementation for future blasting events.

A. Communication Plans

1. Fish Observer/Contractor Communication Plan

The contract specification on fish protection will clearly identify, with the exception of an overriding safety issue as identified in the previous sections, that it is the sole responsibility of the fish observer to determine when conditions are favorable for the blasting sequence to be initiated based on fishery observations. The fish observer will give approval for initiation of the blast sequence until s/he has determined, through use of appropriate technology, that no schools of fish are present in the blast area. However, it is recognized that the on-site safety officer has the authority and responsibility to override the fish observer's determination at those times when either safety concerns or regulatory compliance becomes an issue. The specifications will outline required protocol and the need for clear and constant communication between the fish observer and the blast barge personnel.

2. Fish Observer Reports

The fish observer will prepare an after action report for all blast events monitored, regardless of whether the event resulted in a fish kill. The report should include the date and time monitoring was initiated, deployment and retrieval of the fish startle system, the time of the blast, current speed and direction, tidal conditions, and weather observations throughout the day, and other pertinent observations. The fish observer will note if fish were observed in the project area prior to blasting and if there were any dead or injured fish after the blast. The fish observer must record the number of fish killed or injured, and species including representative sizes and weights. Any equipment or operational issues that may have contributed to the fish kill will also be noted.

The fish observer will report his/her findings to the Resident Engineer for each day of blasting. The Resident Engineer will compile the previous week's reports and forward to the Project Manager or Study Manager and the Environmental Resources Team Member. If a fish kill is observed, the Resident Engineer will notify the Project Manager or Study Manager and the Environmental Resources Team Member immediately. Pertinent information along with the fish observer's report will be forwarded to the above parties as soon as possible. Based on the fish observer's report, the Project Manager, or Study Manager, will convene a meeting with the Resident Engineer and appropriate personnel to discuss events and to determine what, if any, corrective actions can be taken to reduce the changes of further fish kills.

3. External Communication Plan

In the event of a fish kill, the Project Manager or Environmental Team Member will notify the appropriate resource agencies as soon as possible after the event. Additional communication will occur as soon as all pertinent facts and issues surrounding the event have been determined. In the case of the Boston Harbor Deep Draft Project, the NMFS, U.S. EPA, MA DEP, MA DMF, MA Coastal Zone Management Office, and Massport will receive a copy of the fish observers report along with other factual information. If determined necessary, a meeting and/or conference call will be scheduled between the Corps, Massport, and the resource agencies to discuss and identify potential corrective measures. These measures will then be forwarded along with the fish observer report to the agencies.

B. Operational Changes to Minimize Potential for Fisheries Impact

The Contractor will deploy the fish startle system on an alternate vessel instead of the blast barge to allow greater coverage of the blast area and extend duration of the systems deterrence action just prior to blasting. This will allow the fish startle system to stay deployed in the blast area while allowing the blast barge to be pulled back from the area to minimize potential fish "attraction" to the barge shadow in the water column.

It is possible that a dredging plume may serve as an attractant to the fish towards the blast zone. Consequently, it is recommended that any dredging activities adjacent to the area of blasting occur when tidal conditions allow for the transport of resuspended material to move any residual plumes away from the blast area(s).

Additional conversation among the Corps, their blasting contractor, and the fish observer resulted in identifying some additional operational steps that could potentially be taken for future blasting events to help deter the presence of fish in the blast area. These included the use of setting off small charges in the blast area to "scare" the fish from the area or perhaps using bait to attract the fish to another area. After further discussion with the blasting contractor the use of small charges as a deterrent was dismissed since the blast is set off through a percussion process. Small charges could prematurely set of the blast for a percussion process which would constitute a significant safety hazard. Small charges can only be used when electric charges are used.

"Baiting" was another suggestion to draw fish away from the blast zone. However, it would likely act as an attractant for other fish and could make the situation worse. Also, since the target species (herring) are primarily planktonic feeders, appropriate bait was questionable.

V. Discussions for Development of a Blast Plan

In order to move the development of a formal blast plan for both the upcoming Boston Harbor Deep Draft Project and other similar type Corps projects forward, scheduled meetings should be held with the blast subgroup of the Technical Working Group for the Boston Harbor Deep Draft Project. This subgroup would identify blast issues that require further discussion, research, and resolution for incorporation into the plan. At a minimum, the following items should be included for discussion:

- Significance – What constitutes a significant fish kill and what would determine the need for corrective actions, and mitigative measures?
- Mitigation Measures and Operational Approaches – What are the available mitigation measures that can be incorporated into the blast plan? What approaches should be considered and incorporated into the dredge plan to minimize impacts to fisheries?
- Time of Year and Sequencing – Time of year and sequencing approaches based on the presence of fish resources should be explored with the resource agencies as a mitigative tool to minimize blasting impact to fishery resources.

Discussion with the resource agencies should occur to determine, based on the species of concern prevalent in the harbor, and the amount of rock to be blasted in the various harbor locations, what time of year blasting should occur in the harbor and in which location or tributaries.

C. Plan of Action for Fish in the Blast Zone

A discussion of alternatives, if any, should be considered for those times when the side scan sonar survey indicates large numbers of fish are in the blast zone throughout the day and the charges have been set. According to the fish observer (personal communication June 17, 2008), no fish were observed on the side scan sonar during the non-fish kill events. (The exception to this is the first fish kill; during this event, no smelt were observed on the sonar.) This would indicate that, in general, the sonar can and did detect schools of fish in the blast area. There may be days when a suitable time to initiate blasting is not available due to the presence of fish observed in the blast area. Alternatives, if available, should be explored when this condition arises. Safety may dictate that blasting will need to be initiated, even if there are schools of fish in the area.

APPENDIX A

Table A-1. Number and Fish Species Collected By Blast Date

Common Name	Latin Name	Fish Kill Dates (2007)				Total Number of Fish Collected
		October 24	October 29	November 9	November 14	
Alewife	*Alosa pseudoharengus*	2	103			**105**
Atlantic herring	*Clupea harengus harengus*		38			**38**
Blueback herring	*Alosa aestivalis*		18	80		**98**
Butterfish	*Peprilus triacanthus*	1				**1**
Cunner	*Tautogolabrus adspersus*	23	5			**28**
Menhaden	*Brevoortia tyrannus*		30	14	6	**50**
Rainbow smelt	*Osmerus mordax*	124	16			**140**
Red hake	*Urophycis chuss*	3	4			**7**
Total Number of Fish Collected		**153**	**214**	**94**	**6**	**467**

APPENDIX B

Table B-1. Length and Weight of Fish Species Collected October 29, 2007

Alewife		Atlantic Herring		Blueback Herring		Cunner		Menhaden		Rainbow Smelt		Red Hake	
L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)
135	18	138	20	123	17	58	3	98	8	103	5	92	4
157	28	118	11	139	19	55	2	99	9	105	6	80	3
145	26	136	18	155	27	75	8	100	9	125	10	72	2
142	22	158	25	143	22	53	2	102	7	135	14	62	1
137	20	143	22	127	14	38	1	100	11	117	8		
167	37	160	30	120	12			99	10	105	6		
138	19	140	20	125	13			92	7	111	8		
153	29	156	30	137	18			82	5	120	8		
167	38	140	21	143	17			83	7	92	4		
226	94	150	22	120	12			95	7	123	11		
146	23	152	22	119	11			92	8	100	5		
147	24	152	28	117	12			102	11	127	11		
194	70	150	26	137	19			95	7	130	12		
135	19	170	40	141	20			100	9	115	9		
146	26	182	43	120	13			100	9	111	7		
1X*	17	160	30	132	18			81	7	112	7		
167	40	143	23	139	20			85	5				
150	26	152	24	120	13			100	9				
156	27	136	20	122	13			98	8				
148	26	169	33					85	6				
130	17	150	24					110	13				
145	25	134	27					92	7				
145	25	138	20					93	8				
139	20	177	41					113	13				
132	18	162	33					89	6				
150	23	165	34					88	7				
150	26	140	18					100	10				
160	32	130	17					92	7				
145	30	145	21					93	7				
169	39	148	24					100	9				
144	23	140	20										

*1X = No Tail

Table B-1 (cont.). Length and Weight of Fish Species Collected October 29, 2007

Alewife		Atlantic Herring		Blueback Herring		Cunner		Menhaden		Rainbow Smelt		Red Hake	
L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)
155	27	141	20										
150	27	142	22										
135	20	158	30										
145	22	138	20										
138	19	144	24										
153	28	150	25										
153	32	128	16										
152	28												
177	40												
138	20												
157	32												
148	24												
162	32												
130	17												
133	19												
165	36												
145	23												
158	30												
135	18												
135	20												
157	32												
142	21												
134	18												
150	26												
157	29												
136	20												
156	27												
155	30												
141	20												
155	29												
137	19												
158	34												

Table B-1 (cont.). Length and Weight of Fish Species Collected October 29, 2007

Alewife		Atlantic Herring		Blueback Herring		Cunner		Menhaden		Rainbow Smelt		Red Hake	
L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)
149	25												
142	23												
171	38												
149	23												
158	31												
143	23												
138	22												
129	17												
151	27												
156	29												
155	29												
155	29												
135	20												
168	37												
139	20												
135	17												
156	27												
177	45												
138	20												
157	28												
140	22												
129	16												
161	31												
161	35												
152	28												
130	17												
167	36												
139	20												
147	24												
147	25												
148	24												
145	23												

Table B-1 (cont.). Length and Weight of Fish Species Collected October 29, 2007

Alewife		Atlantic Herring		Blueback Herring		Cunner		Menhaden		Rainbow Smelt		Red Hake	
L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)	L (mm)	W (g)
145	24												
150	25												
166	33												
149	25												
173	40												
150	26												
142	21												
128	16												

Table B-2. Length and Weight of Fish Species Collected November 9, 2007

Blueback Herring				Menhaden	
Length (mm)	Weight (g)	Length (mm)	Weight (g)	Length (mm)	Weight (g)
99	7	102	8	75	4
100	7	94	6	108	12
89	5	93	6	96	9
93	6	88	5	83	6
98	7	98	6	70	4
90	5	94	6	61	2
95	6	100	7	70	3
103	8	97	7	64	2
93	6	92	6	81	5
94	6	93	6	54	2
97	8	97	7	80	5
95	8	97	7	60	2
113	11	90	6	59	2
105	9	93	6	57	2
96	8	97	7		
101	9	96	6		
108	10	106	9		
90	6	87	5		
98	7	104	9		
103	9	92	6		
96	6	88	5		
99	7	104	8		
104	8	94	7		
85	5	98	7		
95	7	96	7		
93	6	99	7		
103	8	100	8		
101	7	90	6		
113	10	91	5		
94	6	90	5		
94	6	97	7		
96	7	94	5		
108	9	90	6		
92	6	91	6		
96	7	85	5		
90	6	99	7		
100	7	96	7		
92	6	99	7		
91	6	110	9		
90	6	99	7		

Table B-3. Length and Weight of Fish Species Collected November 14, 2007

Menhaden	
Length (mm)	**Weight (g)**
90	6
62	2
50	1
61	2
51	1
65	3

BOSTON HARBOR
MASSACHUSETTS

DEEP DRAFT
NAVIGATION IMPROVEMENT STUDY

FINAL FEASIBILITY REPORT
AND FINAL SUPPLEMENTAL
ENVIRONMENTAL IMPACT STATEMENT
AND MASSACHUSETTS
FINAL ENVIRONMENTAL IMPACT REPORT

APPENDIX Z

UNDERWATER SOUND RESULTS
FOR BLASTING IN BOSTON HARBOR
SEPTEMBER 2012 ROCK REMOVAL

THIS APPENDIX HAS REPLACED THE REPORT INCLUDED IN THE JULY 2008 DRAFT

September 10, 2012

Mr. Craig Burnham
Burnham Associates Inc.
14 Franklin Street
Salem, Ma 01970

Re: Underwater Sound Results for Blasting in Boston Harbor – September 6, 8 and 10 Blasts

Dear Craig:

Tech Environmental (TE) is please to provide this report on the underwater sound monitoring done during the blasts on September 6, 8, and 10 to clear navigational hazards in Boston Harbor.

Methods and NMFS Sound Criteria

Undersea sound measurements were made with a calibrated Bruel & Kjaer (B&K) model 8104 Hydrophone on a custom-made 100-meter cable, connected through a charge amplifier to a calibrated B&K model 2250 Type 1 Sound Analyzer. TE positioned the hydrophone in the lower third of the water column, and began logging sound levels at least 1 minute prior to the blast event and continued 1 minute after the blast event. The sampling train is designed to measure undersea sound over a spectrum of 12 Hz to 20 kHz, which covers the hearing range of most marine mammals. The equipment measured sound pressure levels (rms) in dBL re 1 micro-Pascal (µPa) and data were logged at 100-ms intervals. Both broadband and 1/3-octave band measurements were made.

The National Marine Fisheries Service (NMFS) guidelines, as listed in Section 1.3.3.1(d) of your permit, are as follows. The onset of Level A (injury) harassment is 205 dB re 1 μPa^2-sec. The onset of Level B harassment is 182 dB re 1 μPa^2-sec (non-injury/physiological) and 177 dB re 1 μPa^2-sec (behavioral). The Level B thresholds apply for the energy flux density (EFD) in any 1/3-octave band. Demonstrating that the broadband EFD does not exceed 177 dB re 1 μPa^2-sec satisfies all three NMFS guidelines.

From the time series sound pressure level measurements, EFD was calculated using the method by Madsen[1]:

$$\text{EFD [dB re 1 } \mu\text{Pa}^2\text{-sec]} = \text{rms-Sound Pressure Level [dB}_{rms}\text{ re 1 } \mu\text{Pa]} + 10 \cdot \log_{10}(T) ,$$

where the duration T is given by the time that incorporates 90% of the total energy of the impulse wave.

[1] Madsen, P.T., "Marine mammals and noise: problems with rms sound pressure levels for transients," J. Acoust. Soc. Am. **117**(6), June 2005.

Blast Report Data

On September 6, the blast event occurred at 4:11 p.m. and consisted of 12 delays (each consisting of a 17 to 32 lb charge) timed 25-ms apart with an approximate total duration of 300 milliseconds (ms). The total powder loaded was 314 pounds of Hydromite. The hydrophone was positioned at a setback distance of 600 feet from the detonation area.

On September 8, the blast event occurred at 11:17 a.m. and consisted of 15 delays (each consisting of a 6.25 to 33.5 lb charge) timed 25-ms apart with an approximate total duration of 375 milliseconds (ms). The total powder loaded was 407 pounds of dynamite. The hydrophone was positioned at a setback distance of 783 feet from the detonation area.

On September 10, the blast event occurred at 11:42 a.m. and consisted of 17 delays (each consisting of a 17.8 to 38.8 lb charge) timed 25-ms apart with an approximate total duration of 425 milliseconds (ms). The total powder loaded was 554 pounds of dynamite. The hydrophone was positioned at a setback distance of 930 feet from the detonation area.

Measured Underwater Sound Pressure Levels and EFD

Figures 1, 2 and 3 present the 100-ms rms-sound pressure levels (dB_{rms} re 1 µPa) as a function of time for the blasts on September 6, 8 and 10, respectively. The series of detonators going off produce the initial rise in sound pressure level. Then, the blast wave arrives at the hydrophone. Given the proximity to Castle Island and the relatively shallow waters of the harbor (38 to 50 feet at the time of the blasts), there were echoes of the pressure wave from shore and the harbor bottom, extending the acoustic event out to about 3 seconds in length in each acse. The duration T, representing 90% of the total cumulative energy of the event, is a much shorter time due to the logarithmic nature of the decibel scale.

Blast 1 - September 6

The rms-sound pressure level corresponding to the ramp-up 5% threshold of total cumulative energy is 170 dB_{rms} re 1 µPa. The distance on the graph between the 170 dB values at ramp-up and ramp-down is approximately T = 0.9 seconds.

The rms-sound pressure level over T was calculated as the energy-average of the nine 100-ms values within the 90%-pulse area and equals 187.6 dB_{rms} re 1 µPa. The calculated broadband EFD is thus 187.6 – 0.5 = **187.1 dB re 1 µPa^2-sec** at a setback distance of **600 feet** for a maximum powder/delay of 32 pounds (Hydromite).

Blast 2 - September 8

The rms-sound pressure level corresponding to the ramp-up 5% threshold of total cumulative energy is 169 dB_{rms} re 1 µPa. The distance on the graph between the 169 dB values at ramp-up and ramp-down is approximately T = 0.9 seconds.

The rms-sound pressure level over T was calculated as the energy-average of the nine 100-ms values within the 90%-pulse area and equals 187.6 dB_{rms} re 1 µPa. The calculated broadband EFD is thus 186.6 – 0.5 = **186.1 dB re 1 µPa^2-sec** at a setback distance of **783 feet** for a maximum powder/delay of 32 pounds (dynamite).

Blast 3 - September 10

The rms-sound pressure level corresponding to the ramp-up 5% threshold of total cumulative energy is 166 dB_{rms} re 1 µPa. The distance on the graph between the 166 dB values at ramp-up and ramp-down is approximately T = 0.8 seconds.

The rms-sound pressure level over T was calculated as the energy-average of the eight 100-ms values within the 90%-pulse area and equals 184.2 dB_{rms} re 1 µPa. The calculated broadband EFD is thus 184.2 – 1.0 = **183.2 dB re 1 µPa^2-sec** at a setback distance of **930 feet** for a maximum powder/delay of 32 pounds (dynamite).

Comparison of Results to NMFS Criteria

Blast 1 - September 6

The measured EFD of 187.1 dB re 1 µPa^2-sec is below the NMFS Level A (injury) threshold for the setback distance of 600 feet. Whereas the broadband EFD is above the Level B (non-injury/ physiological) and Level B (behavioral) thresholds, it was necessary to look at the data for the individual 1/3-octave bands and find the band with the highest EFD, which is the band with the highest rms-sound pressure level within the period T. These data are graphed in Figure 4. **The 125 Hz band has the highest EFD at 179.2 dB re 1 µPa^2-sec**. The 50 Hz band has the second-highest EFD at 176.1 dB re 1 µPa^2-sec. Whereas the highest band EFD is slightly above the NMFS Level B (behavioral) threshold of 177 dB re 1 µPa^2-sec, the exclusion zone for this blast needs to be increased slightly. Attenuation of 2.2 dB is achieved under spherical wave spreading (which is the best approximation for close source-receiver distances) by increasing the distance from 600 feet to 773 feet.

Blast 2 - September 8

The measured EFD of 186.1 dB re 1 µPa^2-sec is below the NMFS Level A (injury) threshold for the setback distance of 783 feet. Whereas the broadband EFD is above the Level B (non-injury/ physiological) and Level B (behavioral) thresholds, it was necessary to look at the data for the individual 1/3-octave bands and find the band with the highest EFD, which is the band with the highest rms-sound pressure level within the period T. These data are graphed in Figure 4. **The 315 Hz band has the highest EFD at 177.4 dB re 1 µPa^2-sec**. Whereas the highest band EFD rounded to a whole decibel meets the NMFS Level B (behavioral) threshold of 177 dB re 1 µPa^2-sec, the exclusion zone for this blast is 783 feet.

Blast 3 - September 10

The measured EFD of 183.2 dB re 1 µPa^2-sec is below the NMFS Level A (injury) threshold for the setback distance of 930 feet. Whereas the broadband EFD is above the Level B (non-injury/ physiological) and Level B (behavioral) thresholds, it was necessary to look at the data for the individual 1/3-octave bands and find the band with the highest EFD, which is the band with the highest rms-sound pressure level within the period T. These data are graphed in Figure 4. **The 400 Hz band has the highest EFD at 177.2 dB re 1 µPa^2-sec**. Whereas the highest band EFD rounded to a whole decibel meets the NMFS Level B (behavioral) threshold of 177 dB re 1 µPa^2-sec, the exclusion zone for this blast is 930 feet.

Conclusions

The exclusion zone is determined by the distance needed to reduce the peak 1/3-octave band Energy Flux Density (EFD) to 177 dB re 1 µPa^2-sec or less, the most restrictive of the three NMFS underwater sound guidelines. The underwater sound measurements made during the September 6 and 8 blasts in Boston Harbor both established an exclusion zone distance of roughly 780 feet to ensure compliance with all NMFS Level A and Level B harassment thresholds. The measurements made during the September 10 blast, however, suggest a much larger exclusion zone distance of 930 feet is necessary.

Normalized by distance, the peak 1/3-octave band EFD for the September 10 blast released 35% more energy than the September 8 blast. Both of those blasts used dynamite, and the September 10 blast had a total powder charge 36% larger than that of the September 8 blast. We conclude that if future blasts on this project do not exceed the total powder charge of the September 10 blast (554 pounds) that an exclusion zone of 930 feet should be sufficient to ensure compliance with the NMFS Level A and Level B thresholds. These results are specific to the site of the blast (type of sediment, water depth, water currents, charge layout, distance to shore) and the charges used. Sound levels for other blasts in Boston Harbor may reveal slightly different results.

Please call if you have any questions.

Sincerely yours,

TECH ENVIRONMENTAL, INC.

Peter H. Guldberg

Peter H. Guldberg, INCE, CCM
President
3583/Report Sept 10 2012

Figure 1. Underwater Blast Event #1 Boston Harbor
September 6, 2012

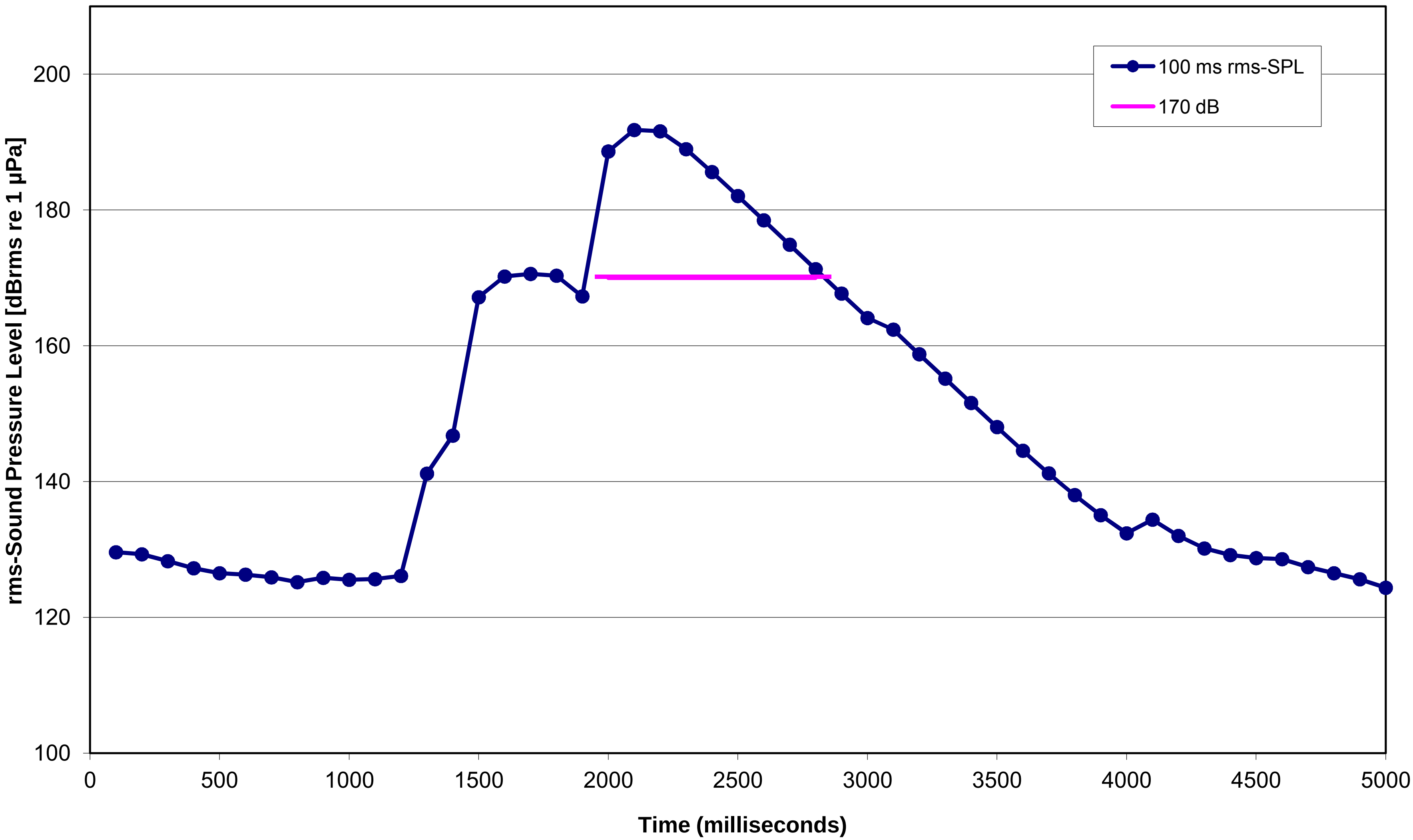


Figure 2. Underwater Blast Event #2 Boston Harbor
September 8, 2012

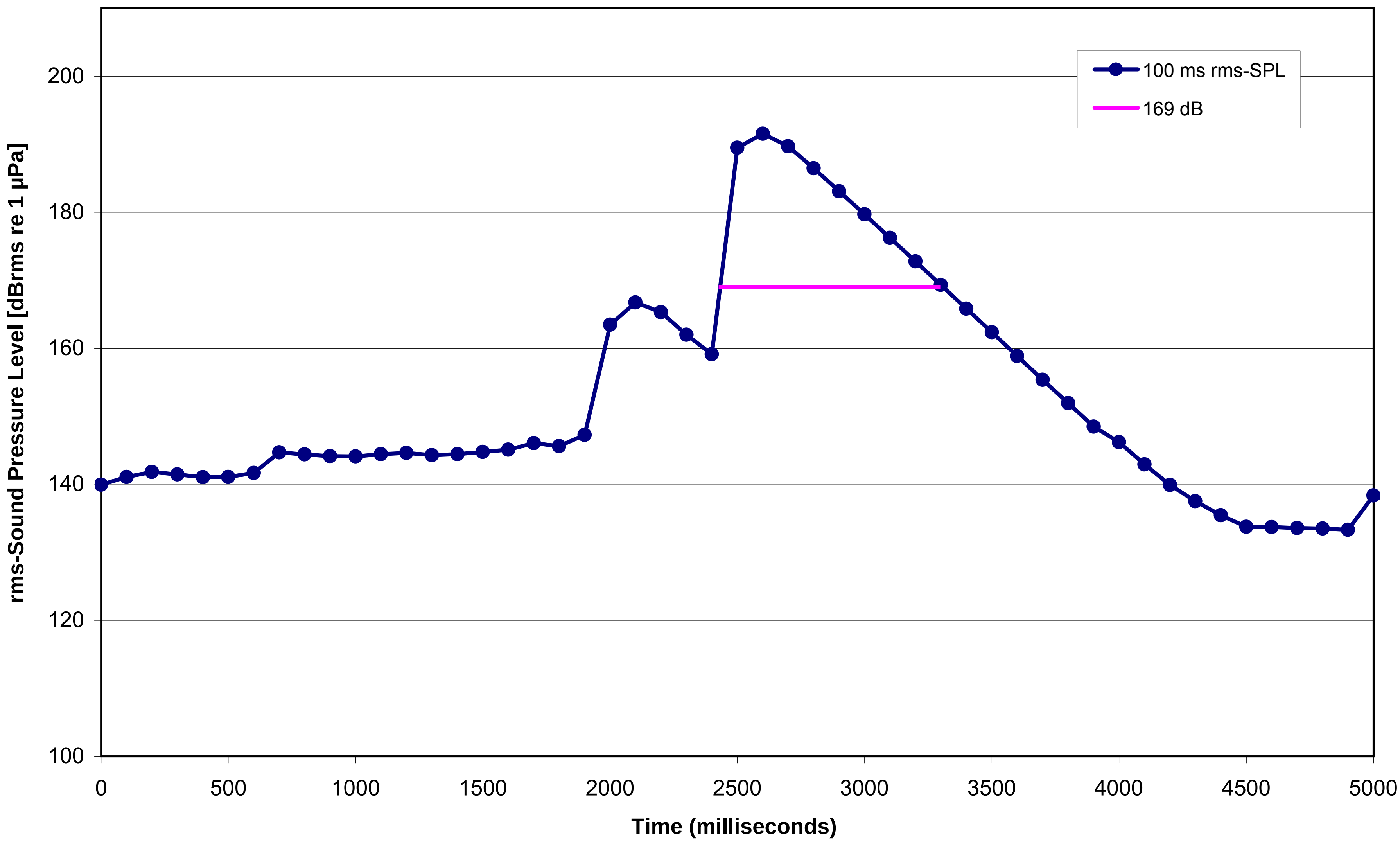


Figure 3. Underwater Blast Event #3 Boston Harbor
September 10, 2012

Figure 4. 1/3 Octave Band Energy Flux Density From Blast Events