Response to USEPA Questions
Commonwealth of Massachusetts
October 22, 2012
New Bedford Marine Commerce Terminal (NBMCT)

Introduction

Thank you for this opportunity to provide USEPA additional information related to the development of the NBMCT. Development of this facility represents an important opportunity to deliver lasting environmental benefits to the New Bedford region, as well as accelerate economic development throughout the region.

This document provides responses to some of the USEPA's questions and requests for information submitted by letter dated October 5, 2012 and submitted by e-mail dated October 17, 2012. This document also provides responses from the Commonwealth to comments of EPA on the Commonwealth's Draft Final Mitigation Plan issued via e-mail on October 19, 2012. Please note that the Commonwealth's Final Mitigation Plan and the Commonwealth's Construction Management Plan are being submitted concurrently with this document (but is not attached to this document).

The format of the document will follow a comment–and-response outline, where each of the USEPA Comments will be listed in the order in which they were presented in the USEPA's Memoranda with the Commonwealths Response to each Comment presented immediately thereafter.

Question (Item 2 From EPA's October 5, 2012 Letter): We told the Commonwealth that it would need to respond to recommended conditions in NMFS's letter concerning Endangered Species Act and Essential Fish Habitat, including narrow dredging windows and other mitigation measures. Now that the Commonwealth has convened consultations with NMFS staff directly, NMFS issued a revised letter and the Commonwealth agreed to provide the scientific basis for EPA to respond to NMFS's EFH recommendations and to complete informal consultation under the ESA. While we have received a draft letter on September 28, we have not yet received a final letter.

EPA position: We need to receive a final letter from the Commonwealth that provides the scientific basis for responding to NMFS's EFH recommendations and completing informal consultation under the ESA by October 12 and supplemental acoustical studies by October 22. We will then need to get rapid review and concurrence from NMFS on modified EFH conditions and concurrence on our conclusions related to the ESA.

Response: On October 4, 2012, the Commonwealth forwarded to EPA the final letter referenced in the (above) comment. A copy of this letter is attached as **Appendix 1** to this document for reference. As referenced in the comment, EPA has requested that the Commonwealth provide certain scientific studies supporting the conclusions and assertions represented in the Commonwealth's October 4, 2012 letter. Specifically, the EPA has requested the Commonwealth submit: 1) an Addendum to the Essential Fish Habitat Assessment that addresses questions from NOAA's National Marine Fisheries Service (NMFS) letter of August 21, 2012; and 2) a Biological Assessment of temporary impacts to Atlantic Sturgeon from site construction activities (including results of acoustic modeling of various sound/vibration emitting activities that will be part of the construction). To that end, the Commonwealth is submitting, attached to this memorandum, the following documents:

- "Essential Fish Habitat Assessment Addendum", dated October 19, 2012 (**Appendix 2**); and
- "Biological Assessment for the Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus* - New Bedford Harbor Marine Commerce Terminal, New Bedford, MA", dated October 22, 2012 (**Appendix 3**).

Taken together, these two documents respond to the question presented above.

The *Essential Fish Habitat Assessment Addendum* provides responses to questions submitted to EPA by NOAA National Marine Fisheries Service (NMFS). It provides details as to the likely presence or absence of certain aquatic species in New Bedford Harbor, and describes alternate mitigation measures to minimize impacts to the potential resources of the harbor.

The *Biological Assessment for the Atlantic Sturgeon, Acipenser oxyrinchus oxyrinchus - New Bedford Harbor Marine Commerce Terminal, New Bedford, MA* provides information concerning the potential habitat ranges for Atlantic Sturgeon and presents acoustic modeling data for various sound and/or vibration generating activities that will be undertaken as part of the construction of the facility.

The results of these studies further inform the Commonwealth's enhanced mitigation efforts to minimize and ameliorate temporary impacts of the project on aquatic resources, and support the actions which the Commonwealth proposes to undertake in that regard, namely:

1. The use of a Fish Exclusion system within the work area during the time of year of concern (submitted by the Commonwealth on October 17, 2012 to EPA) to keep potential fish species of concern from entering the work area during that time period; and
2. Engineering controls on blasting (rock removal) activities, in the form of the use of bubble curtains as an acoustic damping measure if blasting must occur between January 15 and June 30 of any year.

Question (EPA's Comments on Section 9.0 from EPA's October 19, 2012 Comments on the Commonwealths' Draft Final Mitigation Plan): EPA provided multiple comments requesting a 95% performance standard for multiple mitigation areas rather than the standard of 80% proposed by the Commonwealth.

Response: The Commonwealth believes that the 95% standard proposed by EPA is too stringent, and could result in unnecessary work that could hinder the functioning of a mitigation measure that is generally performing within reasonable bounds. The Commonwealth realizes that EPA is requesting a higher standard, and therefore proposes 90% as a reasonable compromise between EPA's requests and what the Commonwealth is prepared to meet. The Commonwealth has revised its mitigation plan to accommodate that change.

APPENDIX 1

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October 4, 2012

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Re: Response to National Oceanic and Atmospheric Administration – National Marine Fisheries Service, Northeast Region Comments on the Draft Determination for the Proposed South Terminal Project, New Bedford, Massachusetts

Dear Ms. Stanley:

Following an August 21, 2012 comment letter to EPA from the National Marine Fisheries Service (NMFS) on the Draft Determination for South Terminal in New Bedford, MA, the Commonwealth convened our team, including our fisheries experts at the Massachusetts Division of Marine Fisheries and project engineers, to meet with NOAA's Regional Administrator John Bullard and NMFS staff to provide a full briefing of the project and detail the project's significant environmental benefits to New Bedford Harbor. At the meeting, we explained the extensive mitigation that the Commonwealth has committed to conduct in the areas of winter flounder habitat, salt marsh restoration, and shellfish reseeding. Additionally, we had the opportunity to clarify and address NMFS concerns regarding impact to fisheries. This letter serves to summarize the Commonwealth's conversation with NMFS and detail the collective approach that has been devised that allows the project to be completed in a manner that protects the potentially impacted resources while maintaining the critical project elements to meet the intended project purpose.

At the meetings, which took place at the Massachusetts Executive Office of Energy and Environmental Affairs on September 21 and 28, 2012, we discussed three main points relative to impacts on fishery resources regarding the South Terminal project: mitigating potential impacts to the endangered Atlantic sturgeon, designing engineering controls to protect winter flounder and anadromous fish species, and refining the Commonwealth's proposed shellfish mitigation plan.

Atlantic Sturgeon

Atlantic sturgeon (*Acipenser oxyrinchus*) is a migratory anadromous species, migrating from the open ocean to coastal rivers to spawn in the spring. All coastal waters along the East Coast, including Buzzards Bay and New Bedford Harbor, are *potential* habitat for Atlantic sturgeon. However, according to NMFS, Atlantic sturgeon are only currently present in approximately 32 rivers from from St. Croix, ME to the Saint Johns River, FL. In Massachusetts, Atlantic sturgeon have been observed along the coast, but have not been observed spawning in the Taunton River (the closest historical spawning river to New Bedford Harbor) for over 15 years (NMFS letter to EPA dated 6-19-12). Additionally, DMF has never spotted the species at or near New Bedford Harbor. In fact, according to NOAA's Distribution and Abundance of Fishes and Invertebrates in Mid-Atlantic estuaries, Atlantic sturgeon have not been observed in Buzzards Bay, and furthermore are listed as rare in Buzzard's Bay under the basis of "reasonable inference" (Stone et al. 1994).

DMF assesses the potential for spawning and forage habitat in all waterbodies for species of concern with respect to impacts from construction projects, including Atlantic sturgeon (Evans et al. 2011). However, New Bedford Harbor has several important characteristics that make it an unlikely environment for Atlantic sturgeon including: a severely restricted entrance (the hurricane barrier) that is constantly monitored, a large amount of vessel traffic, a large seafaring population surrounding the harbor, an extensive Superfund dredging project, frequent navigational dredging conducted under EPA authority, and an anadromous fish restoration project in the Achushnet River. And despite the vulnerability of Atlantic sturgeon to vessel strikes and the relative ease with which these large fish are seen compared to other fish, there have been no reported incidents of vessel strikes to Atlantic sturgeon near or within the New Bedford Harbor.

Furthermore, no Atlantic sturgeon were caught in monthly surveys conducted in New Bedford Harbor for Dredge Material Management Planning (DMMP, Normandeau 1999). Therefore, DMF concluded that Atlantic sturgeon were not present in New Bedford Harbor. Accordingly, we do not make recommendations pertaining to Atlantic sturgeon during our environmental review of the large number of federal and state projects that occur in the harbor. However, we recognize the importance of the Endangered Species Act (ESA) listing and offer the following information and mitigation strategies based on guidance provided by NMFS.

As background, the project calls for the installation of a 1,000 lineal foot coffer-dam style bulkhead with an overhanging pile-supported concrete deck along the quay-side. In order to do this, the Commonwealth will be installing flat sheet piles (to create the coffer-dam structure), z-shaped sheet piles (for the southern return wall) and pipe piles (to support the overhanging concrete deck). The sheet pile installation and pipe pile installation information can be divided into three categories including cofferdam, return wall area, and concrete decking.

For the cofferdam, the Commonwealth will be installing approximately 3,034 thin flat steel sheets that are approximately 19" long and approximately 0.5" thick. These will be installed to form the cellular structure of the cofferdams.

For the return wall area, the Commonwealth will be driving approximately 175 z-shaped steel sheet piles that are approximately 30" long and approximately 3/8" thick. These sheets will be installed along the southern end of the facility in association with the return wall.

For support of the concrete decking, the Commonwealth will be installing three different types of pipe pilings. The first set will include 65 pipe piles that are 24" diameter and have 5/8" wall thickness. These will be installed after the cofferdams are installed and will be installed outside of the cofferdams. However, these pilings will be installed by drilling a "rock socket" in place, placing the piling in the hole, and then grouting it in place. This first set of pilings will not require driving and will be installed in accordance with the "drill and pin to ledge" criteria that NMFS has already stated would be acceptable for installation at all times of the year.

The second set will include 22 pipe piles that are 30" diameter and have 3/4" wall thickness. These will be installed after the cofferdams are installed and will be installed outside of the cofferdams. These pilings will also be installed by drilling a "rock socket" in place, placing the piling in the hole, and then grouting it in place. Similar to the first set, the second set of pilings will not require driving and will be installed in accordance with the "drill and pin to ledge" criteria that NMFS has already stated would be acceptable for installation at all times of the year.

The third set will include 94 pipe piles that are 30" diameter and have ¾" wall thickness. These will be installed after the cofferdams are installed and filled, and will be installed inside of the footprint of the completed cofferdams. These pilings will be vibrated and/or driven, however, because the cofferdams will be completed and filled with earth by the time these piles are installed, the pilings will be driven into earth above the water surface (i.e. – dry land), and as an upland activity this work will not contribute to noise impacts to fisheries resources.

The project also requires the removal of a relatively small quantity of rock from some of the deeper dredge areas near the quay-side portion of the future vessel berth area.

NMFS has expressed concern that acoustic and vibrational energy from the installation of the piles and the bedrock removal methods may adversely impact ESA listed Atlantic sturgeon within their normal migratory ranges. NMFS offered the following guidance to promote mitigation of potential impacts to that species: install piles between November 15th and March 15th; or institute engineering controls to ameliorate vibrational energy in the water column if pile driving must occur outside the recommended time frame. Additionally, NMFS provided additional specifications regarding noise impacts to Sturgeon from vibration-causing activities during a teleconference held on October 2, 2012 as follows:

- Threshold for onset of injury – peak measurement: Peak SPL of any strike that exceeds 206 dB re: 1uPa.
- Threshold for onset of injury – cumulative measurement: cumulative SEL (cSEL), accumulated over all pile strikes, exceeds 187 dB re 1 uPa•s. Note: for vibratory hammer pile advancement, assessment of cSEL may be completed using one of two methods: either equating the number of vibratory periods to the number of pile strikes or using the duration of vibration in the calculation.
- Threshold for behavioral effects: 150 dB_{RMS}

The construction methods anticipated for the various activities noted above include:

- Sheet pile driving activities utilizing a vibratory pile driving system (pipe piles are not currently anticipated to contribute to noise impacts, as discussed above);
- Drilling activities associated with "rock-socketing" of pipe piles drilled into rock;
- Mechanical fracturing of shallow rock patches within the dredge footprint where rock may be encountered (either utilizing a bucket dredge , a "hoe-ram", or hydraulic dredge capable of removing rock); and
- Drilling of small holes into small patches of shallow rock outcroppings in the dredge areas and the injection of expanding grout into those holes for the fracturing of rock so that it can be dredged by traditional means.

Because the critical path nature of the project timeline anticipates the potential for work during the March to November timeframe, the Commonwealth proposes to implement the following engineering controls to mitigate the potential for the noted construction activities impacting the resource:

- "Rock-socketing", or drilling the pipe piles into bedrock;
- Limiting the installation methods to the use of vibratory hammers for the installation of piles to the extent practicable;
- If impact hammers are necessary, attempt to, if practicable, limit the use to one hammer and no more that 50 piles installed per day.

Additionally, prior to the start of construction, the Commonwealth will conduct acoustical modeling of the potential noise-generating pile installation activities noted above to demonstrate that in-water noise levels will not exceed thresholds for physiological impacts or mortality (as noted above) at the zone of passage. Should modeling indicate that acoustical noise levels will exceed the levels indicated above, then additional engineering controls in the form of noise attenuating bubble curtains between the work area and the zone of passage would be employed for work that would occur outside the November to March timeframe.

On the potential impacts to Atlantic sturgeon from blasting, the project may need to utilize blasting for a small quantity of rock from the deep dredge area near the quay-side portion of the vessel berth area. The Commonwealth restates that blasting would only be utilized as a measure of last resort if other methods of rock removal are ineffective. Based upon drilling information from test borings installed within the project site, the Commonwealth anticipates that most of the rock that requires removal from the dredge footprint of the project can be removed using conventional dredging methods or through non-blasting rock removal techniques. However, the possibility does exist that some small volume of rock may need to be removed using blasting techniques. The blasting technique the Commonwealth anticipates utilizing involves the drilling of a series of small blast holes into the rock surface to the depth of desired removal at regular intervals (approximately every 8-15 feet). A small amount of explosive material would then be installed into the blast holes, tamped and covered, and detonated to fracture the rock so that it could be removed using conventional dredging methods.

NMFS recommends that blasting activities occur between November and January 15 to avoid impacts to the various noted species, or to implement engineering controls if blasting is to occur outside that window to mitigate the potential for the noted blasting activities impacting the resource. Because the critical path for this project timeline precludes the Commonwealth from ruling out blasting activities (should they be needed) outside the blasting window, the Commonwealth proposes to implement the following engineering controls to mitigate the potential for the noted blasting activities impacting the Atlantic Sturgeon resource:

- Prior to any potential blasting, the Commonwealth will conduct acoustical modeling to demonstrate that in-water noise levels at the zone of passage will not exceed peak pressure and impulse pressure thresholds for physiological impacts or mortality (less than or equal to 75.6 psi peak pressure levels and less than or equal to 18.4 psi-msec impulse pressure levels).

- Should modeling indicate that acoustical noise levels from blasting activities will exceed the levels indicated above at the zone of passage, then additional engineering controls in the form of noise attenuating bubble curtains between the blast work area and the zone of passage would be employed for work that would occur outside the November to March timeframe.

Shellfish

NMFS has correctly noted that multiple shellfish species in New Bedford Harbor are impacted by the proposed project but that the mitigation plan focuses on quahogs only. There are a couple of reasons for this approach. First, the project area was sampled for shellfish and the dominant species captured was quahog (*Mercenaria mercenaria*). Second, a goal of the mitigation proposed was to be as on-site as possible, so all mitigation activity was targeted in the City of New Bedford. Typically once a transplant is conducted, there is a period of time during which the restoration site is closed to shellfishing to protect the newly planted shellfish. The city already has large, permanent shellfish closures due to poor water quality and relatively little water space, so the mitigation strategy was designed to minimize additional closures while maximizing the number of shellfish planted.

Third, mono-specific quahog transplanting was the most efficient approach since quahogs can tolerate a wide range of depth, sediment type, and water quality conditions. Fourth, another goal of the proposed mitigation is to implement the plan in a timely fashion to limit time lag (the time period between the original loss of ecosystem function and the restoration of ecosystem function). Because of the resilience of quahogs, the transplant success rate is more predictable than with other species.

Finally, the infrastructure to culture and grow-out seed at the scale of this project (millions of seed each year) is not commonplace. With substantial capital investment, the Commonwealth has repurposed its former lobster hatchery to accommodate the anticipated culture of quahogs. The existing infrastructure will be fully utilized focusing on a single species.

However, at the recommendation of NMFS, the Commonwealth has committed to include oyster reseeding outside the New Bedford Hurricane Barrier. It is envisioned that an "oyster reef" will be created in order to mitigate for the lost oyster habitat at South Terminal. A technical team from the Commonwealth's Division of Marine Fisheries and NMFS will meet and collaborate on the establishment and design of the oyster mitigation plan.

Winter Flounder

Winter flounder spawn in shallow estuarine waters in the late winter and early spring. The eggs are demersal and adhesive, and have well-recognized vulnerability to sedimentation (Berry et al. 2003). The Commonwealth has had significant experience with the use of engineering controls in New Bedford Harbor through the work that has previously been conducted as part of the Superfund State Enhanced Remedy (SER) for navigational dredging. As part of the SER dredging program, the Commonwealth and the USEPA established a set of SER "Performance Standards" (detailed in the Commonwealth's restated application to USEPA) that guide all work under the SER process in the Harbor. The SER Performance Standards prescribe a set of activities that must be implemented when necessary beneficial cleanup dredging occurs during a time of year restriction period. These standards include the actions recommended by NMFS in its August 21, 2012 letter to EPA:

- The use of an environmental bucket for dredging of fine grained materials;
- The use of silt curtains (or equivalent) combined with turbidity monitoring with action levels.

The Commonwealth is aware that NMFS has raised concerns that the mitigation efforts that would be undertaken through the SER process for this project would not fully take into account impacts to demersal eggs from Winter Flounder that might stray into pending dredge work zones during the spawning season (January 15 through May 31) and lay eggs in the portions of the work zone that are at the spawning depth range (generally shallower than 16-feet).

The Commonwealth notes that for projects of relatively short incursion into the "no-dredge window," the likelihood that this scenario would produce significant impact to the species in the area is low. However, in recognition of the special circumstances associated with this project, the Commonwealth is proposing to adopt a series of enhanced engineering controls that consist of:

- Cordoning off the entire depth-relevant time-critical construction areas noted above during the time of year that Winter Flounder could potentially be spawning (January 15 through May 31) to make those areas unavailable to spawning fish through the spawning period. The areas would be cordoned off by installing a subsurface curtain wall consisting of a combination of silt curtains (which would be installed and held into place by anchors to assure effectiveness) and bubble curtains (in areas where navigational servitude will need to be maintained). The silt and bubble curtain equipment will be weighted along their entire length (at the benthic end) to ensure that the deterrent curtain extends the full range of the water column throughout the full tidal range, and does not allow fish to pass under it. A mid-curtain positive buoyancy system will be added to the silt curtain system to hold curtain folds off the bottom during low tidal ranges to reduce the potential for the silt curtains causing siltation issues.
- Use of an acoustic fish "startle" deterrent system (EFSS by Sonalysts or similar) within the time-critical work area prior to the January 15 cordoning-off date to remove existing fish from the zone prior to installing the curtain wall. Additionally, a "tactile fish startle system" (TFSS) will be utilized to remove benthic demersal fish from the work zone prior to cordoning off the work zone.

The tactile fish startle system will utilize a curtain of streamers that reach to the benthic surface deployed from a floating boom pulled from a set of moving vessels to encourage benthic demersal fish (such as winter flounder) to move out of the area prior to it being cordoned off. Both the EFSS and TFSS equipment will be deployed from shallow draft vessels roving through the area to be cordoned off along a grid pattern with 25-foot line spacing.

- Conducting periodic weekly camera and diving inspections of the silt curtain/bubble curtain wall to ensure its integrity, and completing necessary repairs in a timely fashion for damage or entanglement of the curtain wall that would impeded its effectiveness.
- Conducting periodic weekly camera and acoustic fish detection system (AFDS) surveys of the enclosed work area (on a 20-foot grid pattern) to determine if fish remain in the area after the EFSS and TFSS systems have been employed. If the results of the camera and AFDS survey indicate that fish remain within the work zone, a second set of EFSS and TFSS transits will be completed.
- The Commonwealth recognizes that the activities proposed herein will constitute a pilot program to evaluate whether these techniques will be successful on future projects. As such, the Commonwealth commits to filing information concerning the fish deterrent activities described in this section, including: documentation of curtain wall and fish detection survey monitoring activities in a weekly report to the EPA, the SER committee, and NMFS; and preparation of a report of the activities at the conclusion of the project that describes the activities undertaken, the effectiveness of the activities, and any modifications made to the activities during the work period.

The above noted enhanced engineering controls would be utilized concurrently with the typical SER Performance Standard actions of water quality monitoring (both inside and outside the curtained area), and use of the environmental bucket for the dredging of fine grained sediments that can be dredged with the environmental bucket – to ensure that silt suspension from the dredging process is minimized to the extent practicable. The Commonwealth believes that the use of this combined set of engineering controls would effectively mitigate the impacts from dredging during sensitive time periods for Winter Flounder. The enhanced engineering controls would also have the added benefit of mitigating impacts of dredging on anadromous fish species that might be present in the Harbor, as the controls would deter fish from entering the work area and reduce the potential for siltation in the water column.

Finally, the Commonwealth commits to work with NMFS on the creation of a technical working group that would finalize the details of the pilot monitoring regime proposed, to ensure the integrity of the winter flounder protection program.

Conclusion

The Commonwealth believes that the measures proposed will allow the project to advance along a timeline that meets the project's intended purpose and need while protecting and minimizing any temporary impacts the construction might have on the fisheries resources found in New Bedford Harbor. The Commonwealth believes that the extensive clean-up, coupled with the mitigation and engineering controls, provides the best long term benefits to the fisheries resources present in New Bedford Harbor.

The Commonwealth's Natural Resource agencies, including the Division of Marine Fisheries, shares a common mission and goal as both EPA and NMFS, and we are committed to a constructive collaboration with you to protect the natural resources of New Bedford Harbor as we construct this historic project. We request for EPA to concur with the information and analysis contained in this letter that was developed in partnership with the National Marine Fisheries Service.

As always, the Commonwealth is available to discuss any aspect of the project approach presented herein, and we look forward to working with you and your staff to advance the Final Decision for the project in the near future.

Sincerely,

Richard K. Sullivan Jr.
Secretary

Paul J Diodati

Paul Diodati
Director, MA Division of Marine Fisheries

cc: John Bullard, NOAA's Northeast Regional Administrator

References

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APPENDIX 2

Essential Fish Habitat Assessment Addendum

New Bedford Harbor
Marine Commerce Terminal

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1 Introduction

This addendum shall respond to the National Marine Fisheries Service (NMFS) Essential Fish Habitat (EFH) Conservation Recommendations for the Proposed South Terminal Project, New Bedford, MA, contained in their August 21, 2012 letter to the New England Environmental Protection Agency (EPA). These EFH Conservation Recommendations are based on review and analysis of the EFH Assessment prepared for this project as required under the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

2 Conservation Recommendation #1: Eliminate Proposed Additional Work

The Commonwealth cannot eliminate the proposed additional work as recommended by NMFS, for reasons outlined in the following paragraphs:

2.1 Increase Width of Approach Channel by Fifty (50) Feet

Marine vessels utilized in international transport vary dramatically in their three primary dimensions (length, beam, and draft), and often times do not vary proportionally. For example, a longer vessel may not be as wide as other vessels that are shorter in length. Similarly, a wide vessel may have a deeper draft and be shorter than a longer vessel that is narrow and has a shallow draft. Alternately, a long and wide vessel may have a shallow draft, while a shorter or narrower vessel may have a deep draft.

The Northeast Marine Pilots Association met with APEX to discuss the proposed project, specifically with respect to vessel maneuverability in New Bedford Harbor (MassDEP, 2012a ref. to Appendix 15). At the meeting, the pilots stated that the largest cargo vessel that they anticipated to dock at the new terminal facility is approximately 600 feet in length with a beam width of 90 feet. The maximum draft of vessels is generally controlled by the depth of the Federal navigation channel, which is set at -30' MLLW. For safety and maneuverability, the Northeast Marine Pilots Association requested a minimum channel width of 200 feet with a 100-foot tug channel for the vessels anticipated to utilize the terminal facility.

The Commonwealth responded to the Northeast Marine Pilots Association's request by proposing to construct a 175 foot wide channel, and to assess potential impacts from and include in the permit an additional 50 feet of expansion (to 225 feet) if required in the future. The 175 foot wide channel may not be wide enough to accommodate the maximum sized vessel cited by the Northeast Marine Pilots Association; however, due to existing harbor use limitations, environmental impact limitations, and financial limitations outlined in the June 18, 2012 submission (MassDEP, 2012b), only the 175 foot channel is currently anticipated to be constructed by the Commonwealth at this time. Nevertheless, the Commonwealth may determine that a wider channel (up to 225 feet in width) is necessary to facilitate either offshore renewable energy projects or to facilitate future cargo operations at the terminal. Channel width is directly related to vessel safety; maneuvering of a large vessel into and out of port is a complicated process, and reasonable buffer zones are necessary to ensure that the vessels do not run aground as they maneuver into port. As it is currently unclear whether the wider channel will be necessary or not, the Commonwealth believes it is in the public interest to permit the larger channel width at this time to avoid segmentation concerns.

In response to the EFH Conservation Recommendation request, this project component cannot be removed. If the Commonwealth determines that the channel must be expanded in width by 50 feet, to 225 feet in width, it will be for safety and maneuverability of either offshore renewable energy international vessels or for large cargo vessels that are slated to utilize the new terminal facility.

2.2 Increase Length of Deep Draft Dredging Area by Three Hundred (300) Feet

As discussed above, marine vessels utilized in international transport vary in their three primary dimensions, length, beam, and draft, and often times do not vary proportionally. At the meeting with the Northeast Marine Pilots Association, it was stated that the largest cargo vessel that they anticipated to dock at the new terminal facility is approximately 600 feet in length with a beam width of 90 feet. Design standards for berth construction typically include at least 50 feet of buffer on either end of the vessel for navigation and safety; however, some guidance documents recommend as much as 100 feet on either end of the berthed vessel. The extra space is intended to assist vessels in preventing accidents as they enter the berthing area and prepare to dock. Therefore, in order to accommodate a deep-draft vessel 600 feet in length, between 700 and 800 feet of deep draft berthing space is needed.

The potential expansion of the deep-draft area of the bulkhead has been included to allow potential for expansion to accommodate future cargo vessels that will require this extra space to be able to dock. The potential expansion involves either the extension of the deep dredge area 100 feet to the south (for a total of 700 feet of deep-draft berthing space), or the extension of the deep dredge area 200 feet to the north (for a total of 800 feet of deep-draft berthing space), or both. The purpose of the expansion is to provide adequate deep draft area for large shipping vessels that are expected to utilize the terminal in the future. Without the proposed extension(s), there is only 600 feet of deep-draft area at the bulkhead (which will be designed for a maximum vessel length of approximately 500 feet). This deep-draft area should be sufficient to accommodate some (but not necessarily all) offshore renewable energy international vessels and smaller cargo vessels, but is unlikely to accommodate the full range of vessels that can maneuver within New Bedford Harbor. Berth length is directly related to vessel safety; maneuvering of a large vessel into and out of port is a complicated process, and reasonable buffer zones are necessary at the berthing location to ensure that the vessels do not run aground as they maneuver into port.

In response to the EFH Conservation Recommendation request, the Commonwealth is requesting to expand the deep draft area, for safety and maneuverability of some larger international renewable energy vessels and large cargo vessels that may utilize the new terminal facility.

2.3 Expand CAD Cell 3

The potential expansion of CAD Cell #3 is intended to accommodate the impacted dredge spoils from the potential expansion in width of the channel (as outlined within Section 2.1, above), the potential expansion of the length of the deep-draft area at the berth (as outlined within Section 2.2, above), and potential dredging of the Federal Turning Basin and Channel, due to the presence of sediment that has accumulated within it since the last navigational dredging by USACE. It is these potential options that drive the necessity of the potential expansion of CAD Cell #3.

Therefore, in response to the EFH Conservation Recommendation request, the expansion of CAD cell #3 is required to provide a suitable disposal site for the expansions that may be necessary for safety and maneuverability of large cargo vessels that may utilize the new terminal facility.

3 Conservation Recommendation #2: Minimize Extent of Concrete Blanket for Pile Supported Apron Adjacent to Wharf

The concrete blanket is an erosion protection measure proposed to run along the inclined slope between the dredge area and the cofferdams (under the pile supported section of the pier). The purpose of the concrete blanket is to prevent erosion of the area under the concrete decking, to protect the toe of the cofferdams. It is a prefabricated material, not poured concrete, so it has a fixed thickness that may not be varied. The areal extent of the concrete blanket has been outlined in order to protect the toe of the cofferdam from prop wash from adjacent vessels. Multiple types of forces, including storm activity, tidal action and vessel prop wash are anticipated to potentially impact the slope under the concrete decking; as a result, it is impossible to know for certain the exact location that will be most vulnerable to erosion, which limits the Commonwealth's ability to reduce the areal extent of the concrete blanket. However, the Commonwealth assures EPA and NMFS that the concrete blanket is an expensive item to purchase and install, and that if it were possible to both protect the slope below the pile supported apron and eliminate the concrete blanket, the Commonwealth would certainly do so.

In response to the EFH Conservation Recommendation request, the extent of the concrete blanket has been reduced as much as possible to minimize potential environmental impacts (and therefore cost), while maintaining the design function of engineered erosion protection.

4 Conservation Recommendation #3: Avoid In-Water Silt Producing Activity Between January 15 and May 31 of Any Year

NMFS recommends avoidance of in-water silt producing activity, such as dredging and in-water construction, between January 15 and May 31 of any given year to avoid adverse effects to winter flounder spawning and early life stages in New Bedford Harbor. Implementing time-of-year (TOY) restrictions on in-water activities is not considered feasible by the Commonwealth for this project, due to the complex critical path of the construction sequence required to build the facility, and the deadline for completion of a functional terminal to support construction of offshore renewable energy facilities. However, due to the significant decline in winter flounder abundance in the last five years, it is important to determine the area of critical winter flounder habitat that will be affected by in-water construction activities, and to develop alternative mitigation strategies that can protect sensitive life stages similar to TOY restrictions.

4.1 Critical Winter Flounder Habitat

Habitat parameters for all winter flounder (*Pseudopleuronectes americanus*) life stages were obtained from Pereira et.al. (1999) and are outlined in Table 1. These habitat parameters were used to identify suitable habitat for each life stage of winter flounder in New Bedford Harbor.

New Bedford Harbor is highly variable with respect to depth and water quality, and therefore, the entire harbor may not be suitable for all life stages of winter flounder based on the habitat parameters listed in Table 1. The entire harbor is suitable habitat for YOY, juvenile, and adult stages, and therefore, no further analysis was performed for these life stages. An analysis was performed on bathymetry and water quality parameters to identify suitable habitat for spawning adult, egg, and larval winter flounder life stages. Suitable habitat areas identified for each parameter were then overlayed to identify critical habitat areas, where all parameters analyzed indicate suitable habitat, for spawning adults, eggs, and larvae within New Bedford Harbor.

Table 1. Summary of life history and habitat parameters for winter flounder.

Stage	Temp	Salinity	Depth	DO	Substrate	Comments
Eggs (Feb-Apr)	• Hatch 3-5°C • Lethal 18°C	10-32ppt	Inshore 0.3-4.5m	11.1-14.2 mg/L	Mud to sand or gravel	• Demersal, adhesive, clusters • Hatch 2-3 weeks
Larvae (May-June)	• Hatch 1-12°C • Most abundant 2-15°C	3.2-30 ppt	Inshore 1-4.5m	10.0-16.1 mg/L	Fine sand, gravel	• Planktonic initially, then settle to bottom @ 9-13 mm SL
YOY	• 2-29.4°C • Prefer 19.5°C • Lethal 30°C	23-33 ppt Avoid <5ppt	Inshore 0.5-12m	Constant 2.2 mg/L or diurnal variation of 2.6-6.4mg/L affects growth	Mud to sand w/shell or leaf litter	• Offshore winter migration due to photoresponse & temperature preferences
Juvenile	• 10-25°C	19-21ppt Avoid <10ppt	18-27m (LI) 11-18m (Can.)		Mud or sand shell	• Spend most of year in deeper, cooler waters • > 25 mm TL variety of habitat types, not dependent on vegetation for cover
Adult	• 0.6-23°C • Prefer 12-15°C • Lethal 27°C	15-33ppt	1-30m inshore Prefer <25m spring, >25m fall	< 2.9 mg/L significantly less abundant; reduced growth	Mud, sand, cobble, rocks, boulders	
Spawning Adult (Feb-Apr)	• Initiated @ 3°C • Upper limit of 4.4-5.6°C	11 ppt (inshore) to 31-33 ppt (offshore)	5-45 m Prefer <5-6m			• Maturity varies w/size & age • Spawn sunset-midnight (majority) • Multiple spawns, millions of eggs • Spawn where hydrodynamics function to keep hatched larvae from being dispersed

Bathymetry data was obtained from the USACE (1999) for the entire lower harbor and entered into ArcMap 10 for analysis. A surface raster was created using the Natural Neighbor interpolation tool in Spatial Analyst. Suitable habitat was then identified by classifying the surface raster for depth preferences according to Table 1 (Figure 1). Results indicate that, generally, areas outside of the Federal navigation channel are suitable habitat for eggs, larvae, and spawning adults based on depth preferences.

To further quantify suitable habitat areas for identification of critical winter flounder spawning habitat within New Bedford Harbor, water quality data was obtained and analyzed for suitability based on habitat parameters listed in Table 1. Water quality data for New Bedford Harbor (Lower/Inner Harbor) was obtained from the Woods Hole Group (2010), The Buzzards Bay Citizen's Water Quality Monitoring Program coordinated by The Coalition for Buzzards Bay (2012), Normandeau Associates (1999), and NOAA National Oceanographic Data Center (NODC) [Table 2]. Woods Hole Group and The Coalition for Buzzards Bay collected water quality data at monitoring stations in the lower (inner) harbor during the months of May – September. Normandeau Associates collected water quality data during seine and trawl sampling for finfish resources within the harbor in October and January - April. Temperature data was obtained from Normeandeau Associates and the NOAA NODC Coastal Water Temperature Table for Atlantic Coast: North.

Table 2. Summary of water quality data for New Bedford Harbor.

Parameter	Min. Value	Max. Value	Notes
Temperature[1, 4]	1.1 °C	25.8 °C	Minimum temperature occurs in January; maximum temperature in July-August.
Salinity[2,3]	19 ppt	37 ppt	
Dissolved Oxygen[3, 4]	4.5 mg/L	13.5 mg/L	Only DO data from January through June utilized.

[1] NOAA NODC [2] Woods Hole Group [3] The Coalition for Buzzards Bay [4] Normandeau Associates

Based on a comparison of Table 1 and Table 2, it appears that temperature and salinity within New Bedford Harbor do not limit habitat use by winter flounder, but dissolved oxygen may limit habitat use by egg and larval life stages. Winter flounder eggs are found at 11.1 - 14.2 mg/L and larvae at 10.0 - 16.1 mg/L (Periera et.al., 1999), where the range of dissolved oxygen in New Bedford Harbor is 4.5 – 13.5 mg/L.

Dissolved oxygen data from January through June, the time of year when spawning adults, eggs, and larvae are present in New Bedford Harbor (see Table 1), was used to identify suitable habitat for those winter flounder life stages. The Coalition for Buzzards Bay and Normandeau Associates monitor station/trawl locations were digitized into ArcMap 10 to determine suitable habitat areas for dissolved oxygen, as these data sets included dissolved oxygen values during the spawning period. The Coalition for Buzzards Bay dissolved oxygen values for the four lower harbor stations were averaged per station due to a large data set (n = 20 to 123 per station), and were then entered into the attribute table as a single value per station. Normandeau Associates dissolved oxygen values for the three lower harbor locations were also averaged (n = 2 to 4 per station) prior to entry into the attribute table as single value per station. This resulted in a data set with seven dissolved oxygen values for the lower harbor.

The Spatial Analyst tool Inverse Distance Weight (IDW) was then utilized to interpolate dissolved oxygen values for the remaining lower (inner) harbor. The following parameters were entered into the tool function: Output Cell Size = 100 m, Power = 2, Search Radius = Variable using 12 points. Results were then classified using Manual class breaks as outlined in Table 3 below.

Table 3. Class breaks for IDW output based on habitat parameters for eggs and larvae.

Start Value	End Value	Reason[1]
0	10.0	10.0 is lower limit for larvae
10.01	11.1	11.1 is lower limit for eggs
11.11	14.2	14.2 is upper limit for eggs
14.21	16.1	16.1 is the upper limit for larvae

Figure 2 depicts interpolated dissolved oxygen levels for New Bedford Harbor. The map demonstrates that much of the harbor appears to have dissolved oxygen levels that are below the lower habitat threshold for winter flounder eggs and larvae.

Regarding the interpretation of dissolved oxygen results, it should be noted that the interpolation is based on a limited number of monitoring stations in the lower harbor, none of which are in the immediate South Terminal project area. However, dissolved oxygen levels for all three of the stations closest to the South Terminal site are below the threshold of 10.0 mg/L for winter flounder eggs and larvae. Furthermore, these three stations are closer to the inlet at the hurricane barrier than the South Terminal site, and would be likely to receive a higher percentage of flux from the outer harbor (anticipated to contain a higher level of dissolved oxygen than areas deeper within the harbor). Therefore, one can infer that dissolved oxygen at the South Terminal site is at or below concentrations measured at these stations, and is not suitable habitat for winter flounder eggs and larvae.

Suitable habitat areas using bathymetry and dissolved oxygen analysis were overlayed in ArcMap 10 using the Fuzzy Overlay tool to identify critical winter flounder habitat for spawning adults, eggs, and larvae (Figure 3). For spawning adults, critical habitat designation is based on bathymetry only, and includes the project area. Analysis based on available bathymetry and dissolved oxygen data indicates that critical habitat for winter flounder eggs and larvae is generally confined to areas north of Pope’s Island and a smaller area near Crow Island.

Winter flounder survey data for New Bedford Harbor was solicited from Massachusetts Division of Marine Fisheries (DMF) to evaluate, if possible, the results of the critical habitat areas analysis. According to DMF (K.Ford, pers.comm.), the only winter flounder survey data for New Bedford Harbor is the Dredged Material Management Plan (DMMP) Fisheries Resources Survey for New Bedford (Normandeau Associates, 1999). For the DMMP survey, two methods of sampling were utilized to characterize the finfish resources within the harbor monthly from June 1998 to May 1999: seine samples for water depths 0-1m and trawls for water depths 2-10m. No winter flounder were collected in seine samples in the lower harbor from December through June, within which the winter flounder spawning season occurs. Two trawls were conducted in the lower harbor, one north of the Fish Island Bridge (NT5, depth at trawl location 6-10ft) and one south of the Fish Island Bridge (NT4, depth at trawl location 26-30ft). For trawl station NT5, the geometric annual mean catch per unit effort (CPUE) for winter flounder was 3.23 (catch/400-m tow), with less than 100 individuals caught from June 1998 through May 1999. The majority of flounder captured with trawl NT5 were caught in October through December and May. For trawl NT4, the CPUE was 1.04 (catch/400-m tow), with less than 20 individuals captured from June 1998 through May 1999. Highest capture rates at trawl NT4 occurred in May, June, and July.

Winter flounder survey data indicates that winter flounder are more abundant north of Pope’s Island, and are observed in this area year-round. Survey data therefore supports the identification of critical habitat in this area of New Bedford Harbor.

In conclusion, in the vicinity of the proposed South Terminal, analysis of habitat parameters indicate that the area is not critical habitat for eggs and larvae, but may be for spawning adults based on the data set. Specifically, the limited dissolved oxygen data set for the period from January through June indicates that dissolved oxygen in this vicinity is too low for winter flounder eggs and larvae. Critical habitat for winter flounder eggs, larvae, and spawning adults does exist in the CAD cell areas north of Pope’s Island, which is supported by finfish resource survey data. Mitigation measures for protection of spawning winter flounder and early life stages should therefore focus on the CAD cell areas.

4.2 Alternate Mitigation Strategies for Protection of Winter Flounder

As discussed above, TOY restrictions for protection of winter flounder spawning and nursery habitat are not considered feasible by the Commonwealth for this project. The Commonwealth developed the following Fish Deterrent Plan (FDP) as an alternate mitigation strategy to TOY restrictions:

Fish Deterrent Plan for the New Bedford Harbor Marine Commerce Terminal

Project Summary

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

An assessment of the potential locations for supporting offshore renewable energy facilities and international shipping completed within the document entitled "State Enhanced Remedy in New Bedford, South Terminal", promulgated by the Commonwealth on January 18, 2012, has resulted in the conclusion that South Terminal in New Bedford, Massachusetts is the only practicable location due to a number of constraints, including: horizontal clearance, jack-up barge access, overhead clearance, total wharf and yard upland area, berthing space, site control/availability, and proximity. Due to the lack of other practicable alternatives, and the avoidance and minimization of impacts to resource areas to the maximum extent practicable, the South Terminal CDF is the Least Environmentally Damaging Practicable Alternative that will meet the primary Project Purpose.

During construction of the NBMCT, many activities (including dredging) may have a temporary detrimental effect to fish that may be present within New Bedford Harbor. A Fish Monitoring Workgroup (including members from NMFS, EPA and MassDMF) was convened to prepare a Fish Deterrent Plan (FDP) that could be utilized to reduce the impact to fish by excluding them from a proposed area. Input from the Fish Monitoring Workgroup has been incorporated into this FDP, which will include all measures to be taken that will decrease the chance of mortality to the following marine species of concern and their spawning activities (where applicable): Atlantic sturgeon, winter and windowpane flounders, scup, and anadromous fish species as directed by NMFS.

Objectives

The objective of this FDP is to construct the NBMCT without restricting access to daily fishing traffic and have the "least environmentally damaging as practicable alternative" in place to deter fish species from the NBMCT construction area, so that none are harmed or inadvertently "taken." The system is also intended to prevent spawning within the area of work, such that the eggs of these species will not be present when work commences, and therefore will not be damaged or destroyed. Fish species of concern for which this FDP has been developed are as noted in the "NMFS comments on the Draft Determination for South Terminal in New Bedford, MA" dated August 21, 2012 and listed below:

- Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)
- Winter flounder (Pseudopleuronectes americanus)
- Windowpane flounder (*Scopthalmus aquosus*)
- Scup (*Stenotomus chrysops*)
- Black sea bass (*Centropristus striata*)

Methods

A series of engineered barriers will be in place to exclude fish from entering the areas where dredging and other marine construction are to take place (Figure 4). The barriers will re-direct, but not otherwise limit vessel traffic in the area of work. The three types of barriers to be erected are a fish weir, silt curtain, and bubble barrier. Coupled with an extensive monitoring program, the system is intended to exclude fish from using the area while work is taking place.

Fish Weir

A fish weir is a net which is placed in the water column and extends approximately 4 feet off the bottom (Figure 5). It is designed to channel ground fish away from the area where work is to take place. The weir will be placed on the outside of all the engineered barriers in close proximity to the bubble curtain and silt curtain.

Silt Curtains

Turbidity Barriers, also known as turbidity curtains, silt barriers, and silt curtains in the industry, are designed specifically to contain and control the dispersion of floating turbidity and silt in a water body related to marine construction, pile driving, site work, and dredging activities. Silt curtains or silt protectors minimize these impacts by improving settling times and settling suspended solids in a defined area well away from natural resources.

For the NBMCT project, a modified silt curtain will be used both for turbidity control and also as a fish barrier. Traditional silt curtains may or may not touch the harbor bottom. In the past silt curtains which do not touch the bottom have been utilized in the Harbor during disposal activities at CAD Cell #2, and during dredging activities during the posted TOY restriction when water depth is greater than 4 feet. Water depth is critical as when there is a tidal exchange the bottom of the curtain creates turbidity as it moves up and down in the mud. The Commonwealth proposes to create a solid barrier extending silt curtains to the harbor bottom; however the curtain will be modified so that the curtain does not create turbidity. Two sections will be at the site of the proposed New Bedford Marine Commerce Terminal, and a third section will be at the proposed CAD Cell #3. The silt curtain will utilize a tidal flux pocket, consisting of a continuous line of floatation running the length of the silt curtain that is 3 feet from the harbor bottom, ensuring that the portion of the silt curtain nearest the bottom is always held taut and vertical thereby preventing contact with the bottom that often is the cause of increased turbidity common in traditional silt curtain installations. This floatation accounts for the tidal range of New Bedford Harbor, which is ±3.8 feet. When the tide is high, the silt curtain will be extended and will be stretched to its full length. When the tide falls, the floats at the 3 foot level will hold the bottom portion of the silt curtain off of the harbor floor, while the upper portion of the silt curtain will be supported on one side by the lower floats and on the other side by the surface floats. This modified silt curtain design will eliminate potential turbidity generation by the silt curtain, while allowing the silt curtain to extend from the water surface to the harbor floor (Figure 6).

Bubble Barrier

The bubble barrier is a fairly recent addition to the mitigation techniques used in marine construction. Bubble barriers are, in their simplest form, a perforated pipeline running along the bottom of a waterway. Compressed air is pushed through the pipeline creating an array of bubbles along the limits of a proposed construction site. Bubble barriers perform three significant functions. First, fish species see the bubble array as a solid barrier, in effect a wall of air bubbles. Second, the air bubbles dampen sounds created by construction activities. Third, because the bubble barrier is a non-physical barrier, vessels may still use the existing South Terminal and Gifford Street channels during construction.

For the NBMCT project, one bubble barrier will be incorporated into the fish barrier at the northern end of the channel leading from the Gifford Street Boat Ramp (Figure 7). The bubble barrier and silt curtain will be overlapped to eliminate the potential for fish swimming around the barriers, creating a fish exclusion system.

Fish Monitoring

After the fish exclusion system is installed, weekly monitoring of the system will be performed. This procedure will be first implemented one day after the initial fish exclusion efforts are undertaken and once per week thereafter. The survey will be done with a sonar fish finder and a towed video system. The perimeter of the area will be surveyed twice, first to verify the silt curtain and bubble curtains are in place and second to verify the weir leader net is in place). The dredge area will then be surveyed to determine if fish are present using the following procedure:

Run transects parallel to shore or at depth contours with a randomly selected start point for each survey.
The survey area is approximately 1200 feet in length and runs parallel to shore. Survey will be run at approximately 1 nautical mile per hour.
Two methods for detecting fish will be utilized: a fish finder used for identifying pelagic fish schools, and a video surveillance system used to identify flat fish.
The video method is most appropriate for detecting flat fish. In order to ensure that visibility is acceptable for the survey, a laser scaling method will be used at each transect to visually confirm the seafloor.
If a transect fails the visibility test, the monitoring team can select up to 5 additional grids to transect.
If more than 5 transects fail the visibility test, then divers will complete the survey. Since the camera survey will image at a maximum 3% of the dredge area, the conservative measure of a single fish being imaged will be used as the threshold for implementing additional fish exclusion efforts.

The following decision tree will be used for the implementation of fish exclusion efforts:

VIDEO

- If no flatfish are encountered → the area will be considered free of fish.
- If 1 or more flatfish are encountered → fish removal procedure will be initiated.

SONAR

- If < 5 pelagic schools are encountered on sonar → the area will be considered free of fish.

- If ≥ 5 pelagic schools are encountered on sonar → fish removal procedure will be initiated.

Reporting
A video monitoring report will be provided to the Fish Monitoring Workgroup weekly within 4 days of the completion of monitoring. For every video monitoring event the report will describe:

- Condition of the engineered barriers (silt curtain, bubble curtains, and weir leader net);
- Prevalence of flatfish and other fish at the base of the fish exclusion devices;
- Any actions taken to improve the conditions of the fish exclusion devices;
- Total count of grid/transects completed;
- Total count of grid transects skipped due to visibility – if grid survey method used;
- Description of any survey alterations due to lack of visibility;
- Total count of flatfish encountered;
- Total count of other fish encountered;
- Total count of schools on the sonar record;
- Description of any actions taken to remove fish from the area;
- Any turbidity monitoring exceedances;
- Recommendations to improve the survey methodology, the fish exclusion devices, or the fish removal tactics;
- Field notes from video and sonar survey (note that the video and sonar data will be observed in the field but will not be recorded).

Fish Exclusion Efforts
In the event that fish are found to be present during the monitoring surveys (the first video survey), measures will be taken to use a "fish startle system" to move fish outside the aforementioned barriers. The bubble barrier will be turned off and fish exclusion techniques will the deployed. The three different types of systems that will be mounted to the survey vessel to startle fish species are: (1) light, (2) sound, and (3) tactile (Figure 8).

All three systems will be used during all fish startling activities. The light system will include strobe lights mounted on either side of the helm with extendable poles. Lights range in size from four to eight feet in length. Range of the color of light projected will vary, as will the intensity of light emitted. Bright lights have been shown to startle fish in many studies. Extendable poles will allow the lights to startle fish farther down in the water column than if the system was mounted to the helm. The sound emitting part of the startle system will be an underwater speaker capable of sound ranges from 100-1200 hertz. The speaker will hang on a tether into the water column. The tactile fish deterrent will be made of a fish net with light chain hanging to the harbor bottom. The net will be large enough gauge line that the fish will see it but will have large openings so they are not caught. The system will progress through the deterrence area at 2-4 knots on a calm day. During the fish startle activities the bubble barrier will not be active to allow fish to pass through these areas unimpeded.

Following fish startling, the bubble curtain will be turned on and the video survey will be repeated (second video survey). If fish are found again and time permits, a second attempt at removing the fish will be conducted and the video survey will be repeated again. If fish are still found in the work area during the third video survey, the Commonwealth will re-inspect the integrity of the fish exclusion methodology. If there is a breach or other issue with implementation of the fish exclusion methodology, it will be repaired and monitoring will begin again.

If, after one month of deployment, the fish exclusion methodology does not appear to be meeting all of the goals of the fish exclusion program, the Commonwealth will meet with the Fish Monitoring Workgroup (FMW), the Commonwealth's monitoring team, and others with relevant expertise, to discuss issues and potential mitigation measures. The procedures implemented will be reviewed with the FMW, and potential alternate methods for monitoring and/or silt curtain maintenance, mitigation, or additional fish exclusion methods will be discussed.

Once a breach, issue, or problem is corrected, or once a potential alteration/mitigation measure is implemented, the monitoring will begin again to determine its effectiveness. Should fish be found in three consecutive video surveys after correction of the problem or implementation of the additional mitigation measure, the Commonwealth will implement a subsequent alteration/mitigation measure, or a meeting with the FMW will be scheduled to discuss whether or not modifications to the engineering controls could be made.

In response to the EFH Conservation Recommendation, the Commonwealth has determined that implementation of TOY restrictions is not feasible for this project. However, the Fish Deterrent Plan (FDP) as an alternate mitigation strategy will provide sufficient protection to winter flounder resources in lower New Bedford Harbor.

5 Conservation Recommendation #4: Modify the Shellfish Mitigation Plan to Include Other Species Identified in Shellfish Survey

The Commonwealth responded to this item in an October 4, 2012 letter to the US EPA New England, as follows:

> NMFS correctly noted that multiple shellfish species in New Bedford Harbor are impacted by the proposed project but that the mitigation plan focuses on quahogs [*Mercenaria mercenaria*] only. There are a couple of reasons for this approach. First, the project area was sampled for shellfish and the dominant species captured was quahog (*Mercenaria mercenaria*). Second, the goal of the mitigation proposed was to be as on-site as possible, so all mitigation activity was targeted in the City of New Bedford. Typically, once a transplant is conducted, there is a period of time during which the restoration site is closed to shellfishing to protection the newly planted shellfish. The city already has large, permanent shellfish closures due to poor water quality and relatively little water space, so the mitigation strategy was designed to minimize additional closures while maximizing the number of shellfish planted.
>
> Third, mono-specific quahog transplanting was the most efficient approach since quahogs can tolerate a wide range of depth, sediment type, and water quality conditions. Fourth, another goal of the proposed mitigation is to implement the plan in a timely fashion to limit lag time (the time period between the original loss of ecosystem function and the restoration of ecosystem function). Because of the resilience of quahogs, the transplant success rate is more predictable than with other species.
>
> Finally, the infrastructure to culture and grow-out seed at the scale of this project (millions of seed each year) is not commonplace. With substantial capital investment, the Commonwealth has repurposed its former lobster hatchery to accommodate the anticipated culture of quahogs. The existing infrastructure will be fully utilized focusing on a single species.
>
> However, at the recommendation of NMFS, the Commonwealth has committed to include oyster reseeding outside the New Bedford Hurricane Barrier. It is envisioned that an “oyster reef” will be created in order to mitigate for the lost oyster habitat at South Terminal. A technical team from the Commonwealth’s Division of Marine Fisheries and NMFS will meet and collaborate on the establishment and design of the oyster mitigation plan.

6 Conservation Recommendation #5: Provide All Mitigation Plans and Monitoring Reports to Resource Agencies for Review

As recommended by NMFS, prior to final approval, all mitigation plans and monitoring reports shall be submitted to resource agencies for review and comment.

7 Fish and Wildlife Coordination Act Conservation Recommendation

NMFS recommends that blasting activity should incorporate a TOY restriction, such that blasting may not occur from April 1 – June 30 of any given year. In response to this recommendation, the Commonwealth asserts that blasting shall only be performed as a measure of last resort if other methods of rock removal are ineffective. If blasting is required, and due to construction scheduling must be performed outside of the recommended TOY, the Commonwealth will utilize alternate mitigation in the form of noise attenuating bubble curtains around the work area.

8 Literature Cited

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9 List of Preparers

Kelly Risotto, Senior Ecologist and Project Manager, Land Use Ecological Services, Inc.
William Bowman, PhD., Senior Scientist, Land Use Ecological Services, Inc.

Figure 1. Bathymetry data and analysis of suitable habitat based on depth preferences for winter flounder. Note that for YOY, juvenile, and adult winter flounder, the entire harbor is suitable habitat.

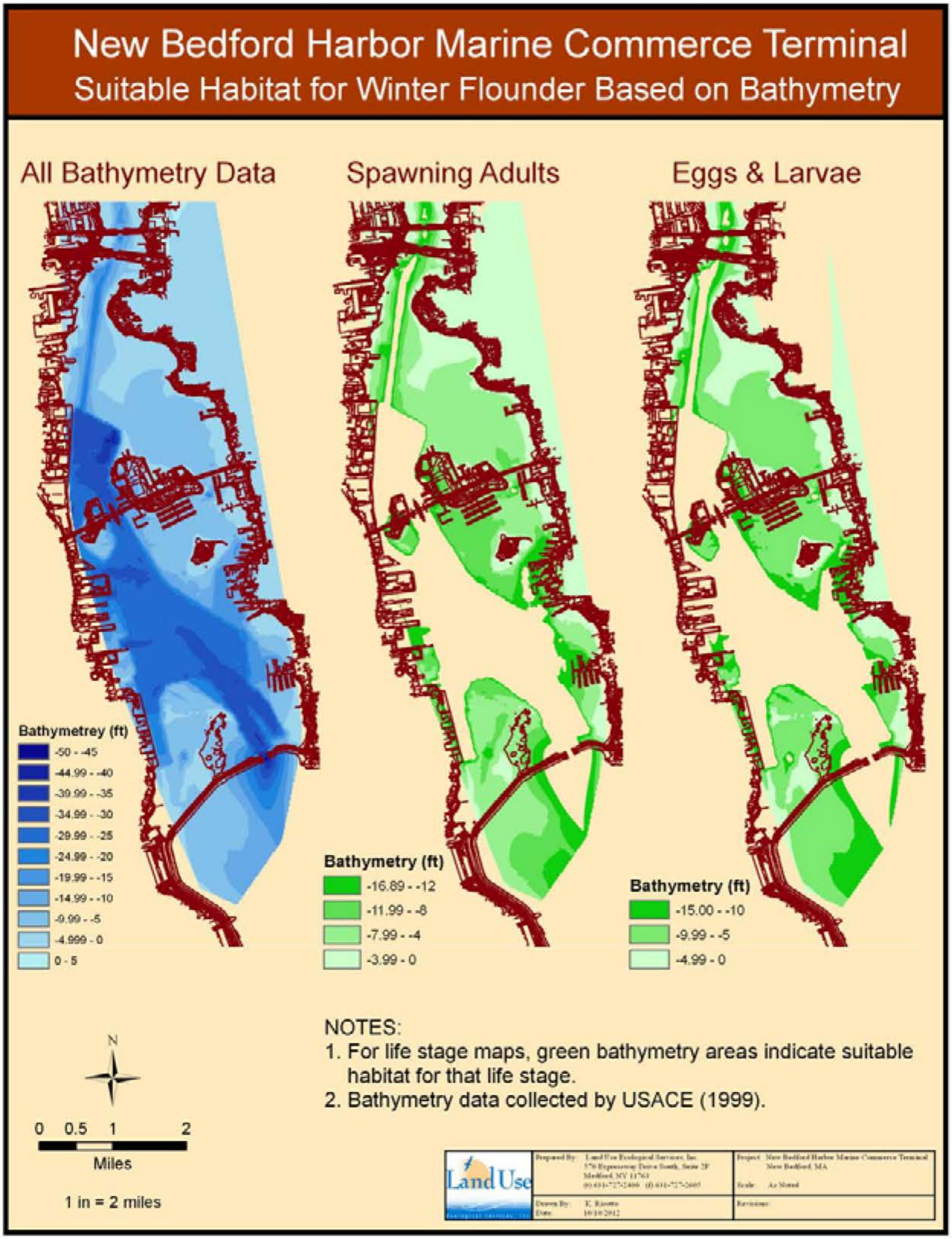


Figure 2. Interpolated dissolved oxygen levels for New Bedford Harbor.

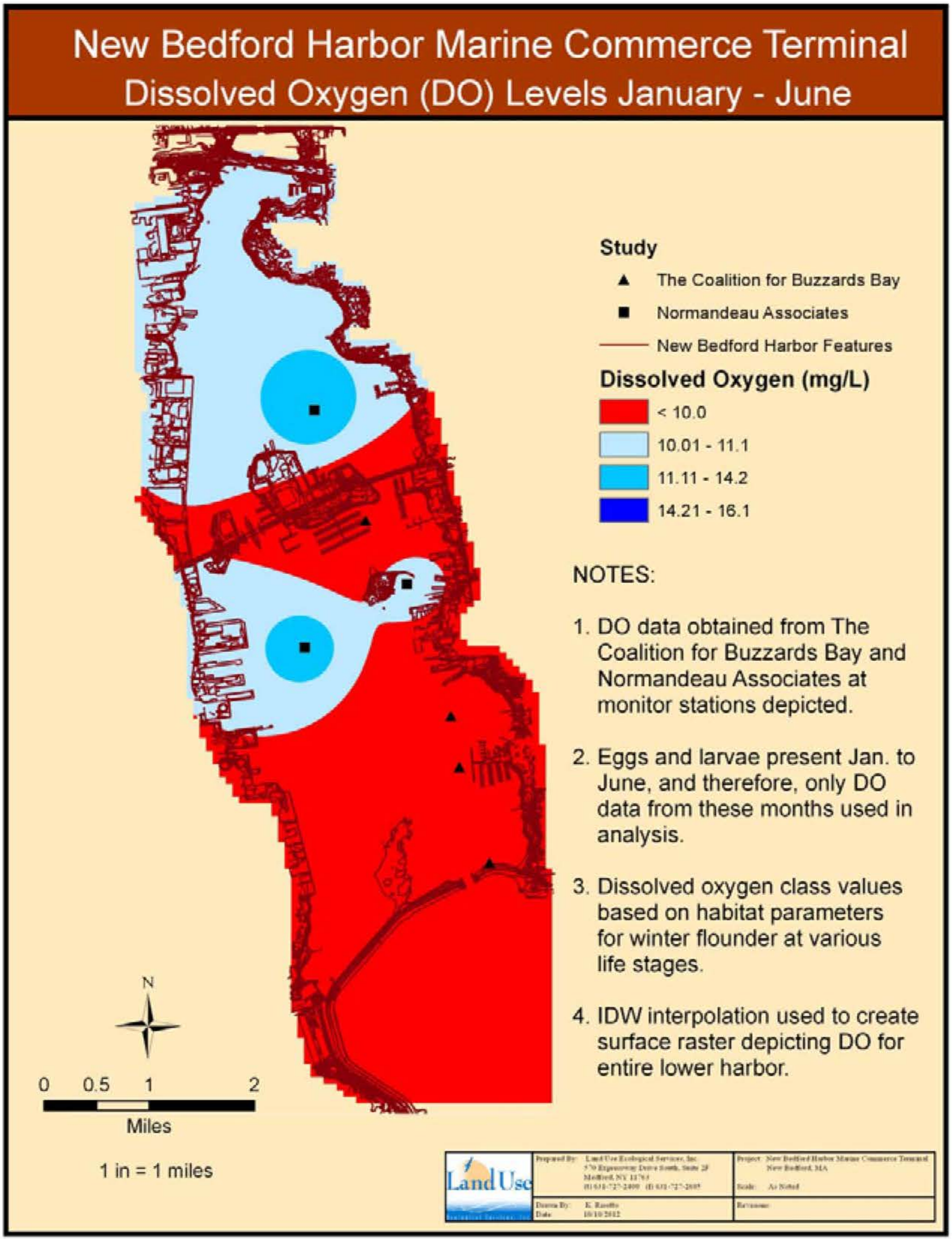


Figure 3. Critical winter flounder habitat for spawning adult, egg, and larval life stages.

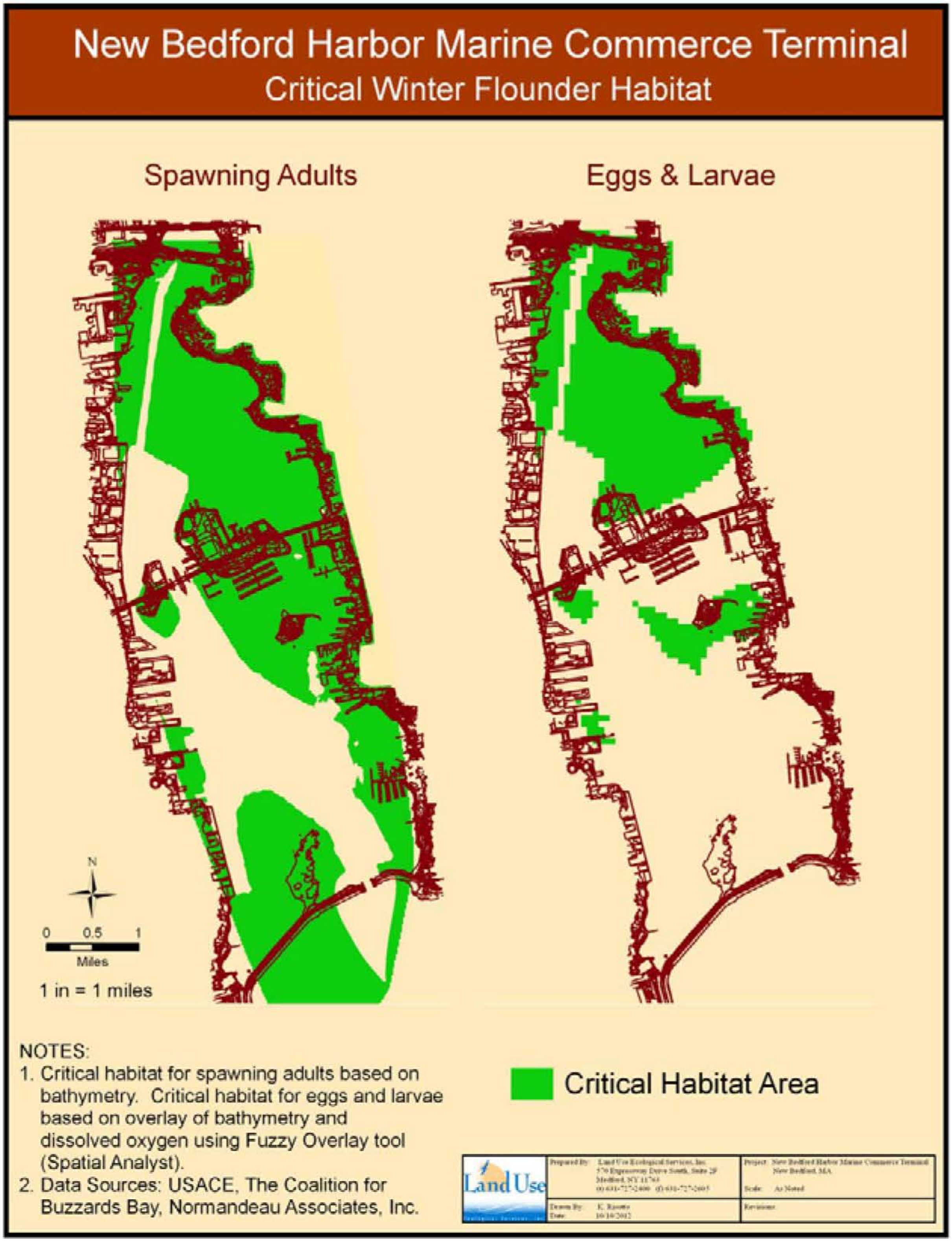


Figure 4. Layout of proposed fish exclusion system that includes silt curtain and bubble barrier.

APEX

PROJECT

NEW BEDFORD MARINE COMMERCE TERMINAL

OWNER

MASSACHUSETTS CLEAN ENERGY CENTER
55 SUMMER STREET, 9TH FLOOR
BOSTON, MA

NO	DATE	DESCRIPTION	BY

PROJECT NO	6690
CADD FILE	GIFFORD_ST
DESIGNED BY	JER
DRAWN BY	JER
CHECKED BY	CHM
DATE	8-27-13
DRAWING SCALE	1"=150'

GRAPHIC SCALE

SCALE: 1"=150'

0 75 150 300

SHEET TITLE

NEW BEDFORD MARINE COMMERCE TERMINAL FISH BARRIER

DRAWING NO

FIGURE 2

1 OF 1

Figure 5. Fish weir details.

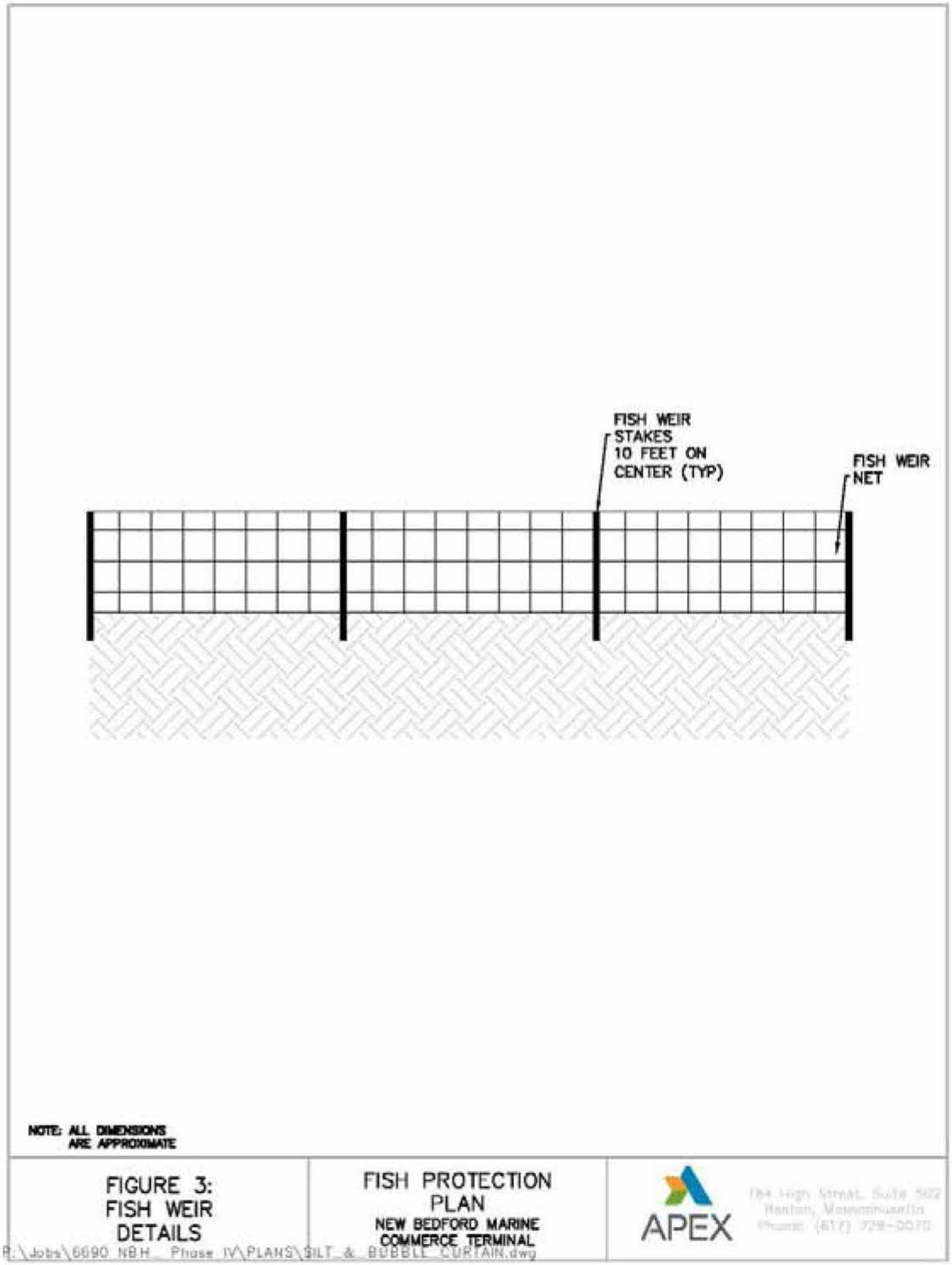


Figure 6. Silt curtain details.

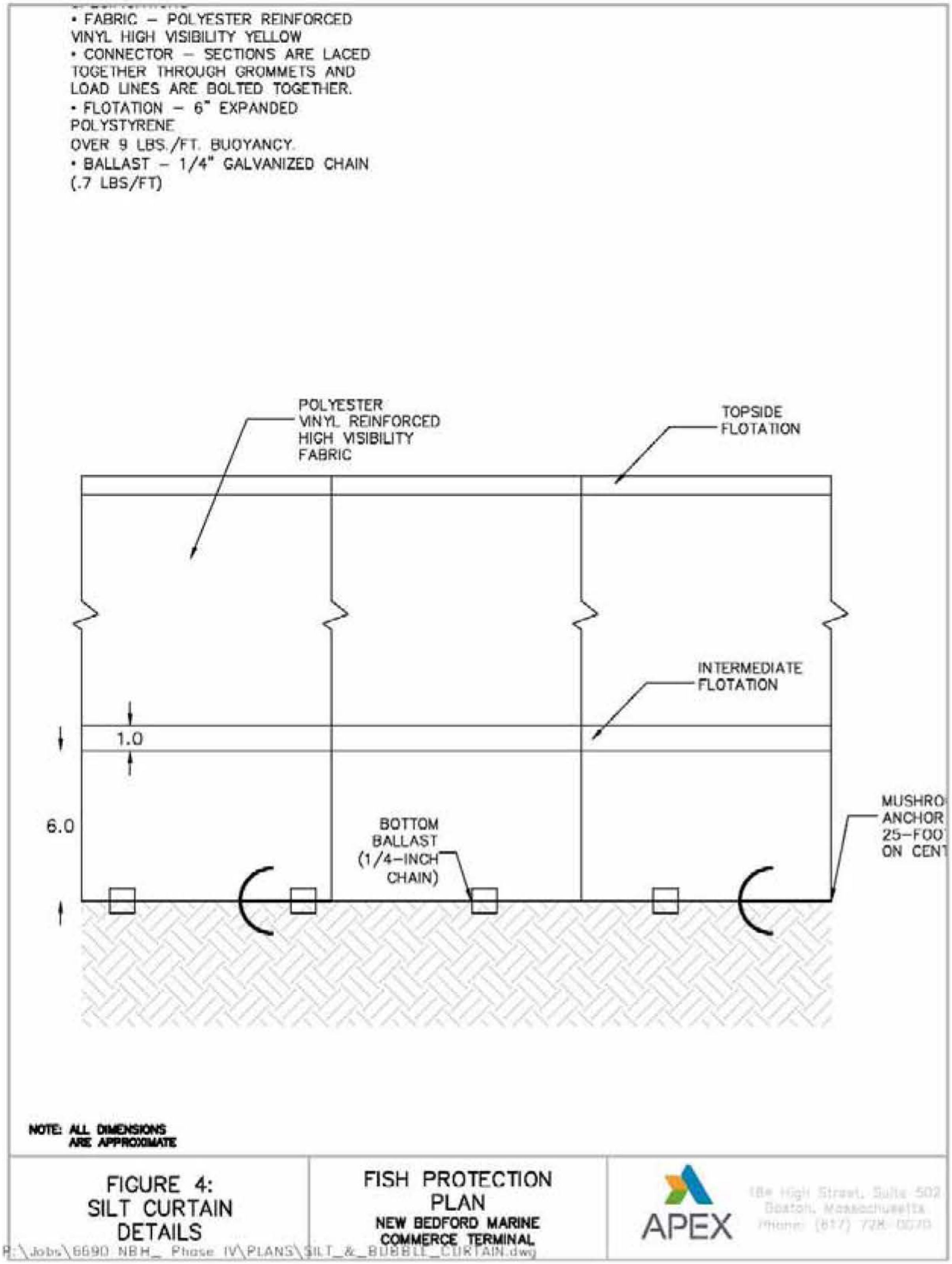


Figure 7. Bubble curtain details.

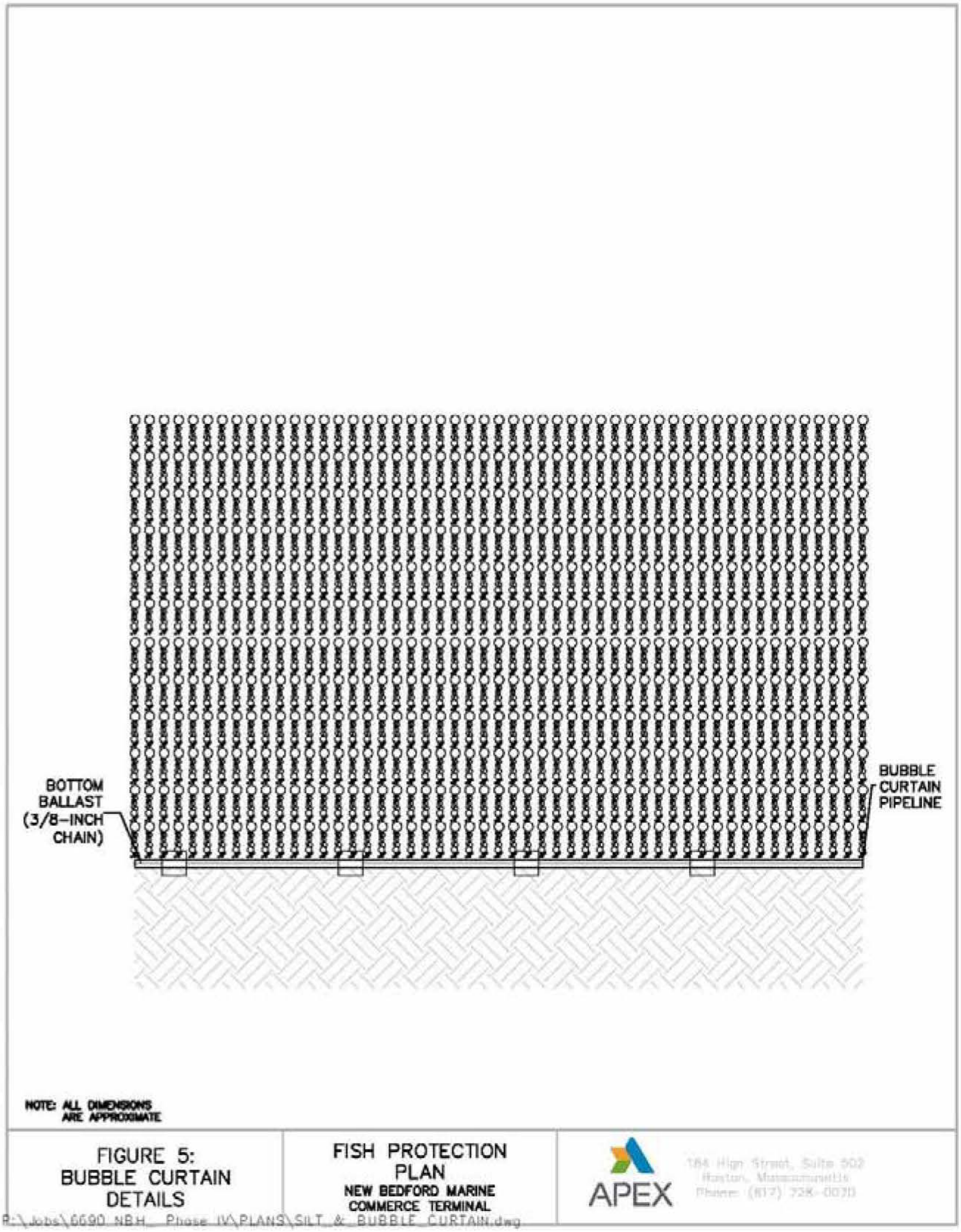
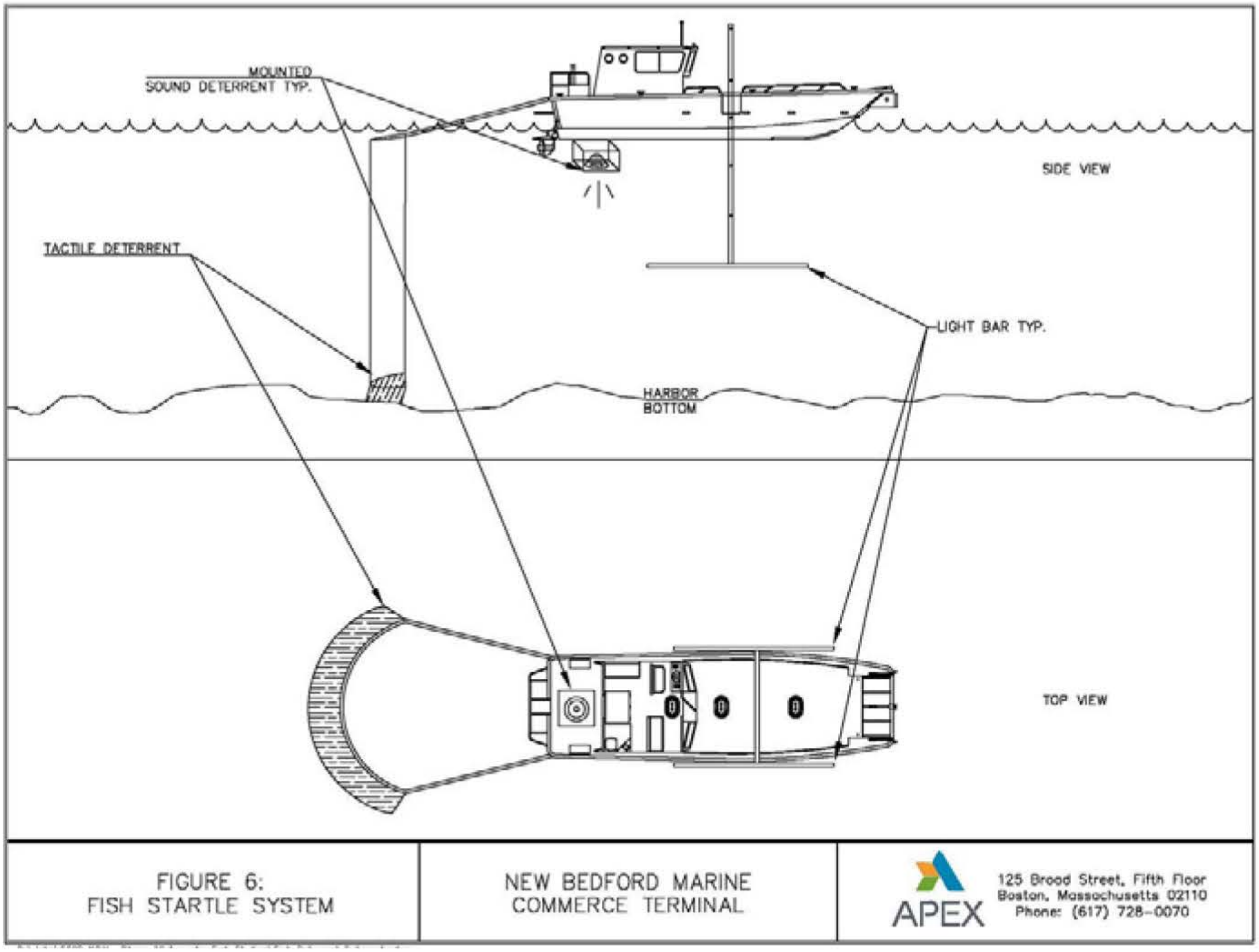


Figure 8. Fish startle system layout.



APPENDIX 3

Biological Assessment
for the Atlantic Sturgeon,
Acipenser oxyrinchus oxyrinchus

New Bedford Marine Commerce Terminal
New Bedford, Massachusetts

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1 Introduction

Section 7 of the Endangered Species Act (ESA,16 USC 1531 et seq.) mandates that all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. If the federal agency determines that an action may adversely affect a federally listed species, consultation with National Marine Fisheries Service (NMFS) is required to ensure that the action will not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat. If it is determined that a proposed federal action is likely to result in the "take" of a listed species, then NMFS may describe those conditions which must be met in order for an activity to proceed. "Take" includes harming or harassing a species in ways which interfere with its normal breeding, feeding, or sheltering behaviors.

This Biological Assessment (BA) was prepared to comply with Section 7 of the ESA, as outlined above, to assess potential impacts of construction and long-term operation of the proposed New Bedford Harbor (NBH) South Terminal Project in New Bedford, MA, on Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Atlantic sturgeon are divided into five distinct population segments (DPSs), which were federally listed as endangered (New York Bight DPS, Chesapeake Bay DPS, Carolina DPS, South Atlantic DPS) or threatened (Gulf of Maine DPS) on February 6, 2012. Although New Bedford Harbor is not designated as critical habitat for any federally species listed under the ESA, the project area may provide potential forage habitat for juvenile and adult Atlantic sturgeon from any of the five DPSs (NMFS letter, June 19, 2012).

2 Description of Project and Action Area

The following sections provide a description of the project and the portion of New Bedford Harbor where the project is proposed (i.e. action area).

2.1 Project Description

The Commonwealth of Massachusetts (hereafter Commonwealth) proposes to construct an approximately 28-acre marine commerce terminal (South Terminal) within the Designated Port Area of New Bedford Harbor at a site north of the harbor's hurricane barrier (Figure 1). The purpose of the terminal is to provide critical infrastructure to serve offshore renewable energy facilities, and to accommodate domestic and international shipping. The project is described in detail in the State Enhanced Remedy in New Bedford, South Terminal (MassDEP, 2012a), submitted January 18, 2012, and the Response to USEPA Comments on the January 18, 2012 Submission by the Commonwealth of Massachusetts for the New Bedford Marine Commerce Terminal (MassDEP, 2012b0, submitted June 18, 2012.

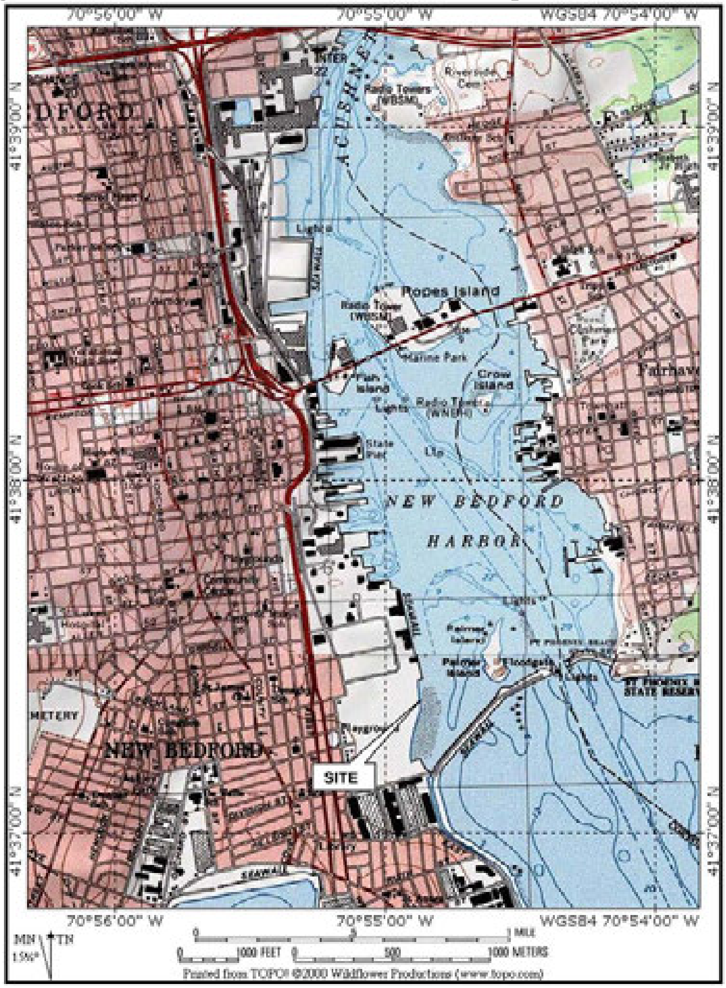
In summary, the project includes the following construction activities in waters of the United States (U.S.):

- Dredging to create a channel, from the existing Federal navigation channel to the facility, to accommodate vessel travel to the new terminal;
- Dredging to relocate two existing vessel mooring areas and the Gifford Street boat channel;
- Construction of a confined aquatic disposal (CAD) cell for disposal of contaminated sediments below the ocean floor;
- Construction of a confined disposal facility (CDF) for disposal of sediments above the ocean floor to create the upland terminal structure;

- Construction of approximately 1,000 linear feet of bulkhead, and utilization of 200-feet of existing South Terminal bulkhead (for a total facility bulkhead length of 1,200 feet), to contain the CDF and new terminal.

The project is proposed under the State Enhanced Remedy provision of the US Environmental Protection Agency (EPA) Superfund program (CERCLA). CERCLA regulations allow for a state to petition the EPA to expand its remedial action to include additional activities as an enhancement of the remedy; for this project this includes navigational dredging and disposal of contaminated sediments in CAD cells and construction of a CDF.

Figure 1. NBH South Terminal site location map (MassDEP, 2012a).



Dredging and construction of the South Terminal project will permanently impact 22.39 acres of intertidal, near-shore subtidal, and salt marsh resource areas. Project construction will temporarily impact 36.48 acres of near-shore subtidal resources. Please refer to Section 3 below for a discussion of resources to be impacted by the South Terminal project.

2.2 Action Area

New Bedford Harbor is located on the northern shore of Buzzards Bay, and is bounded on the east by Fairhaven and the west by New Bedford. The Acushet River flows into the bay from the north, and is the most significant freshwater input for the harbor (Figure 1).

New Bedford Harbor is classified into three regions: (1) Upper, north of Cogshell Street Bridge, (2) Lower (or Inner), between Cogshell Street Bridge and New Bedford Hurricane Barrier, and (3) Outer, south of New Bedford Hurricane Barrier. The South Terminal and CDF, CAD cell, and dredging areas are within the Lower (Inner) Harbor, which is bounded on the north by the Acushet River and the south by the hurricane barrier.

Currently, the inner harbor is characterized by a commercial fishing fleet, recreational vessel fleet, fish processing and cold storage facilities, commercial shipping facilities, a ferry and cruise ship terminal, vessel maintenance and repair facilities, several marinas, and historical attractions. Land use along the shoreline is a mixture of industrial, commercial, and residential uses (MassDEP, 2012a).

Historically, New Bedford Harbor was characterized by industrial and commercial uses, including textile mills and electronics industries that resulted in the contamination of harbor sediments with polychlorinated biphenyls (PCBs) and heavy metals. Contamination extends from the upper Acushet River to Buzzards Bay to varying degrees. Bioaccumulation of PCBs within the aquatic food web has resulted in closure of the harbor to fishing and shellfishing. PCB contamination has also led to restrictions in recreational activities and development within the harbor. In 1983, EPA added New Bedford Harbor to the National Priorities List as a designated Superfund Site (USEPA, 2012). Remediation of New Bedford Harbor by the EPA through dredging to remove and containment to sequester contaminated sediments began in 2004, and to date has removed or contained approximately 200,000 cubic yards of contaminated sediments (USEPA, 2012).

3 Environmental Setting

The following sections provide a description of the environmental setting in which the New Bedford Marine Commerce Terminal project shall take place, inclusive of subtidal biological resources and physical characteristics of the Harbor.

3.1 Subtidal Biological Resources

New Bedford Harbor functions as an ocean embayment and estuary, and supports a variety of benthic invertebrates, shellfish, and finfish resources (USEPA, 2012). However, contamination of harbor sediments with PCBs and heavy metals has resulted in the closure of the Upper Harbor, Lower Harbor, and portions of the Outer Harbor to fishing and shellfishing (USEPA, 2012). Bioaccumulation of PCBs and other contaminants in shellfish and finfish is monitored through the Annual Seafood Monitoring program (http://www.epa.gov/nbh/data.html#OtherRelevantDocs).

3.1.1 Benthic Fauna

New Bedford Harbor features a diverse assemblage of benthic invertebrates, which may exhibit important variations across seasons and sites. These invertebrates provide a food source for many predatory finfish, including Atlantic sturgeon (see Section 4).

As part of the New Bedford Harbor Long Term Monitoring Program, twenty-nine (29) sampling stations are located throughout the Lower Harbor, at a range of depth, habitat, and substrate types. In 2010, 10,226 organisms from 136 species were sampled (Woods Hole Group, Inc., 2010). *Streblospio benedicti*, a polychaete worm, was the dominant species, followed by the polychaetes *Tharyx acutus* and *Leitoscoloplos* sp. Please refer to Appendix K of the 2010 Long Term Monitoring Report V for a complete species list for

New Bedford Harbor, which includes sampling data from 1993 through 2009 (Woods Hole Group, Inc., 2010).

In 2005, 14,547 organisms from 85 species were sampled (Batelle, 2005). 2005 sampling was dominated by *Mulinia laterialis*, the dwarf surf clam, followed by *S. benedictii* and oligochaete worms. The complete species list for the 2005 Long Term Monitoring Report IV can be found in Appendix 9 of that report (Batelle, 2005).

3.1.2 Shellfish Resources

Shellfish resources in New Bedford Harbor are dominated by quahog or hard clam, *Mercenaria mercenaria* (MassDEP, 2012a). Other species found within the Lower Harbor include common or eastern oyster (*Crassostrea virginica*), bay scallop (*Argopecten irradians*), soft shell clam (*Mya arenaria*), blue mussel (*Mytilus edulis*), and ribbed mussel (*Geukensia demissa*).

The project is expected to result in the mortality of approximately 9.8 million quahog and other shellfish species. A mitigation plan has been developed that includes seeding of approximately 24.5 million quahog and oysters over a 10-15 year period (NMFS letter, August 21, 2012 and Commonwealth response dated October 4, 2012).

3.1.3 Finfish Resources

Finfish resources within New Bedford Harbor are presented in detail in Section 6.4.5, Essential Fish Habitat Assessment, of the State Enhanced Remedy in New Bedford, South Terminal (MassDEP 2012a). Essential Fish Habitat (EFH) is designated for twenty (20) species within the 10 minute x 10 minute square for Atlantic Ocean waters that encompass New Bedford Harbor. Essential Fish Habitat is designated for fifteen (15) species within the Buzzards Bay Estuary/Bay/River (Table 1).

Table 1. Species for which New Bedford Harbor is designated Essential Fish Habitat by NMFS.

Species	Eggs	Larvae	Juveniles	Adults	Spawning Adults[1]
Atlantic cod (*Gadus morhua*)	X	X	X	X	
Haddock (*Melanogrammus aeglefinus*)	X	X			
Red hake (*Urophysis chuss*)		X	X	X	X
Winter flounder (*Pseudopleuronectes americanus*)	X	X	X	X	X
Windowpane flounder (*Scopthalmus aquosus*)	X	X	X	X	X
American plaice (*Hippoglossoides platessoides*)			X	X	
Atlantic sea herring (*Clupea harengus*)			X	X	
Bluefish (*Pomatomus saltatrix*)			X	X	
Long finned squid (*Loligo pealeii*)[2]	n/a	n/a	X	X	
Atlantic butterfish (*Peprilus triacanthus*)	X	X	X	X	
Atlantic mackerel (*Gadus morhua*)	X	X[2]	X[2]	X	
Summer flounder (*Paralicthys dentatus*)	X[2]	X	X	X	
Scup (*Stenotomus chrysops*)	X	X	X	X	
Black sea bass (*Centropristus striata*)	X[3]	X	X	X	
Surf clam (*Spissula solidissima*)[2]	n/a	n/a	X	X	
King mackerel (*Scomberomorus cavalla*)	X	X	X	X	
Spanish mackerel (*Scomberomorus maculates*)	X	X	X	X	
Cobia (*Rachycentron canadum*)	X	X	X	X	
Sandbar shark (*Carcharhinus plumbeus*) [2]				X	
Bluefin tuna (*Thunnus thynnus*) [2]			X		

[1] Spawning adult designation for Buzzards Bay Estuary/Bay/River only. [2] Designated within Atlantic Ocean quadrant only.
[3] Designated within Buzzards Bay Estuary/Bay/River only.

Finfish resources were also characterized by Normandeau Associates using survey data collected monthly over a one-year period (Normandeau Associates, 1999). Seine (0-1 m depth) and trawl (2-10 m depth) methods were utilized to survey the harbor for finfish resources from June 1998 through May 1999. In the Lower Harbor, one seine (NS3) and two trawls (NT4, NT5) characterized the finfish resources. Species captured through survey efforts in the Lower Harbor are listed in Table 2.

Table 2. Finfish resources captured in lower New Bedford Harbor by Normandeau Associates (1999).

Species	Seine (S) or Trawl (T)
Alewife (*Alosa psuedoharengus*)	T
American eel (*Anguilla rostrata*)	T
Atlantic herring (*Clupea harengus*)	T
Atlantic menhaden (*Brevoortia tyrannus*)	S, T
Atlantic silverside (*Menidia menidia*)	S, T
Atlantic tomcod (*Microgadus tomcod*)	S
Banded rudderfish (*Seriola zonata*)	T
Bay anchovy (*Anchoa mitchilli*)	T
Black sea bass (*Centropristus striata*)	S
Bluefish (*Pomatomus saltatrix*)	S
Crevalle jack (*Caranx hippos*)	T
Cunner (*Tautogolabrus adspersus*)	S
Fourspine stickleback (*Apeltes quadracus*)	S
Fundulus sp.	S
Grubby (*Myoxocephalus aenaeus*)	S
Gulf stream flounder (*Citharichthys arctifrons*)	T
Hake sp. (*Urophycis* sp.)	S
Mummichog (*Fundulus heteroclitus*)	S
Northern kingfish (*Menticirrhus saxatilis*)	S
Northern pipefish (*Syngnathus fuscus*)	S
Northern puffer (*Sphoeroides maculates*)	S
Oyster toadfish (*Opsanus tau*)	T
Pollock (*Pollachius virens*)	T
Rainbow smelt (*Osmerus mordax*)	T
Red hake (*Urophysis chuss*)	T
Scup (*Stenotomus chrysops*)	S
Seaboard goby (*Gobiosoma ginsburgi*)	S
Sheepshead minnow (*Cypinodon variegates*)	S
Short bigeye (*Pristigenys alta*)	T
Skate sp. (*Raja* sp.)	T
Smooth flounder (*Pleuronectes putnami*)	S
Spotted hake (*Urophycis regia*)	S
Striped bass (*Morone saxatilis*)	T
Striped killifish (*Fundulus majalis*)	S
Striped searobin (*Prionotus evolans*)	S
Summer flounder (*Paralicthys dentatus*)	T
Tautog (*Tautoga onitis*)	T
Tidewater silverside (*Menidia peninsulae*)	S
Weakfish (*Cynoscion regalis*)	T
White perch (*Morone americana*)	T
Windowpane flounder (*Scopthalmus aquosus*)	T
Winter flounder (*Psuedopleuronectes americanus*)	S, T

3.2 Physical Characteristics

New Bedford Harbor is a shallow coastal embayment characterized by open water, rocky shores, beaches, tidal creeks and marshes, and other coastal habitats. The harbor has been altered by dredging and other anthropogenic uses, including establishment and maintenance of a Federal navigation channel that extends from the hurricane barrier north to the Acushet River; development of industrial, commercial, and recreational uses that line the harbor; and construction of the hurricane barrier. Decades of industrial activity within and along the banks of the Harbor has resulted in the contamination of Harbor sediments with PCBs and heavy metal constituents to the degree that the Harbor has been declared a Superfund Site.

New Bedford Harbor has mean tidal range of approximately 3.7 ft (1.1 m) and spring tidal range of 4.6 ft (1.4 m). Water temperature in New Bedford Harbor ranges from 1.1°C (Jan/Feb) to 25.8°C (Jul/Aug) [NOAA NODC, 2012]. Salinity ranges from 19 ppt to 37 ppt, and dissolved oxygen ranges from 4.0 mg/L to 13.5 mg/L (USEPA, 2010; The Coalition for Buzzards Bay, 2012).

The Lower (Inner) Harbor is generally shallow, with depths ranging from 0 – 50 feet below mean lower low water (MLLW) [USACE, 1998]. The terminal site is characterized by shallow water (< 8' below MLLW) and coastal wetland habitats. Shallow water and various coastal habitats are present from the terminal site to Palmer Island and the western edge of the federal navigation channel. The federal navigation channel enters the Lower Harbor at the hurricane barrier, where it splits into two channels. The New Bedford Reach, authorized to a depth of -30 feet MLLW, runs through the center of the Lower Harbor and terminates with a turning basin between the western harbor shoreline and Pope's Island. A maneuvering area lies adjacent to the west side of the New Bedford Reach, also authorized to a depth of -30 feet MLLW. The Fairhaven Reach, authorized to a depth of -15 feet MLLW to Old South Wharf and then to a depth of -10 feet MLLW for the remainder of the channel, provides access to the eastern shore of the Lower Harbor and extends northeasterly to between Crow Island and the eastern shore. Adjacent to the Fairhaven Reach is an anchorage area, authorized to a depth of -25 feet MLLW (Maguire Group, Inc., 2002).

Long-term sediment and toxicity monitoring has been conducted in New Bedford Harbor as part of the Superfund monitoring program. PCB levels within the Lower Harbor range from non-detectible to 190 ppm. Higher PCB concentrations occur in shallower depths outside of the Federal navigation channel, and north of Popes Island (NBHTC, 2001). EPA Monitor Station 253 lies within the proposed South Terminal dredge area, and has been monitored since 1993. Sediment characteristics for this station include PCB concentrations that average 5.7 ppm and an average silt/clay content of 46.9% (MassDEP & MassDMF, 2010). Sampling conducted as part of the South Terminal project indicates that sediments within the footprint the project facility contain PCBs up to approximately 20 ppm. Note that the US Food and Drug Administration (FDA) criterion for PCB concentrations in commercial seafood is 2.0 ppm.

Harbor circulation conditions are influenced primarily by tidal currents. Currents in the Lower Harbor are weak, typically less than 0.4 knots (0.18 m/s). Bottom friction in the Lower Harbor results in small-scale eddies that create a vertically well-mixed boundary layer in deeper waters, causing sediments to remain suspended in the water column (NBHTC, 2001). The exceptions to weak Lower Harbor currents are the entrance to the hurricane barrier, where currents have been measured at 2.4 knots (122 m/s) during the flood tide, and the Coggshell Street Bridge, where currents have been measured at 3.5 knots (1.8 m/s).

4 Biology of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)

The following sections provide a description of the Biology of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*, including its life history, habitat and feeding preferences, and geographical distribution.

4.1 Life History

The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) is a long-lived, late maturing, estuarine dependent, anadromous finfish species. Atlantic sturgeon spawn in freshwater river systems, but otherwise spend the majority of their adult life in marine ecosystems (Dunton et al., 2010; ASSRT, 2007; Beamesderfer & Farr, 1997; Gilbert, 1989).

Spawning takes place from April – May in mid-Atlantic systems and May – July in Canadian systems. Atlantic sturgeon return to their natal river to spawn every 1-5 years (male) and 2-5 years (female). Females migrate back out to coastal waters immediately after spawning, while males remain in spawning ground through the season. Sturgeon spawn in flowing water between the salt front and fall line of large rivers, where flows are high due to spring runoff. Eggs are highly adhesive and are deposited on the bottom on hard substrates such as cobble (ASSRT, 2007; Beamesderfer & Farr, 1997). Hatching occurs 94-140 hours after eggs are deposited (ASSRT, 2007; Gilbert, 1989).

The yolksac larval stage, from hatching to 31.5 mm total length (TL), is completed in 8-12 days, during which time the larvae migrate downstream to rearing grounds. Larval migration is limited to night during the first half of this migration downstream, and daylight is spent using benthic structure, such as gravel or cobble, as refuge. As larvae develop, migration expands to daylight hours (ASSRT, 2007). Young-of-the-year (YOY) sturgeon, 31.5 mm – 41 cm TL are also dependent on bottom substrate for refuge from predators.

Juvenile sturgeon continue the downstream migration into brackish and then estuarine waters, where they become residents for months to years. At approximately 76-92 cm TL, juvenile or sub-adult sturgeon move to coastal waters and may undertake long-range migrations throughout sub-adult and adult life stages. Data suggests that Atlantic sturgeon migrate south along the coast to North Carolina to Virginia during winter months, with return migration to northern waters in the spring prior to spawning season (Dunton, et al., 2010; Fox & Breece, 2010; Gilbert, 1989).

Age at maturity for Atlantic sturgeon varies, with faster growth and earlier age at maturation for southern populations. Average age at maturity for females is 15 years or 197 cm TL (ASSRT, 2007).

4.2 Habitat and Feeding Preferences

New Bedford Harbor has been identified as possible habitat for sub-adult and adult life stages of Atlantic sturgeon (NMFS letter, August 21 2012). This assessment shall therefore focus on the habitat parameters for these life stages. Juvenile and sub-adult terminology is often interchanged in the literature concerning Atlantic sturgeon. For this report, sub-adult shall be defined as any juvenile or sub-adult sturgeon that is not considered a YOY (≤ 41 cm TL) or mature adult (ASSRT, 2007).

4.2.1 Depth

Sub-adult and adult Atlantic sturgeon occupy shallow coastal waters adjacent to estuaries. Capture of sub-adult and adult Atlantic sturgeon typically occurs at depths of 10-50 m dominated by gravel and sand substrates (ASSRT, 2007; Dunton, et al., 2010; Laney, et al., 2007; NRDC, 2009; Stein et al., 2004).

Dunton et al. (2010) analyzed abundance and distribution of Atlantic sturgeon using fishery-independent survey data from 1973 – 2007, and concluded that depth is the primary parameter defining distribution of Atlantic sturgeon. Analysis revealed that the majority of Atlantic sturgeon captured in trawl surveys from Maine to North Carolina were sub-adults aggregating around the mouths of estuaries and along a narrow migration corridor in waters less than 20 m deep from Cape Hatteras (NC) to the south shore of Long Island (NY).

Laney et al. (2007) synthesized data from winter tagging cruises from 1988 – 2006 off the coasts of Virginia and North Carolina, and found that sturgeon were captured at depths ranging from 9.1 – 21.3 m (30 – 70 ft). Stein et al. (2004) used fishery data from 1989 – 2000 to categorize habitat for Atlantic sturgeon as depths of 10-50 m dominated by gravel and sand substrates.

Higher concentrations of Atlantic sturgeon are associated with coastal features such as inlets and the mouths of bays (Dunton, et al., 2010; Fox & Breece, 2010, Stein et al., 2004). Coastal features identified as areas where Atlantic sturgeon aggregate include Bay of Fundy, Kennebec River, Massachusetts Bay, Rhode Island, Hudson River-NY Bight, New Jersey, Delaware Bay, Chesapeake Bay, Cape Hattaras (Dunton, et al., 2010; Fox & Breece, 2010, Stein et al., 2004). The reason for higher concentration of sturgeon in these areas is not known, but it is theorized that abundance of preferred prey in these areas is a key factor. Tidal outflow plumes have physical and biological characteristics that appear to influence distribution of sturgeon in these areas, including increased prey base (Stein et al., 2004).

4.2.2 Water Quality

Atlantic sturgeon sub-adults inhabit waters with temperatures of 13.2 – 28 °C, moving to deeper, cooler waters during summer months (Musick, 2005). Studies have shown that Atlantic sturgeon sub-adults will avoid temperatures greater than 28°C (Niklitschek & Secor, 2005). Atlantic sturgeon adults occupy coastal waters with temperatures typically ranging from 13 – 24 °C (Dunton, et al., 2010).

Sub-adult sturgeon inhabit waters with salinities ranging from brackish (5-25 ppt) to marine (> 25 ppt), while adults mainly inhabit marine waters except during spawning season. Both sub-adults and adults avoid regions of hypoxia, where dissolved oxygen is < 4.0 mg/L.

4.2.3 Feeding Habits

Atlantic sturgeon are benthic omnivores, feeding on a variety of invertebrates and small fish by rooting along the bottom, sucking in large quantities of mud and prey. They compete for prey with other benthic predators, including suckers (*Moxotoma* sp.), winter flounder (*Pseudopleuronectes americanus*), tautog (*Tautoga onitis*), cunner (*Tautagolabrus adspersus*), porgies (Sparidae), croakers (Sciaenidae) and stingrays (*Dasyatis* sp.) [ASSRT, 2007].

Sub-adults feed mainly on aquatic insects and invertebrates; adults expand their diets to include mollusks, gastropods, amphipods, isopods and small fish, especially sand lances (*Ammodytes* sp.) [ASSRT, 2007; Murawski & Pacheco, 1977; NRDC, 2009; Smith, 1985]. Distribution of sub-adult and adult sturgeon is correlated with prey base. Sturgeon will often forage at or near mudflats with areas of submerged aquatic vegetation (SAV) or shellfish resources. Although no SAV beds are present in the project area, the presence of benthic invertebrates and shellfish resources in the Lower Harbor has led resource scientists to suggest that the area should be evaluated as foraging habitat for sub-adult and adult sturgeon.

4.3 Geographical Distribution

Atlantic sturgeon are distributed from Hamilton Inlet on the coast of Labrador to the Saint Johns River in Florida (ASSRT, 2007; Dunton, et al., 2010, Stein et al., 2004). Records confirm that spawning historically occurred in 35 rivers of the U.S., from St. Croix, ME to Saint Johns River, FL. Closest to New Bedford Harbor, historic spawning populations of Atlantic sturgeon existed in the Taunton River (RI and MA) until the early 20th century, but only a handful of non-natal sub-adults and adults have been recorded since (ASSRT, 2007). Currently, Atlantic sturgeon spawn in an estimated 20 U.S. rivers. The closest confirmed spawning river to the New Bedford Harbor project area is the Hudson River in New York (NRDC, 2009). For this reason, the New Bedford Harbor project area is not considered habitat for spawning adults and early life stages of Atlantic sturgeon.

Given the habitat preferences and migration patterns outlined above for Atlantic sturgeon, NMFS has asserted the possibility that sub-adult or adult sturgeon from any of the five ESA listed distinct population segments (DPSs) of Atlantic sturgeon may forage in New Bedford Harbor from April – October (NMFS letter, August 21 2012). To assess the potential impacts of this project on sub-adult and adult Atlantic sturgeon, a literature and data review of surveys and abundance estimates for New Bedford Harbor and Buzzards Bay, located to the south of New Bedford Harbor, was performed.

The only finfish resource survey conducted in New Bedford Harbor was performed by Normandeau Associates (1999) from June 1998 to May 1999. Surveys were conducted monthly using seine (0-1 m depth) and trawl (2-10 m depth) methods. No Atlantic sturgeon were recorded.

Massachusetts Division of Marine Fisheries (DMF) was consulted regarding known occurrences of Atlantic sturgeon in New Bedford Harbor based on other data sources. Massachusetts DMF stated that Atlantic sturgeon have never been recorded in New Bedford Harbor, and that the Harbor is not considered habitat by their sturgeon experts (Kathryn Ford, MassDMF New Bedford Office, via telephone call October 9, 2012).

Massachusetts DMF (King et al., 2010) synthesized data from trawl surveys conducted throughout waters of Massachusetts from 1978 – 2007 to develop a comprehensive list of species recorded by region. New Bedford Harbor and Buzzards Bay are within Region 1 of the DMF trawl surveys. Trawl surveys were conducted in Region 1 in May and September at depths of ≤ 30 ft, 30-60 ft, 60-90 ft, and 90-120 ft. Atlantic sturgeon were not recorded in any Region 1 trawl survey.

Camisa & Wilbur (2002) conducted trawl surveys in Buzzards Bay for the Buzzards Bay Dredge Material Management Plan (DMMP) Draft Environmental Impact Report (DEIR). Surveys were conducted using an otter trawl in March 2001, twice monthly from April – October 2001, and once monthly from November 2001 – March 2002. Atlantic sturgeon were not captured in any trawl.

Stone et al. (1994) synthesized literature and data to assess distribution and abundance of fishes and invertebrates in mid-Atlantic estuaries, inclusive of Atlantic sturgeon. Spatial distribution, temporal distribution, and relative abundance was estimated for Atlantic sturgeon in Buzzards Bay. Atlantic sturgeon sub-adults and adults are listed rare in Buzzards Bay throughout the year. Rare is defined as "species is definitely present by not frequently encountered." In addition to assessing each species, the reliability of the conclusions was determined. For Atlantic sturgeon in Buzzards Bay, the data reliability is listed as "reasonable inference", defined as "little or no data available. Information on distribution, ecology, and preferred habitats documented in similar estuaries."

Finally, the FishBase (Froaese & Pauly, 2011) database for occurrences of Atlantic sturgeon was also reviewed. No Atlantic sturgeon have been recorded in New Bedford Harbor or Buzzards Bay from 1878 – present.

In summary, based on all available data, Atlantic sturgeon have never been recorded in New Bedford Harbor. Atlantic sturgeon have also never been recorded in Buzzards Bay, where they would be more likely to occur as the bay is proximal to known coastal foraging and migratory habitat. Therefore, New Bedford Harbor should not be considered as migratory or foraging habitat that is utilized by sub-adult or adult Atlantic sturgeon.

5 Analysis of Potential Effects of the Proposed Action

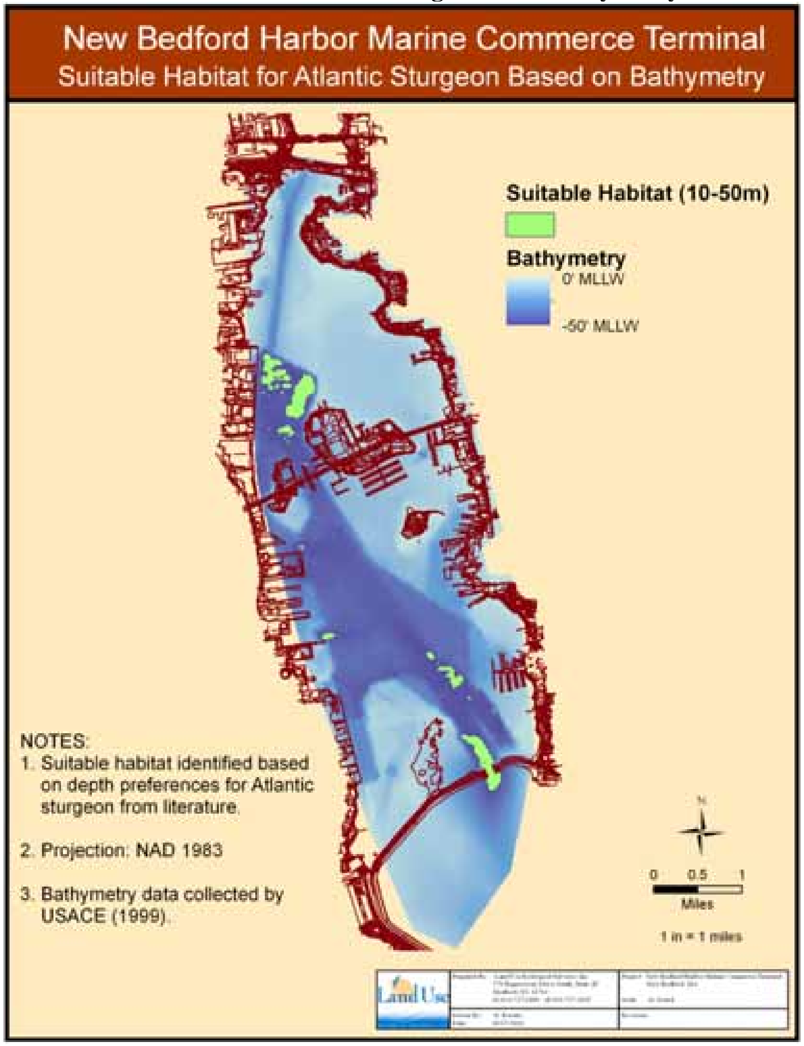
The following sections provide information on identification of suitable habitat within New Bedford Harbor, and assessment of direct and indirect impacts to Atlantic sturgeon from project activities, and discussion of the ecological benefits of the South Terminal project.

5.1 Identification of Suitable Habitat within New Bedford Harbor

As discussed above, Atlantic sturgeon distribution is correlated to prey base. New Bedford Harbor contains sufficient benthic invertebrate and shellfish resources to be considered suitable forage habitat for sub-adult and adult life stages. As such, to determine the potential effects of the proposed action on Atlantic sturgeon resources, bathymetry and water quality data was reviewed to determine parameters to be utilized to identify suitable habitat within New Bedford Harbor. Temperature, salinity, and dissolved oxygen data from The Coalition for Buzzards Bay (2012), Normandeau Associates (1999), Woods Hole Group (2010), and NOAA NODC (2012) demonstrate that the entire Lower Harbor is within the habitat range for sub-adult and adult Atlantic sturgeon from April – October, when these life stages could be present according to NMFS. Suitable habitat was therefore identified within New Bedford Harbor based on 1998 bathymetry data obtained from the USACE.

Bathymetry point data was interpolated using the Natural Neighbor Interpolation Tool (Spatial Analyst) in ArcMap 10 to develop a surface raster for the entire Lower Harbor. Bathymetry in the Lower Harbor ranges from -50.7 feet – 0 feet MLLW (-15.5 – 0 m MLLW). Based on habitat parameters identified in NRDC (2009), ASSRT (2007), and Stein et al. (2004), areas with water deeper than -32.8 feet (10m) MLLW were extrapolated to identify suitable habitat for Atlantic sturgeon sub-adults and adults within New Bedford Harbor (Figure 2). As depicted in Figure 2, there are only small pockets, all within the federal navigation channel and maneuvering area north of Pope's Island, wherein suitable depths exist for Atlantic sturgeon in the lower New Bedford Harbor project area. Suitable habitat identified represents less than 2% of the harbor area.

Figure 2. Suitable habitat areas for Atlantic sturgeon sub-adults and adults within New Bedford Harbor using USACE bathymetry data.



Although small areas of suitable habitat have been identified within the New Bedford Harbor Federal navigation channel, based on bathymetry and depth preferences for sub-adult and adult Atlantic sturgeon, it is highly unlikely that Atlantic sturgeon sub-adults or adults migrate to waters within the Lower Harbor, as sturgeon would need to cross large stretches of unsuitable habitat to reach these areas. As discussed in Section 4 above, sub-adult and adult sturgeon typically inhabit shallow coastal waters, conducting long-distance migrations along the coast within a depth corridor of 10 – 50 m. Higher concentrations of these life stages are associated with open bays and coastal areas, such as Massachusetts Bay (open bay) and coastal Rhode Island. Inland migration only occurs during spawning runs into large freshwater rivers, and the Acushet River is not spawning habitat for Atlantic sturgeon. Therefore, although New Bedford Harbor has small areas of adequate depth within the Federal navigation channel, and prey base to support foraging sub-adult and adult Atlantic sturgeon, it should not be considered as habitat that is utilized by this species.

5.2 Direct Impacts

The following sections summarize potential direct impacts to Atlantic sturgeon, including the potential for physical impacts and acoustic impacts, from the proposed South Terminal project.

5.2.1 Physical Impacts

Atlantic sturgeon are susceptible to entrainment in dredge drag-arms, impeller pumps, hydraulic pipelines, and bucket-and-barge dredge operations (ASSRT, 2007). Studies have shown, however, that sub-adult and adult sturgeon avoid dredge project areas during construction (ASSRT, 2007).

Dredging associated with the South Terminal project is not expected to impact Atlantic sturgeon, as dredging is proposed outside of the areas identified in Section 5.1 as suitable habitat (Figure 1). Placement of dredge spoil in the CAD cells north of Pope's Island will overlap small areas identified as suitable habitat. However, as stated above, New Bedford Harbor should not be considered habitat utilized by Atlantic sturgeon due to its generally shallow depths and distance from the coastal migratory corridor. Furthermore, sturgeon would need to cross large stretches of unsuitable habitat to reach these areas. Finally, Atlantic sturgeon have never been recorded or observed in New Bedford Harbor. Therefore, no direct, physical impacts to Atlantic sturgeon are expected from the South Terminal project.

5.2.2 Acoustic Impacts

In-water construction activities, such as the pile driving, dredging and use of non-explosive rock removal methods, and (potential) use of explosives proposed for the South Terminal project, generate sound that has the potential for negative effects on Atlantic sturgeon. Several studies have documented the effects of in-water construction activities such as pile driving and use of explosives on various species of finfish. Effects range from behavioral (startle response, avoidance), to physiological (stress, temporary or permanent hearing loss, structural and cellular damage of auditory and non-auditory tissues), to lethal (Normandeau Associates, 2012; Caltrans, 2009; Popper & Hasting, 2009; Hastings & Popper, 2005; Yelverton et al., 1975).

NMFS utilizes two sets of criteria to assess potential impacts of in-water sound producing activities on fish, one for non-explosive sound and one for use of explosives. Criteria for injury to fish from pile driving activities were established by the Fisheries Hydroacoustic Working Group (FHWG, 2008). NMFS Northeast Region has adopted these criteria, summarized in Table 3 below.

Table 3. Criteria for assessment of impacts on Atlantic sturgeon from pile driving and non-explosive rock removal.

Threshold	Level
Onset of Injury: Peak	206 dB re 1 μPa
Onset of Injury: Cumulative	187 dB re 1 $\mu Pa^2 \cdot s$
Behavioral Effects	150 dB_{RMS}

For blasting activities, NMFS does not have formal acoustic guidelines or protective criteria for fish. NMFS provided the Commonwealth with the guidelines summarized in Table 4 for use in this acoustic modeling exercise, based on a study performed by Moser (1999) to assess acoustic impacts on juvenile shortnose sturgeon (*Acipenser brevirostrum*) and striped bass (*Morone saxatilis*).

Table 4. Criteria for assessment of impacts on Atlantic sturgeon from use of explosives.

Threshold	Level
Onset of Injury: Peak Pressure Level	75.6 psi
Onset of Injury: Peak Impulse Level	18.4 psi•msec

To determine potential effects of the South Terminal project in-water construction activities on Atlantic sturgeon, JASCO Applied Sciences (Dartmouth, Nova Scotia) conducted an acoustic modeling study of the project site to determine sound levels in New Bedford Harbor that may result from pile-driving, non-explosive rock removal, and use of explosives for rock removal. Site location for each model scenario was based on a worst-case scenario, i.e. the location where sound propagation would extend farthest from the source.

Interpretation of the modeling results to assess potential impacts to Atlantic sturgeon is provided in the following sections.

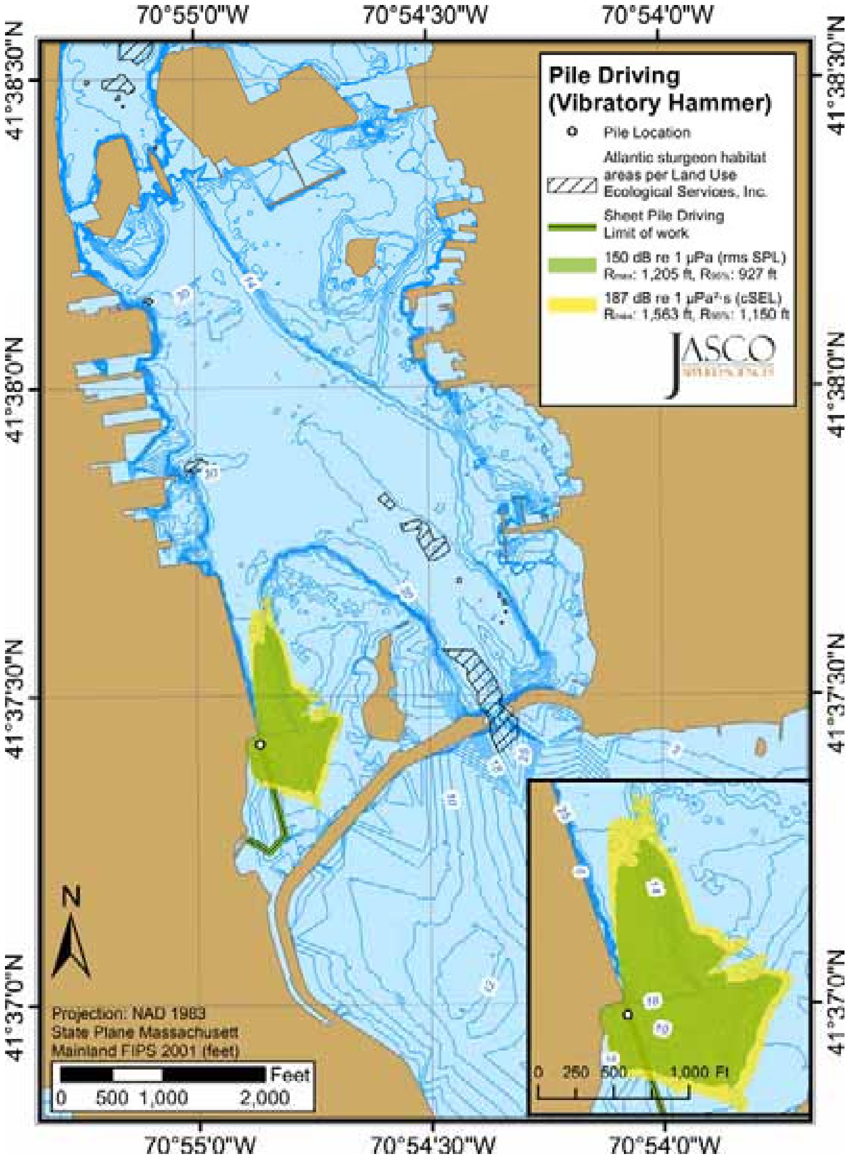
5.2.2.1 Vibratory Pile Driving

Pile-driving for the South Terminal project will be performed using a vibratory hammer. Vibratory pile driving produces a continuous sound with peak pressures lower than impact pile driving. Sound signals are typically a low fundamental frequency characterized by the speed of rotation of the vibratory hammer, and its higher harmonics (Normandeau Associates, 2012).

Acoustic modeling results for pile driving with a vibratory hammer are depicted in Figure 3. As shown in Figure 3, pile driving using a vibratory hammer does not produce a peak sound pressure level (SPL) above the 206 dB re 1 μPa threshold for onset of injury. Cumulative sound exposure level (cSEL) results for onset of injury are based on a threshold established for impulse (i.e. impact) sounds. Pile driving using vibratory hammers produces a continuous sound that does not have the same cumulative effect as pile driving using impact hammers, which produce impulses. It is therefore likely that the area of potential onset of injury is smaller than what is depicted in Figure 3, and would be contained within the behavioral effects area (Marie-Noel Matthew, JASCO Applied Sciences, personal communication). However, in the absence of threshold criteria for onset of injury from continuous sound, the impulse threshold value must be used.

Model results depicting areas for onset of injury and onset of behavioral effects do not overlap suitable habitat areas identified for New Bedford Harbor (Figure 3). Therefore, acoustic modeling demonstrates that pile driving using a vibratory hammer associated with the South Terminal project will have no acoustic effects on Atlantic sturgeon.

Figure 3. Acoustic modeling results for pile driving activities in New Bedford Harbor.



5.2.2.2 Dredging and Use of Non-Explosive Rock Removal Techniques

Noise produced by dredging is dependent on the type of dredge used and the sediment being dredged. Mechanical dredging, using a bucket, grab, or backhoe dredge, produces a repetitive sequence of sounds generated by winches, bucket impact with substrate, bucket closing, and bucket emptying. In addition, operation of mechanical parts of grab and backhoe dredges produces sharp transient sounds. Suction dredging, using a hopper or cutterhead dredge, produces a combination of sounds from relatively continuous sources that include the dredge engine and propeller, operation of pumps, and drag head movement along the substrate (Normandeau Associates, 2012). Substrate properties affect the production of sound with dredging activities. Dredging of sandy substrates creates less noise than dredging of rocky substrates.

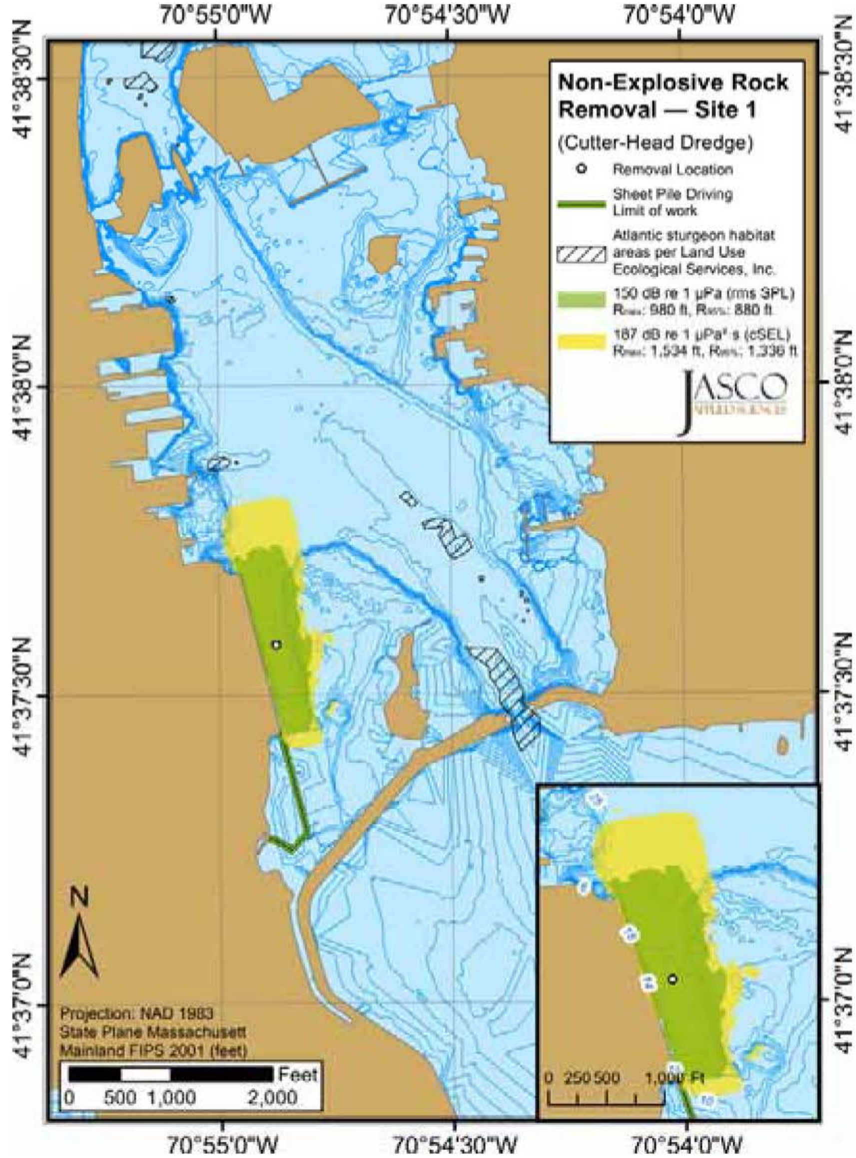
A comparison of prospective sound data found in the literature indicates that the highest level of acoustic and vibrational sound (and thus the highest potential for acoustic impacts on the resource) is most likely to come from cutterhead dredge activities (Marie-Noel Matthews, JASCO Applied Sciences, personal communication). Accordingly, as the activity to have the most likely highest resource impact, the cutterhead dredge activity for the breakup of rock is the activity that was modeled for this section. Acoustic modeling results for cutterhead dredging for removal of rock associated with the South Terminal project are depicted Figure 4. Two locations were selected for modeling. Site 1 is located within the navigation channel, at the northern end of potential rock removal activities (Figure 4a). Site 2 is the same location as modeled for pile driving, to enable comparison of the two sound sources (Figure 4b).

As with pile driving, non-explosive rock removal does not produce peak levels at or above the 206 dB re 1 μPa threshold for onset of injury. Similar to the results for pile driving using a vibratory hammer (Section 5.2.2.1), model results for cumulative impacts are likely an overestimate of the actual extent for onset of injury. Cumulative sound exposure level (cSEL) results for onset of injury are based on a threshold established for impulse (i.e. impact) sounds. Dredging produces a continuous sound that does not have the same cumulative effect as pile driving using impact hammers, which produce impulses. It is likely that the area of potential onset of injury is smaller than what is depicted in Figure 4, and would be contained within the behavioral effects area (Marie-Noel Matthew, JASCO Applied Sciences, personal communication). However, in the absence of threshold criteria for onset of injury from continuous sound, the impulse value must be used.

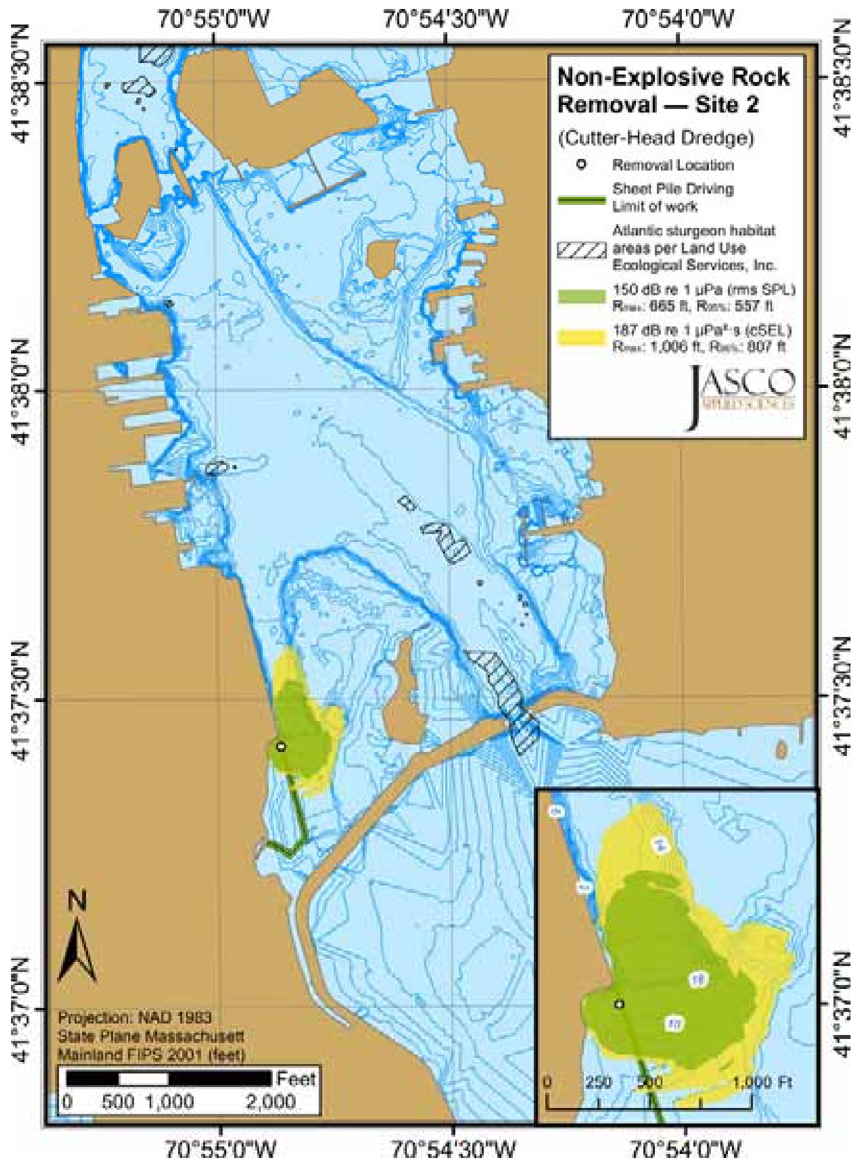
Areas within the onset of injury and onset of behavioral effects thresholds do not overlap with suitable habitat areas identified for New Bedford Harbor, as depicted in Figure 4. As stated above, cutterhead dredging for rock removal was modeled as it produces highest level of acoustic and vibrational sound of the dredging and non-explosive rock removal techniques proposed. Modeling results therefore demonstrate that dredging and non-explosive rock removal associated with the South Terminal project will have no acoustic effects on Atlantic sturgeon.

Figure 4. Acoustic modeling results for non-explosive rock removal activities in New Bedford Harbor. (a) Location #1, within the deeper navigation channel area (b) Location #2, the northern boundary of the South Terminal.

4(a) Location #1, within the deeper navigation channel area.



4(b) Location #2, the northern boundary of the South Terminal.



5.2.2.3 Explosives

Explosives as a rock removal technique are proposed by the Commonwealth for the New Bedford Harbor South Terminal project as a last resort for removal of rock if non-explosive techniques prove ineffective. If explosives are required to remove rock within the proposed navigation channel, they will be placed in a drilled shot hole beneath the floor of the Harbor and covered, which will act to attenuate the sound and acoustic energy in the water column. Additionally, separate engineering modeling of potential vibrational impacts of blasting on the New Bedford Hurricane Barrier (requested by the USACE) has also been conducted; results indicate that the size of blast charges should be limited to ≤ 50 lbs to ensure that potential blasting for the South Terminal project will not impact the hurricane barrier, which is located to the south of the project site (Figure 1). As such, the Commonwealth will be requiring that the selected contractor limit the size of blast charges to ≤ 50 lbs. In keeping with this requirement, acoustic modeling conducted for resources impacts utilized charge sizes from 10 – 50 lbs.

Underwater explosions produce a spherical shock wave with a large oscillating gas bubble that radiates sound. Pressure from underwater explosions consists of a primary pulse (shock) characterized by a rapid rise time and exponential decay, followed by a series of bubble pulses (Normandeau Associates, 2012). Type and size of explosive charge contribute to the pressure produced by an explosive.

Acoustic modeling of explosives was performed for charge sizes of 10 – 50 lbs buried at depth as described above. Results of the model are depicted in Figures 5 and 6. Figure 5 depicts peak pressure threshold (Figure 5a) and impulse level threshold (Figure 5b) for use of explosives without mitigation. Figure 6 depicts peak pressure threshold (Figure 6a) and impulse level threshold (Figure 6b) for use of explosives coupled with use of bubble curtain(s) to mitigate potential impacts.

Figure 5. Acoustic modeling results of the use of explosives of various charge sizes for rock removal. (a) Peak pressure level threshold (left). (b) Impulse level threshold (right).

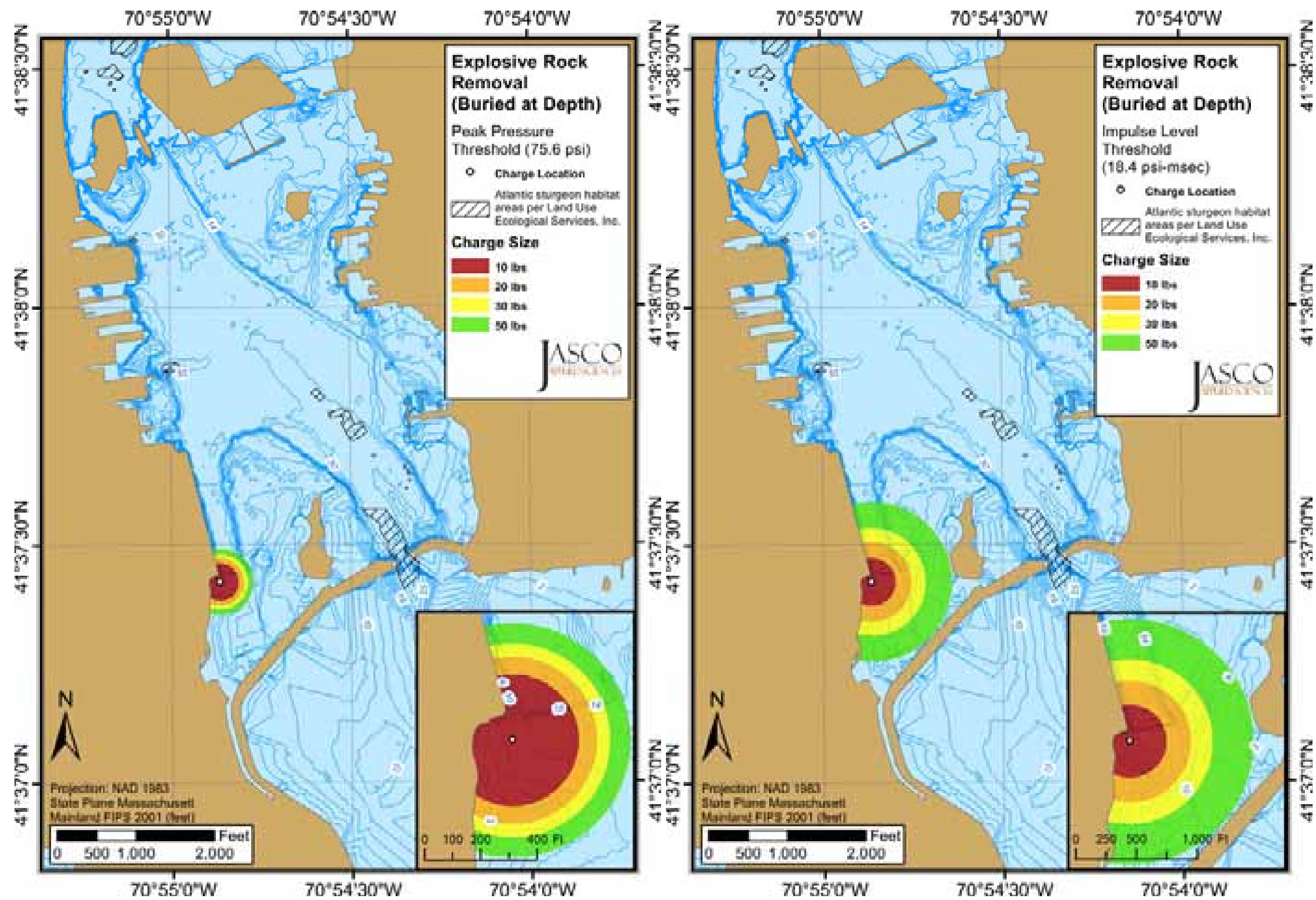
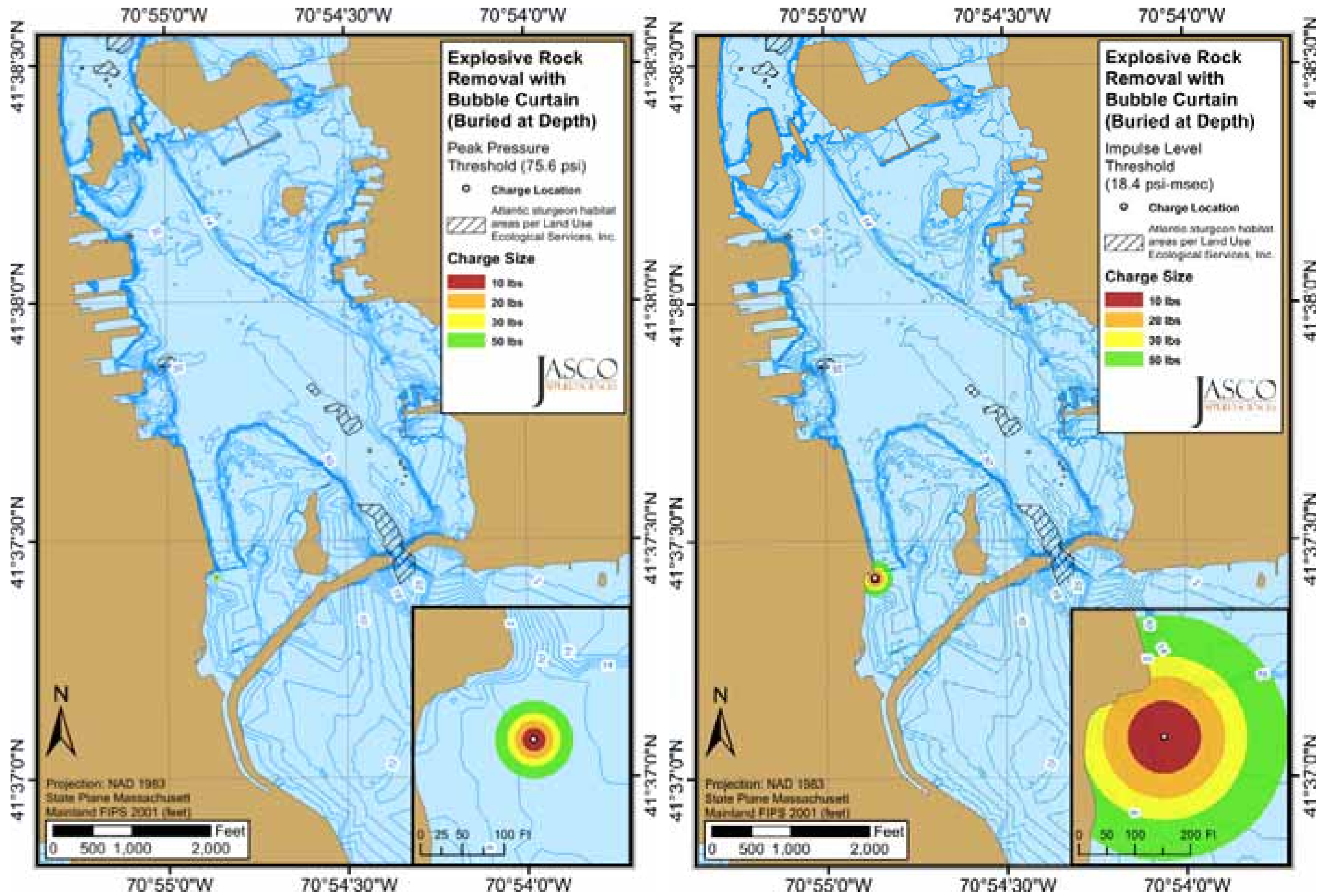


Figure 6. Acoustic modeling results of the use of explosives for rock removal with bubble curtain mitigation. (a) Peak pressure level threshold (left). (b) Impulse level threshold (right).



Model results for use of explosives with and without bubble curtains for attenuation of sound demonstrate that neither peak nor impulse level injury thresholds overlap with areas identified as suitable habitat for Atlantic sturgeon. Potential use of explosives associated with the South Terminal project will therefore have no acoustic effects on Atlantic sturgeon.

5.3 Indirect Impacts

Indirect impacts to sub-adult and adult (non-spawning) Atlantic sturgeon associated with dredging and in-water construction activities include impacts to water quality and benthic prey assemblages. Dredging and in-water construction disturbs bottom sediments, resulting in increases in turbidity during construction activities. Dredging and in-water construction also results in the destruction of benthic feeding areas of Atlantic sturgeon.

Although the benthic community will be impacted by dredging and in-water construction, New Bedford Harbor is not suitable habitat utilized by Atlantic sturgeon due to its generally shallow depths and distance from the coastal migratory corridor. As noted in Sections 4 and 5 above, Atlantic sturgeon have never been recorded or observed in New Bedford Harbor. Therefore, indirect impacts to Atlantic sturgeon are not expected from the South Terminal project.

5.4 Ecological Benefits of the Proposed Project

New Bedford Harbor is contaminated with PCBs and metals (ref. to Section 2.2). PCB contamination in finfish causes reproductive and developmental effects, including reproductive failure and mortality. Exposure to PCBs has also been shown to cause fin erosion, epidermal lesions, blood anemia, and altered immune response in finfish (ASSRT, 2007). Toxic metals may cause death or sub-lethal effects to finfish, and chronic toxicity of some metals may lead to loss of reproductive capabilities, body malformation, inability to avoid predation, and susceptibility to infectious organisms (ASSRT, 2007).

Dredging associated with the South Terminal project will reduce the levels of PCBs and metals in sediments within the areas to be dredged. Contaminated sediments will be disposed of/confined in a CAD cell as outlined in Section 2.2. Removal of contaminated sediments and disposal or confinement will reduce the future potential for finfish and benthic organisms to be exposed to these contaminants. Monitoring as part of EPA's Superfund cleanup has shown measureable decreases in PCB concentrations, and corresponding increases in benthic community conditions, for New Bedford Harbor.

6 Determination of Effects on Atlantic Sturgeon

Based on the analysis presented above, the proposed New Bedford Harbor Marine Commerce Terminal (or South Terminal) project is unlikely to adversely affect the Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus*. New Bedford Harbor and the Acushnet River are not considered spawning habitat for this species, and therefore, the project will have no direct impacts on Atlantic sturgeon spawning or early life stages. In addition, the project is sufficiently distant from the closest extant spawning river for Atlantic sturgeon, the Hudson River in New York, and will therefore have no indirect impacts to spawning or nursery habitat.

The South Terminal site and associated locations of dredging and sediment placement are located in areas that are not suitable habitat for migratory sub-adult and adult Atlantic sturgeon due to shallow water depths and distance from the known coastal habitat and migratory corridor. Based on the existing literature and survey data, Atlantic sturgeon have never been observed in New Bedford Harbor, nor have they been recorded in Buzzards Bay, where they would be more likely to occur as the bay is proximal to known coastal foraging and migratory habitat. Furthermore, sub-adult and adult sturgeon avoid dredging and in-water construction activities, and so, in the unlikely event that a transient sturgeon traveled through the hurricane barrier into lower New Bedford Harbor, dredging and in-water construction activities would drive it out of the project area. Therefore, the project will have no direct effects on sub-adult or adult Atlantic sturgeon. Moreover, as New Bedford Harbor is not considered foraging habitat for Atlantic sturgeon due to shallow depths, the project will have no indirect effects on sturgeon foraging success.

7 Conclusions

The proposed New Bedford Harbor Marine Commerce Terminal project is not expected to affect the Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus*.

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