WRIGHT-PIERCE
Engineering a Better Environment

Pepperrell Cove Wave Attenuation Feasibility Study

April 2015

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

The Pepperrell Cove Wave Attenuation Feasibility Study was developed for the Town of Kittery and Kittery Port Authority by Wright-Pierce. Funding for this plan was provided through a Shore and Harbor Technical Assistance Grant from the Maine Coastal Program at the Maine Department of Agriculture, Conservation and Forestry.

Consultant team members from Wright-Pierce were Jonathan Edgerton, Jeff Normandin, Travis Pryor and Kim McIntire. Chris Heinig of MER provided assistance in the assessment of benthic habitat in the vicinity of the project area.

Thanks go to Town staff and members of the Kittery Port Authority for their work, and to the citizens and representatives of local organizations who participated in the public outreach efforts and meetings, and who provided input. In particular, support was provided by Peter Walsh, Bob Melanson and Nancy Colbert Puff.

This report was prepared by The Town of Kittery under award NA13NOS4190045 from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, as distributed by the Maine Coastal Program. The statements, findings, conclusions, and recommendations are those of the authors and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration, the Department of Commerce or the Maine Coastal Program.

EXECUTIVE SUMMARY

During the recent development of the Town's Shore and Harbor Plan, concerns were expressed regarding the potential impacts of sea level rise, coupled with wave action associated with major storms. In particular, interest was expressed relative to the desirability of enhancing the level of protection of the community's principal anchorage at Pepperrell Cove. Concurrently, as information became available regarding the planned dredging of the Piscataqua River by the Corps of Engineers, a potential opportunity was identified with respect to enhancing the natural wave barrier provided by Fishing and Gooseberry Islands. In concept, the initiative would involve placement of dredged rock debris along the south sides of the two islands to form an artificial ledge, or reef.

Initial discussions with representatives of the Corps were encouraging, and on that basis the Town applied for and was awarded a Shore and Harbor Technical Assistance Grant from the Maine Coastal Program to conduct a feasibility assessment of the initiative. Due to the nature of the contemplated improvements, it was determined that implementation would require significant screening by various state and federal agencies, many of which would be focused on the potential for adverse impacts on benthic and other marine habitats.

Following completion of an assessment of habitats within the area of likely impact, agency representatives were provided an opportunity to comment on their concerns. The primary area of concern noted in these discussions related to the historic presence of eelgrass within the general area of the proposed work, and the potential for the project to preclude or limit the regeneration of now-defunct eelgrass beds in the area between Fishing and Gooseberry Islands and Fort Foster.

As a part of the feasibility assessment, the community and its consultant conducted a public forum, which included information for residents and other stakeholders regarding the study effort, as well as an opportunity for members of the public to ask questions and provide comments regarding the potential improvements.

As state and federal regulatory processes often include consideration of "lower impact practicable alternatives" as a requirement, this report includes discussion of the potential use of a floating wave attenuation system. A system of this nature was installed across the estuary at the USCG facility several years ago, and consideration of this option was included in the planning process.

Information obtained during the planning process was assimilated and presented at a public meeting conducted by the Kittery Port Authority on February 5, 2015. At that time it was determined that the community would not proceed with the initiative to place dredged rock material as had been contemplated. The basis for this decision was related primarily to the following areas of concern:

- Risk of increased/altered sediment deposition patterns within the lower estuary;

- Impact to historic areas of eelgrass beds, and associated concern that construction of the improvements will inhibit potential future regrowth of these eelgrass beds; and

- Long-term value given potential impacts of climate change on sea level rise and storm surge.

Part 1 – Introduction/Background

1.1 Background/Purpose

During the recent development of the Town's Shore and Harbor Plan, concerns were expressed regarding the potential impacts of sea level rise, coupled with wave action associated with major storms. In particular, interest was expressed relative to the desirability of enhancing the level of protection of the community's principal anchorage at Pepperrell Cove. The Town has two public piers and mooring field located within the cove. Recent larger storm events, especially those with a south to southwesterly wind direction have caused damage to the public assets in the cove as well as moorings, private piers and the shoreline.

Concurrently, as information became available regarding the planned dredging of the Piscataqua River by the Corps of Engineers, a potential opportunity was identified with respect to enhancing the natural wave barrier provided by Fishing and Gooseberry Islands. In concept, the initiative would involve placement of dredged rock debris along the south sides of the two islands to form an artificial ledge, or reef (see figure 1).

Initial discussions with representatives of the Corps were encouraging, and on that basis the Town applied for and was awarded a Shore and Harbor Technical Assistance Grant from the Maine Coastal Program to conduct a feasibility assessment of the initiative.

Due to the nature of the contemplated improvements, it was determined that implementation would require significant screening by various state and federal agencies, many of which would be focused on the potential for adverse impacts on benthic and other marine habitats.

Following completion of an assessment of habitats within the area of likely impact, agency representatives were provided an opportunity to comment on their concerns. The primary area of concern noted in these discussions related to the historic presence of eelgrass within the general area of the proposed work, and the potential for the project to preclude or limit the regeneration of now-defunct eelgrass beds in the area between Fishing and Gooseberry Islands and Fort Foster.

As a part of the feasibility assessment, the community and its consultant conducted a public forum, which included information for residents and other stakeholders regarding the study effort, as well as an opportunity for members of the public to ask questions and provide comments regarding the potential improvements.

TOWN OF KITTERY PEPPERRELL COVE KITTERY POINT, MAINE YORK COUNT	NO.	REVISIONS	APP'D
	1		
	2		
	3		
PROJ NO: MTB13 DATE: OCTOBER 2013			
WRIGHT-PIERCE Engineering a Better Environment	LOCATION MAP		FIGURE:

As state and federal regulatory processes often include consideration of "lower impact practicable alternatives" as a requirement, this report includes discussion of the potential use of a floating wave attenuation system. A system of this nature was installed across the estuary at the USCG facility several years ago.

1.2 Study Tasks

The scope of the assessment included the following tasks:

Task 1: Information Collection. The initial stage of the project involved the collection of available bathymetric information regarding Pepperell Cove, the Piscataqua River, Portsmouth Harbor and the dredge project. Natural resource information regarding the area was collected by MER Assessment Corp (see appendices). Other meteorological data was reviewed for the project vicinity, including the data available from the buoy (Station IOSN3) which is located in the vicinity of the Isles of Shoals and is maintained by National Data Buoy Center.

Task 2: Coordination with Regulatory Agencies. Key to the feasibility of the proposed improvements is the ability to obtain agency approvals. Due to the potential for impacts to benthic and other marine ecosystems the effort has included dialogue with a number of state and federal agencies.

Task 3: Wave Attenuation Assessment. The effort included a review of the likely benefits of constructed reefs on wave attenuation, as well as use of alternative wave mitigation measures that may present reduced environmental impacts.

Task 4: Public Input. On September 4, 2014, Wright-Pierce presented the results of preliminary assessments and agency discussions in a public forum in Kittery to expand public knowledge regarding the initiative and solicit feedback from the public, including: boaters, fishermen, adjacent property owners and other residents of the community (see appendices).

Task 5: Prepare and Present Report. This document represents a summary of the investigation effort as well as the resulting conclusions and recommendations.

1.3 Federal Dredge Project

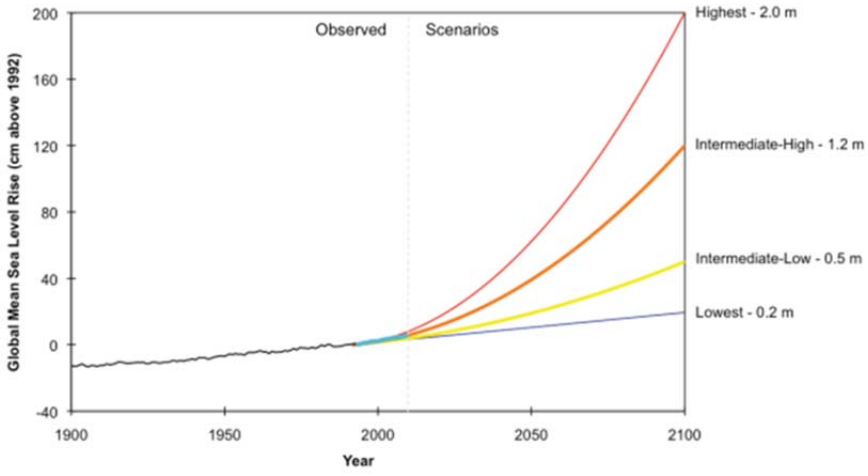
The Corps, working with the New Hampshire Pease Development Authority, Division of Ports and Harbors (NHPDA) is planning a major dredge of the existing federal navigational project, as well as an expansion of the project to enlarge the so-called upper turning basin. The appendices include a map showing the limits of the project, which would extend approximately 6.2 miles up the river from the deepwater in the lower estuary (in the vicinity of Pepperrell Cove). The majority of the dredge effort would consist of maintenance dredging of the 400 foot wide channel to restore the 35 foot depth,

while additional width would be added to the upper turning basin. The expansion of the upper turning basin would result in the dredging of rock/ledge. Overall quantities of material to be dredged have been estimated to be on the order of 728,000 cubic yards of sand/silt and 25,300 cubic yards of ledge. It is the potential for beneficial reuse of this dredged rock material in the form of artificial reefs that is the subject of this assessment.

Discussion with Corps representatives has suggested that there is strong interest in this project due largely to the proximity of the site to the dredging operations. The cost to transport the material to approved alternative dredge disposal areas, such as the Cape Arundel site is substantial. It is anticipated that if the project were to proceed, the Corps would provide for deposition of the material within the designated areas, although it is likely that the community would bear some costs for shaping the deposited material into the desired reef geometries.

1.4 Sea Level Rise and Storm Surge Data

Significant research has been conducted by state and federal government agencies over the past several years with respect to the effects of climate change on long term sea level rise and storm surge. Many recent and ongoing assessments into the likely impacts of sea level rise in the area have considered increases in water surface of up to 1.2 meters. A commonly used nomograph as issued by the U.S. Global Change Research Program is shown here:



U.S. Global Change Research Program (USGCRP)

Web mapping is available displaying "near worst case storm surge flooding (inundation) scenarios" using the National Weather Service (NWS) SLOSH model maximum of maximums (MOMs) for different hurricane wind categories at a high tide.

Part 2 – Conceptual Design

2.1 Artificial Reefs

Artificial reefs have been used for many decades for the protection of harbors and anchorages. While artificial reefs have been constructed for a variety of reasons, their use for the dissipation of wave energy is well established.

The hydraulics associated with artificial reef systems can be extremely complex, particularly when the system exists in an area with significant tidal fluctuations. In general, the construction of an artificial reef results in wave setup due to mass transport over the reef. This can generates nearshore circulation around the reef, resulting in offshore littoral drift between adjacent reefs. The magnitude of wave setup behind the reef is typically governed by the wave dissipation rate and the type of wave breaking on the reef (which, in turn, is driven by reef geometry and incident wave conditions). The geometry of the top of the reef (i.e. the crown) can act to reduce wave setup on the onshore side of the reef. Different types of breaking waves (plunging, collapsing, intermediate or backwash, e.g.) possess different energy dissipation characteristics.

The difference of these wave formations correlates to variations in wave setup behind the reef. Use of an inclined reef crown tends to result in incoming waves breaking with plunging type, collapsing type or intermediate of those types in most wave conditions. Use of a flat crown tends to result in the waves break on the offshore edge of the reef with backwash type breaker.

The reef with an inclined crown lowers the wave setup in comparison with the conventional flat crown in the wide range of incident wave height. The plunging type breaker or the collapsing type breaker on the inclined reef gradually reduces wave energy over the reef. On the other hand, the backwash type breaker dissipates wave energy largely on the offshore edge of the reef. The difference of these wave deformations causes one of the reasons of lower wave setup in Case-A and Case-B with inclined crown.

Due to the intensive wave breaking on the reef under the larger wave height conditions, it has been found that reefs with inclined crown are likely to have equal or better wave dissipating function to conventional flat crown reefs.

2.2 Impacts to Sediment Deposition

Observations regarding the impact of the construction of jetties at Wells harbor and at the mouth of the Saco River have attuned both regulators and the general public to the often unanticipated consequences of jetty construction on nearshore flow patterns and the resultant impact on sediment transport. Any decision to construct one or more segments of artificial reefs in the vicinity of Fishing and Gooseberry Islands should be accompanied by more detailed

assessment into the potential for increased sediment deposition within the project area. In particular, concerns have been expressed with respect to possible shoaling at the entrance to Chauncey Creek.

Dr. Larry Ward at the UNH Center for Coastal and Ocean Mapping published mapping indicating the general nature of bottom sediments within the lower Piscataqua estuary in 1995. A copy of Dr. Ward's map is included in the appendices.

Dr. Ward's research suggests that the bottom (substrate) within much of the lower Piscataqua Estuary tends to be coarse sands and clays, with an absence of fine silts. However, observations during the benthic survey conducted by MER Assessment Corp suggest that much of the bottom in the area of the proposed improvements is comprised of finer grained materials.

2.3 Conceptual Plan and Section

Appendix F includes conceptual design sketches. These will require refinement in the event the project proceeds to implementation.

Information provided by the Corps with regard to the gradation and delivery of the material included:

> "Blasted rock will be of various sizes, unsorted, from fist-sized to a couple CY in size. Depending on the site depth and tide it would be delivered by scow or beck barge and dumped or pushed over the side where the Town (in compliance with its permits) designates, or delivered at the dredge site if the Town supplies its own contractor with barge or scow.
>
> Timeframe is dependent on Congressional authorization followed by Congressional appropriations. Early construction is likely the winter of 2016-2017, with the rock scheduled for removal in the Feb-March timeframe."

Part 3 – Regulatory Issues

3.1 Applicable Regulations

Wright-Pierce has engaged in discussions and correspondence with those regulatory agencies (and secondary resource agencies) expected to have jurisdiction over the project to obtain information that would influence design considerations and natural resource protection considerations for the project. These agencies include the US Army Corps of Engineers and the Maine Department of Environmental Protection, as well as agencies consulted by the DEP and Corps in issuing approvals for projects of this nature, such as the Maine Department of Marine Resources, Maine Geological Survey, Maine Submerged Lands Program and the National Marine Fisheries Service.

The design considerations are likely to include requirements relative to navigational and construction timing elements. Environmental requirements can be expected to include consideration of benthic impacts within the areas directly impacted by reef construction. Consideration of indirect impacts will also be explored. The indirect impacts may include the reef's impacts to circulation changes, and changes in the pattern of sediment deposition. Potential mitigation of these impacts will also be investigated (see the summary of investigation into benthic habitat developed for this project by MER Assessment Corporation included in the appendices)

3.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) was promulgated in 1969 to ensure that federal agencies take into account the environmental impacts of their actions and decisions. Under NEPA, federal agencies are required to assess the environmental impacts associated with their proposed actions and consider alternative means to accomplish their missions, with a focus on determining whether alternatives may be less damaging to, and protective of, the environment. NEPA stipulates that "it is the continuing responsibility of the federal government to use all practicable means, consistent with other essential considerations of national policy" to avoid environmental degradation, preserve historic, cultural, and natural resources, and "promote the widest range of beneficial uses of the environment without undesirable and unintentional consequences". Federal agencies are required to use a systematic interdisciplinary approach in environmental planning and consideration of projects which may have impacts on the environment.

For the purposes of this project, the clearance required under NEPA would be addressed by the Corps of Engineers as a part of the overall NEPA clearance associated with the dredge project.

3.3 Maine Natural Resources Protection Act

Maine's Natural Resources Protection Act (NRPA) dictates that "the State's rivers and streams, great ponds, fragile mountain areas, freshwater wetlands, significant wildlife habitat, coastal wetlands and coastal sand dune systems are resources of state significance. These resources have great scenic beauty and unique characteristics, unsurpassed recreational, cultural, historical and environmental value of present and future benefit to the citizens of the State and that uses are causing the rapid degradation and, in some cases, the destruction of these critical resources, producing significant adverse economic and environmental impacts and threatening the health, safety and general welfare of the citizens of the State."

Approvals are required under NRPA when an "activity" will be:

- Located in, on or over any protected natural resource, or
- Located adjacent to a coastal wetland, great pond, river, stream or brook or significant wildlife habitat contained within a freshwater wetland, or certain freshwater wetlands.

The term "activity" includes a variety of potential impacts, including dredging or displacing soil or other materials

3.4 Section 404 of the Clean Water Act

The Corps of Engineers exercises jurisdiction over many types of projects that may impact navigation under Section 404 of the Clean Water Act. Specifically, Corps permits are required for any work located within the Nation's navigable waters. The Corps attempts to balance the benefits and impacts of proposed projects, and issues permits that acknowledge a variety of factors. As a part of the permit process, the Corps consults with other federal, state and local agencies and the public. The results of this review are intended to allow reasonable use of private property, infrastructure development, and growth of the economy. Adverse impacts to the aquatic ecosystems are often offset through required mitigative actions (typically involving: restoration, enhancement, creation or preservation of the impacted functions and values).

3.5 Section 10 of the Rivers and Harbors Act

The Corps of Engineers exercises jurisdiction over many types of projects that may impact navigation under Section 10 of the Rivers and Harbors Act. Specifically, the regulation is as follows:

33 U.S.C. 403. Construction of bridges, causeways, dams or dikes generally; exemptions: That the creation of any obstruction not affirmatively authorized by Congress, to the navigable capacity of any of the waters of the United States is hereby prohibited; and it shall not be lawful to build or commence the building

of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, or other structures in any port, roadstead, haven, harbor, canal, navigable river, or other water of the United States, outside established harbor lines, or where no harbor lines have been established, except on plans recommended by the Chief of Engineers and authorized by the Secretary of War; and it shall not be lawful to excavate or fill, or in any manner to alter or modify the course, location, condition, or capacity of, any port, roadstead, haven, harbor, canal, lake, harbor of refuge, or enclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless the work has been recommended by the Chief of Engineers and authorized by the Secretary of War prior to beginning the same.

3.6 Benthic Habitat Assessment

In July of 2014, personnel from MER Assessment Corporation completed an assessment of habitats within the area of likely impact. A copy of the resulting assessment report is included in the appendices.

3.6 Agency Interactions

As noted above, the regulatory approvals necessary for construction of one or more artificial reefs for the protection of Pepperrell Cove would require inter-agency consultation at both the state and federal levels. In order to gauge the feasibility of acquiring the necessary approvals, we have engaged the key agencies in dialogue to understand the nature and magnitude of any concerns that they might have. Our discussions with the agency representatives can be summarized as follows.

3.7 State Agencies

Maine Department of Environmental Protection: Angela Brewer of the Maine DEP. The Maine DEP provided the following comments, and indicated that additional comments would be forthcoming in the event the proposed project is submitted for a NRPA permit:

"Most of my questions/concerns would revolve around how the proposed structures would alter water circulation and sediment transport and accretion. I expect Steve Dickson could address these issues. As you probably are aware, the intertidal area just east of Fishing Island hosted eelgrass as recently as 2005 and was the site of a long term monitoring site managed by Fred Short as part of the SeagrassNet program. There was clear documentation in 2005 of thorough grazing on eelgrass by Canada geese, which decimated this Fishing Island eelgrass bed and the bed has yet to recover. I have contacted Fred Short to get his impression as to whether or not this site would still be suitable for reestablishment of eelgrass, and can let you know how he responds. If the wave barrier were to be installed, I would be interested to know if that would cause the area to its east fill in with finer sediment and therefore increase the elevation

and make this area less suitable for eelgrass reestablishment. The reestablishment of eelgrass as well as any shellfish that may utilize the proposed structure could all be a moot point if there is a healthy population of green crabs in the vicinity, however. The wave barrier could additionally serve as refuge for green crabs, which would not likely be beneficial to the community.

If green crabs did not control the bivalve community, I see a benefit to having more filter feeders in this area to remove particulates from the water column. Suspended sediment, detritus and/or nutrients in the particulate form have been implicated in decreased light availability for eelgrass in the Piscataqua and Portsmouth Harbor, and the improved filtration capacity could be beneficial."

Maine Geological Survey: We have been in correspondence with Stephen M. Dickson, Ph.D., Marine Geologist, but have not received any comments to date.

3.8 Federal Agencies

National Marine Fisheries Service: The NMFS can be expected to offer comments for: Essential Fish Habitat (EFH), Fish and Wildlife Coordination Act (FWCA), Endangered Species Act (ESA), and possibly Marine Mammal Protection Act (MMPA). Mike Johnson op the NMFS offered the following comments:

"For EFH and FWCA, we will need to conduct an assessment of the existing area in terms of habitat (bottom), depths, vegetation, etc., as well as an assessment of the effects of the proposed work. I will tell you in advance that we generally do not like to see proposals to place rock over open bottom habitat since that is considered a conversion of habitat, and has certain impacts to existing resources. You will also want to evaluate hydrodynamic changes that may alter the sediment regime and erosion, and sediment transport in the area. I'm not sure how large a structure you are considering, but you might consider a more benign structure like a wave fence that has a smaller footprint. The US Coast Guard installed a wave fence at the Portsmouth Station a few years ago, so if you aren't familiar with that project you might take a look.

Construction of solid structures, like a wave barrier or jetty, alters sediment transport and wave dynamics and can adversely affect adjacent habitats. I recommend that the applicant address this issue in the application, which may involve conducting further studies to investigate and evaluate this. But for the purpose of environmental site assessments, I would want to know what type of habitats are present in the adjacent area that may be affected by changes in the physical environment due to a wave barrier. Secondly, the area around Fishing Island use to support a large eelgrass bed, although the bed began to diminish in the mid-2000s. The attached map (see appendices) is based on NH eelgrass bed shapefiles, which was converted to kml files for Google Earth and subsequently

saved as an image file so the individual years of mapping are aggregated. You can go to the NH Granit database to get the original shapefiles.

The other issue with this project will be the footprint of the proposed barrier will eliminate the potential for regrowth of eelgrass in this historic eelgrass habitat. The widespread loss of eelgrass in the Piscataqua River estuary is primarily attributed to eutrophication and general degradation of water quality, which is being addressed through various means including reducing point and nonpoint source pollution. We believe eelgrass beds will come back to areas that historically supported eelgrass if and when water quality improves. But if structures are continually built over these historic beds, the opportunity for recolonization will be greatly diminished. We want to discourage constructing structures in historic eelgrass habitat, even if the beds are not currently present. I recommend the applicant fully address this in the application. The NHDES is beginning to require applicants provide historic information on eelgrass for projects that may alter the substrate or shade the substrate for these reasons."

US Fish and Wildlife Service: Wende Mahaney of the US Fish and Wildlife Service offered the following comments:

"USFWS doesn't have the time or staff at the moment to thoroughly review this site assessment and offer detailed comments.

However, based on a quick review, we completely support the comments already submitted by Mike Johnson at NMFS. This project certainly the has potential for impacts that extend beyond the footprint of the placed rock debris. The Town of Kittery must evaluate whether or not there will be impacts beyond the footprint of the structure, say from changes in sediment transport or wave dynamics as Mike points out.

And we completely support NMFS regarding currently vacant eelgrass habitat. Impacts to eelgrass habitat needs to be thoroughly assessed regardless of whether or not the particular habitat is currently vegetated. Given the recent losses of eelgrass beds in various places in Maine, we really need to be looking hard at avoidance of impacts wherever possible and keeping currently unvegetated habitat available should conditions allow for revegetation in the future."

Part 4 – Alternatives Assessment

4.1 General

As state and federal regulatory processes often include consideration of "lower impact practicable alternatives" as a requirement, this report includes discussion of the potential use of a floating wave attenuation system. A system of this nature was installed across the estuary at the USCG facility several years ago.

4.2 Floating Wave Attenuation System

A copy of the drawings associated with the implementation of the floating wave attenuation system at the US Coast Guard Station in New Castle, NH is included in the appendices. Given the use of such a system in such close proximity to the project area, it is likely that the agencies would expect this option to be given serious thought during the approval process.

Part 5 – Conclusions

5.1 General

A number of concerns were identified relative to the initiative over the course of our investigations. They are as follows:

- Risk of increased/altered sediment deposition patters within the lower estuary;

- Impact to historic areas of eelgrass beds, and associated concern that construction of the improvements will inhibit potential future regrowth of these eelgrass beds; and

- Long-term value given potential impacts of climate change on sea level rise and storm surge.

Information obtained during the planning process was assimilated and presented at a public meeting conducted by the Kittery Port Authority on February 5, 2015. At that time it was determined that the community would not proceed with the initiative to place dredged rock material as had been contemplated.

Appendix A
Federal Dredge Project Summary

US Army Corps of Engineers
New England District

Project Information Sheet

Portsmouth Harbor and Piscataqua River New Hampshire & Maine Feasibility Study for Navigation Improvement

February 24, 2014 696 Virginia Road, Concord Massachusetts, 01742-2751

1. Project: The purpose of this study is to determine the feasibility of modifying the existing Federal navigation project on the Piscataqua River to increase the width of the upper Turning Basin. This study was directed by Section 437 of the Water Resources Development Act of 2000.

2. Location of Project: The Piscataqua River forms a portion of the state boundary between Maine and New Hampshire. Portsmouth Harbor, located at the mouth of the river, is about 45 miles northeast of Boston Harbor, Massachusetts, and 37 miles southwest of Portland Harbor, Maine. The existing Federal project includes a 35-foot deep channel, 400 feet wide, extending from deep water in Portsmouth Harbor (river mile 2.6) upstream to river mile 8.8. The project also included widening the bends at Henderson Point, Gangway Rock, Badgers Island, the Maine-New Hampshire Interstate Bridge and Boiling Rock, a 950-foot wide turning basin upstream of Boiling Rock, and an 800-foot wide turning basin at the upstream end of the Federal channel.

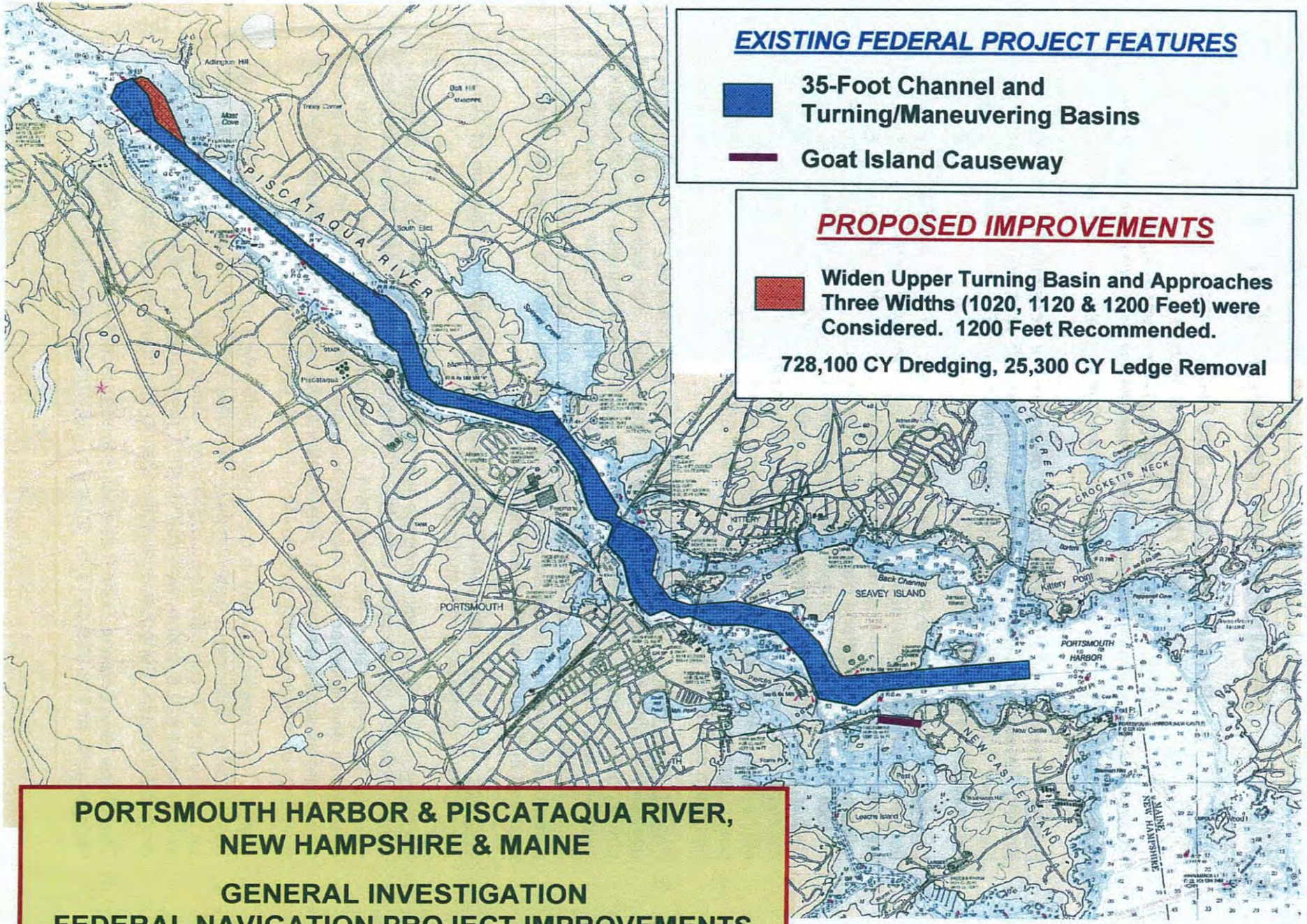
3. Project Description: This study investigated the feasibility of widening the upstream turning basin that is currently 800 feet wide. The existing width of the turning basin causes major safety concerns for LPG cryo-tankers and other bulk shippers, and limits the existing and future use of the terminals. All aspects of Federal interest, including engineering feasibility, economic justification, design optimization, environmental acceptability and cultural resource impact, are being analyzed in detail during the feasibility study.

4. Sponsor: The New Hampshire Pease Development Authority, Division of Ports and Harbors (NHPDA) is the study sponsor.

5. Schedule: The Corps will complete the feasibility study in FY 2014. Current efforts include: coordination with New Hampshire, Maine and Massachusetts officials to identify sites for placement of dredged material; final evaluation of alternatives and selection of a recommended plan; and preparation of a final report and environmental assessment. These reports will be subject to a higher level and a number of reviews in response to WRDA 2007 requirements.

6. Costs: The Feasibility Study is cost shared 50/50 with the NHPDA. A Feasibility Cost Sharing Agreement was originally executed with NHPDA in June 2006, and an amendment is currently being processed. Design and construction is estimated to cost about $20.5 million, with the NH PDA responsible for 35% of that cost. The project will require Congressional authorization and future appropriations.

7. The Corps New England District contact is the Project Manager, Mr. Richard Heidebrecht, at 978-318-8513, or richard.w.heidebrecht@usace.army.mil.



PORTSMOUTH HARBOR & PISCATAQUA RIVER, NEW HAMPSHIRE & MAINE

GENERAL INVESTIGATION
FEDERAL NAVIGATION PROJECT IMPROVEMENTS

Appendix B
Benthic Habitat Assessment Report

HABITAT CHARACTERIZATION SURVEY
FOR
PROPOSED WAVE BARRIER
PEPPERRELL COVE
KITTERY, MAINE

Prepared for

Wright Pierce
99 Main Street
Topsham, Maine 04086

Phone: 207-725-8721

28 July 2014

Report prepared by

Christopher S. Heinig
and
Steve Karpiak

MER Assessment Corporation
14 Industrial Parkway
Brunswick, Maine 04011
cheinig@merassessment.com

Introduction

The Town of Kittery, Maine has proposed the installation of rock wave barriers in the vicinity of Fishing Island, Kittery to provide protection for the anchorage area in Pepperrell Cove; the proposed main barrier is located between Fishing Island and Gooseberry Island and a smaller barrier is proposed in a shoal area west of the ledges north of Fishing Island. Wright-Pierce of Topsham, Maine, requested the assistance of MER Assessment Corporation (MER) to carry out a habitat characterization survey of the proposed locations of the barriers to allow initial discussion of project feasibility. The survey was requested by the National Marine Fisheries Service (NMFS).

This report summarizes the observations made during reviews of the video recordings taken over the two proposed locations and adjacent areas at mid-tide and direct observations at low tide in the vicinity of Fishing Island on 7 July 2014. The general location of the survey area and the proposed locations of the main barrier (shown as pink hash-marked rectangle) and small secondary barrier (shown as pink hash-marked circle) are shown in Figure 1.

Methods

Video Surveys

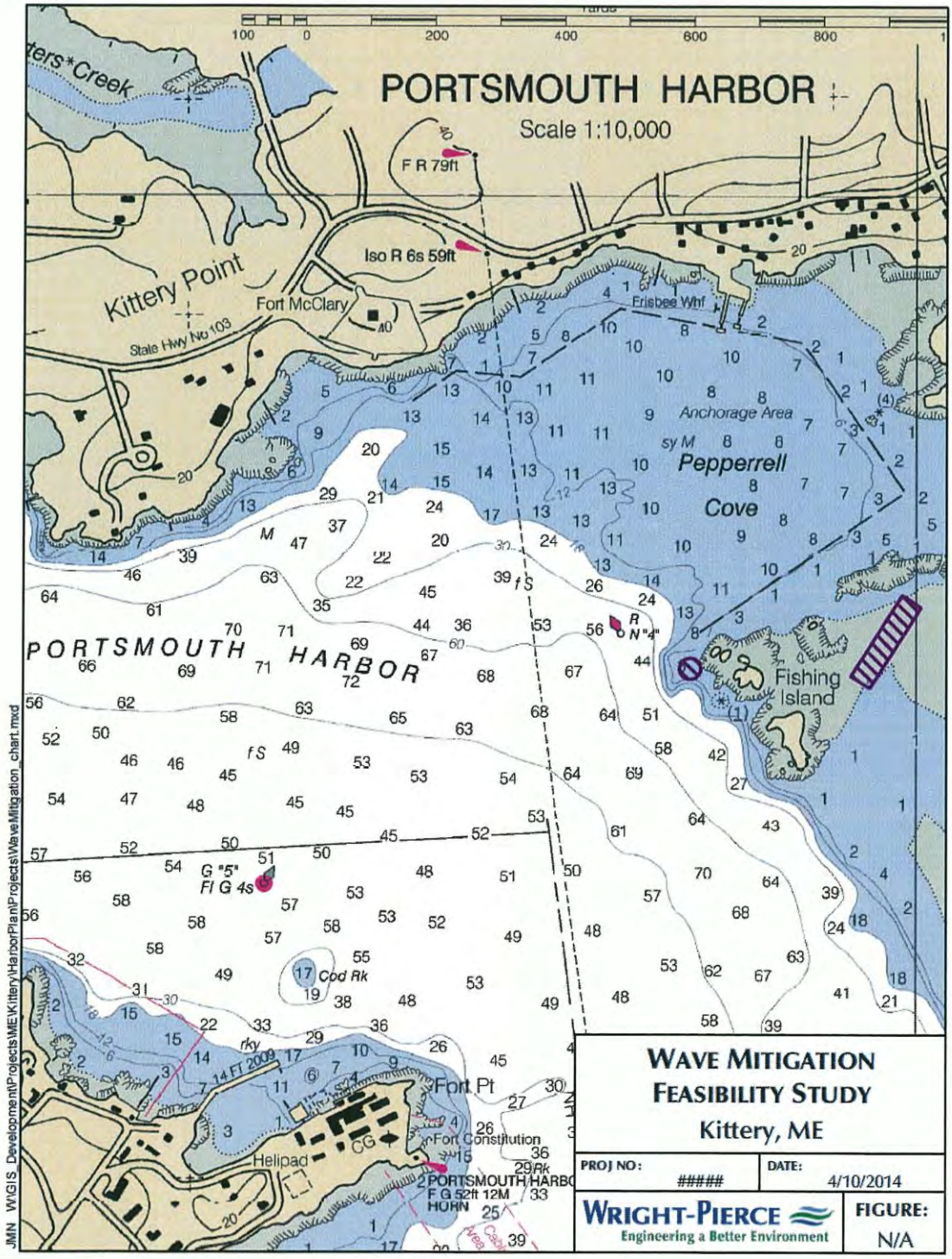
The video recordings were taken using a SeaViewer Sea-Drop 650 Series real-time color camera system attached to a stainless steel frame equipped with an Amphibico Discovery G3 underwater arc lamp. The camera video feed was connected to a SeaViewer SeaTrak unit that embeds GPS (WGS84) and date/time data (GMT), collected by a Garmin 76 GPS unit, directly on the video recording; the videos were recorded on-board using a Sea Viewer DVR-SD digital video recorder. The camera was allowed to run continuously from time of deployment to time of recovery. Figure 2 shows a Google Earth detailed aerial view of the area and the location of video transects used in this survey; Figure 3 shows a schematic of the area and the location of video transects used in this survey. Table 1 lists the approximate coordinates of the main barrier. Table 2 lists the coordinates for the start and end of the video transects.

Low tide survey of exposed intertidal

A walking survey was conducted of the exposed intertidal area to the west of the proposed location of the main barrier. Exposed ledge was examined for resident fauna and randomly located test plots were made in exposed soft sediments using a standard clam rake.

Due to the neap tide, the footprint area of the proposed main barrier was never fully exposed and remained covered with 6 to 12 inches of water. A walking survey was conducted along two paths, one on each side of the approximate centerline of the main barrier; no test plots were made due to the covering water.

Figure 1. Portsmouth Harbor navigational chart showing Pepperrell Cove, Kittery and the proposed locations of the main (shown as the rectangle) and small (shown as the circle) wave barriers.



Source: Wright-Pierce

Figure 2 Detail of vicinity of Fishing Island showing site and video recording transects.

Figure 3. Schematic of vicinity of Fishing Island showing site and video recording transects.

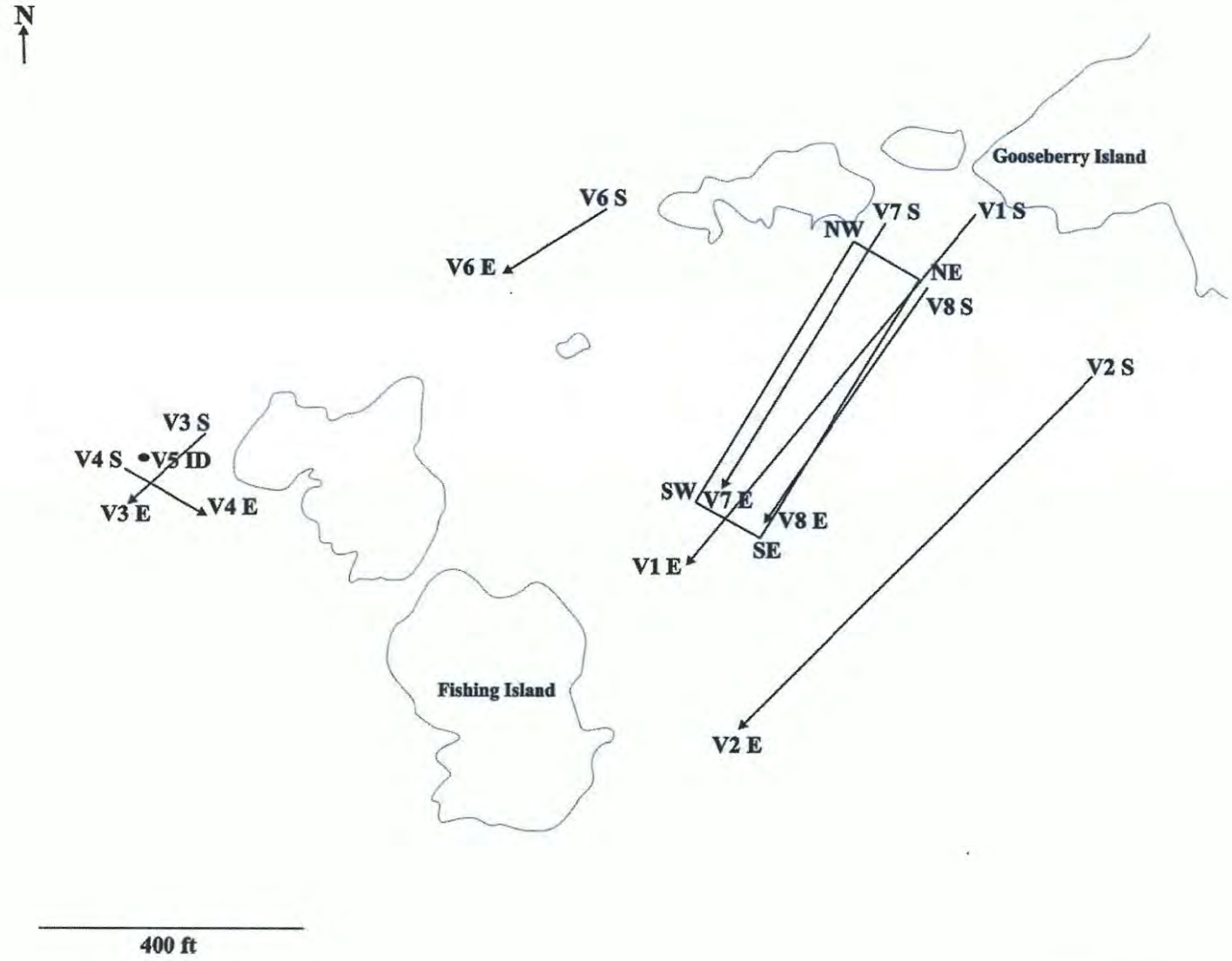


Table 1
Approximate main barrier corner coordinates (WGS84)

Barrier corners and Transect Start and End	Latitude	Longitude
NE	43° 04.688'	70° 41.994'
NW	43° 04.697'	70° 42.015'
SE	43° 04.634'	70° 42.067'
SW	43° 04.625'	70° 42.046'

Table 2
Video transect start and end coordinates (WGS84)

Transect Start and End	Latitude	Longitude
V1 start	43° 04.704'	70° 41.974'
V1 end	43° 04.618'	70° 42.071'
V2 start	43° 04.665'	70° 41.936'
V2 end	43° 04.587'	70° 42.053'
V3 start	43° 04.650'	70° 42.230'
V3 end	43° 04.633'	70° 42.256'
V4 start	43° 04.642'	70° 42.257'
V4 end	43° 04.630'	70° 42.229'
V5 start	43° 04.640'	70° 42.250'
V5 end	43° 04.636'	70° 42.254'
V6 start	43° 04.705'	70° 42.097'
V6 end	43° 04.689'	70° 42.132'
V7 start	43° 04.702'	70° 42.005'
V7 end	43° 04.637'	70° 42.059'
V8 start	43° 04.686'	70° 41.991'
V8 end	43° 04.629'	70° 42.044'

Observations

Main barrier

The proposed location of the main barrier is generally surrounded by ledge to the north, west and southwest and is exposed to the east and southeast. Sediments north and west of the proposed main barrier site gradually shift from cobble, gravel and small rocks with relic shell at the base of the ledges to sand and silt moving toward the site. South and east of the site sediments are sand and silt with occasional relic shell. Within the footprint area of the main barrier, (Videos 1, 7 and 8) sediments are predominantly soft sand and silt with relic shell. Sediments to the east of the proposed main barrier location (Video 2) are similarly soft sand and silt with relic shell and evidence of wave rippling of the surface.

The intertidal rocks and ledges (Photo 1) support dense growth of rockweeds, *Fucus* spp. and *Ascophyllum* sp. Fauna include periwinkles, *Littorina* sp., blue mussels, *Mytilus edulis*, barnacles, *Balanus* sp., green crabs, *Carcinus maenas*, and amphipods, *Gammarus* sp.

Photo 1. Intertidal rocks and ledges

Over the soft sand and silt bottom flora is sparse consisting of only a few, small sea lettuce sheets, *Ulva lactuca*, and small clusters of unidentified green and red moss; no eelgrass, *Zostera marina*, was seen within or around the proposed main barrier footprint. Epibenthic fauna include green crabs, *Carcinus maenas*, mud shrimp, *Crangon septemspinosa*, European oysters, *Ostrea edulis*, (Photo 2) hermit crabs, *Pagurus* sp., rock crabs, *Cancer irroratus,* and a small number of unidentified small fish. The soft sand and silt bottom appears to support a dense polychaete worm infaunal community, as evidenced by the abundance of small holes and exposed worm tubes. No benthic cores were taken as part of the feasibility study but test plots (Photo 3) in substantially similar exposed sediment revealed a dense polychaete community

including maldanid worms, *Clymenella torquata*, blood worm, *Glycera* sp., and red line worms, *Nephtys* sp. Samples returned to the lab for analysis included spionids, *Polydora* spp., red nemertean, possibly *Lineus* sp., ribbon worms, *Cerebratulus lacteus*, and oligocheates. No evidence of soft-shell clams, *Mya arenaria*, or common razor clams, *Ensis directus*, was seen as "clam holes" on the video and none were found in the test plots in similar adjacent exposed sediment, although shells of both species were found at the base of the ledges.

Photo 2. European oysters, *Ostrea edulis*, collected from soft sand and silt bottom

Photo 3. Test plot in soft sand and silt bottom

Small barrier

The substrate in the vicinity of the proposed small barrier northwest of Fishing Island (Videos 3, 4 and 5) is rock with coarse sand and fragmented relic shell at the base. Flora is abundant and consists of pink coralline algae, kelp, *Laminaria* sp., dulse, *Rhodymenia palmata*, sea lettuce, *Ulva lactuca*, unidentified green filamentous, and dense growth of unidentified brown-red weed, possibly *Ceramium* sp. or *Polysiphonia* sp. View of fauna was limited by the dense flora. Visible fauna include unidentified bryozoans attached to *Laminaria* sp., barnacles, *Balanus* sp., encrusting sponges, one American lobster, *Homarus americanus* and small fish, likely cunner, *Tautogolabrus adspersus*.

The substrate in the lower intertidal, shallow subtidal area northeast of the small barrier and northwest of proposed main barrier location (Video 6) is soft sand and silt with worm holes and worm tubes and attached unidentified red weed. Fauna include barnacles on hard surfaces, and European oysters, hermit crabs, green crabs and rock crabs on the soft sand silt.

Flora and fauna observed in the field and during review of the video recordings are listed in Table 3 below.

Table 3
Summary of observed flora and fauna and relative abundance

Common name	Scientific name	Relative abundance
Flora		
Rockweed	*Fucus sp., Ascophyllum* sp.	locally abundant on intertidal rocks and ledges
Kelp	*Laminaria* sp.	abundant over subtidal hard substrate
Dulse	*Rhodymenia palmata*	occasional on hard substrate
Irish sea moss	*Chondrus crispus*	rare on ledge
Sea lettuce	*Ulva lactuca*	occ. over soft sand/common on hard substrate
Unidentified red seaweed	possibly *Ceramium* sp. or *Polysiphonia* sp.	abundant on subtidal hard substrate
Unidentified coralline algae	----	common on rocks and relic shells
Fauna		
Unid. oligochaetes	----	common in sand-silt
Spionid polychaete	*Polydora* spp.	common in sand-silt
Common periwinkle	*Littorina littorea*	common/abundant on rockweed
Blood worm	*Glycera sp.*	common in sand-silt
Bamboo worm	*Clymenella torquata*	common in sand-silt
Red line worm	*Nephtys* sp.	occasional in sand-silt
Ribbon worm	*Cerebratulus lacteus*	occasional in sand-silt
Red nemertea	possibly *Lineus* sp.	common in sand-silt
Blue mussel	*Mytilus edulis*	rare on intertidal hard substrate
European oyster	*Ostrea edulis*	occasional on soft sand-silt
Amphipod	*Gammarus* sp.	common under rockweed
Mud shrimp	*Crangon septemspinosa*	common on soft sand-silt
Hermit crab	*Pagurus* sp.	common on soft sand-silt
Green crab	*Carcinus maenas*	common on soft sand-silt
Rock crab	*Cancer irroratus*	occasional on soft sand-silt
American lobster	*Homarus americanus*	rare on subtidal hard substrate
Unid. encrusting sponge	----	occasional over subtidal hard bottom
Unid. small fish possibly cunner	*Tautogolabrus adspersus*	occasional over subtidal hard bottom

Essential Fish Habitat (EFH) (Northeast Region link: http://www.nero.noaa.gov/hcd/list.htm)

Certain commercially important marine species found in waters of the Northeast Region, including the Portsmouth Harbor area (between Great Bay and Wells Harbor), are managed under the National Marine Fisheries Service (NMFS) New England Fisheries Management Council (NEFMC). Those managed species identified by NMFS/NEFMC as potentially found in the vicinity of Portsmouth Harbor at some stage of life are listed in Table 4 below; the life stage(s) most likely to be found in the area and the links to the Northeast Regional Office EFH Guidance document for each species are also listed.

Table 4
Essential Fish Habitat Description

Species	eggs	larvae	juvenile	adult	spawners	Web link
Atlantic plaice - *Hippoglossoides platessoides*	---	---	---	---	---	http://www.nero.noaa.gov/hcd/am-plaice.pdf
Atlantic cod - *Gadus morhua*	s	s	*s*	*s*	---	http://www.nero.noaa.gov/hcd/cod.pdf
Atlantic halibut - *Hippoglossus hippoglossus*	s	s	s	s	s	http://www.nero.noaa.gov/hcd/halibut.pdf
Atlantic herring - *Clupea harengus*	---	m,s	m,s	s	---	http://www.nero.noaa.gov/hcd/herring.pdf
Atlantic salmon – *Salmo salar*	---	---	f,m	---	---	http://www.nero.noaa.gov/hcd/salmon.pdf
Atlantic sea scallops - *Placopecten magellanicus*	---	---	s	s	s	http://www.nero.noaa.gov/hcd/scallops.pdf
Haddock - *Melanogrammus aeglefinus*	s	s	---	---	---	http://www.nero.noaa.gov/hcd/haddock.pdf
Ocean pout - *Macrozoarces americanus*	---	---	---	---	---	http://www.nero.noaa.gov/hcd/ocean-pout.pdf
Little skate – *Raja erinacea*	---	---	x	x	---	http://www.nero.noaa.gov/hcd/skateefhmaps.htm
Pollock - *Pollachius virens*	s	s	s	---	---	http://www.nero.noaa.gov/hcd/pollock.pdf
Red hake - *Urophycis chuss*	---	---	s	s	---	http://www.nero.noaa.gov/hcd/red-hake.pdf
White hake - *Urophycis tenuis*	s	---	s	s	---	http://www.nero.noaa.gov/hcd/white-hake.pdf
Whiting - *Merluccius bilinearis*	---	---	---	---	---	http://www.nero.noaa.gov/hcd/whiting.pdf
Windowpane flounder - *Scophthalmus aquosus*	m,s	m,s	m,s	m,s	m,s	http://www.nero.noaa.gov/hcd/windowpane.pdf
Winter flounder - *Pleuronectes americanus*	m,s	m,s	m,s	m,s	m,s	http://www.nero.noaa.gov/hcd/winter.pdf
Yellowtail flounder - *Pleuronectes ferruginea*	s	s	---	---	---	http://www.nero.noaa.gov/hcd/yellowtail.pdf

S ≡ The EFH designation for this species includes the seawater salinity zone of this bay or estuary (salinity > 25.0‰).
M ≡ The EFH designation for this species includes the mixing water / brackish salinity zone of this bay or estuary (0.5 < salinity < 25.0‰).
F ≡ The EFH designation for this species includes the tidal freshwater salinity zone of this bay or estuary (0.0 < salinity < 0.5‰).

These EFH designations of estuaries and embayments are based on the NOAA Estuarine Living Marine Resources (ELMR) program (Jury *et al.* 1994; Stone *et al.* 1994). For a detailed view of the salinity zone boundaries, as described in the ELMR reports, please see Appendix B. The Council recognizes the spatial and temporal variability of estuarine and embayment environmental conditions generally associated with this species.

Discussion

The installation of the main barrier would likely have little, if any, impact to the surrounding ledge, *Fucus-Ascophyllum* community other than changes in tidal current around the barrier. The installation of the main barrier would result in a permanent loss of soft sand and silt habitat and would be replaced by a hard, rock substrate habitat, the lower portion of which would be covered with rockweed. Some of the mobile species currently using the existing habitat, specifically green crabs, rock crabs and hermit crabs, could utilize the hard substrate of the replacement habitat and European oysters would likely settle on the hard substrate, but their persistence would depend on the time of exposure at low water.

The greatest impact resulting from the installation of the main barrier would be the permanent loss of the dense polychaete community of the soft sand and silt habitat. The polychaetes serve as forage for crustaceans (Ropes, 1968), and fish (Bigelow and Schroder, 1953) and the loss of the habitat would displace these foragers and concentrate them onto unaffected areas.

The installation of the hard substrate, rock barrier would result in a considerable increase of the intertidal hard surface habitat, similar to the existing *Fucus-Ascophyllum* covered ledge habitat, which would provide a large amount of surface area for attachment of both flora and fauna. The rock barrier would also provide sheltered and shaded habitat within the interstitial spaces between the rocks.

Full colonization by *Fucus* spp. and *Ascophyllum* sp. would take a number of years but some species such as barnacles, *Balanus* sp., the rock crab, *Cancer irroratus*, and the green crab, *Carcinus maenas*, blue mussel, *Mytilus edulis*, and common periwinkles, *Littorina* sp. would colonize in a shorter time.

Although no evidence of commercially important soft-shell clams, *Mya arenaria*, or razor clams, *Ensis directus*, was seen during the survey, their absence will need to be confirmed by a survey conducted on a low draining tide.

The installation of the smaller barrier over the existing subtidal hard ledge habitat would result in a temporary loss of the habitat provided by the floral community, but once reestablished would result in an expansion of the habitat with added complexity afforded by the interstitial spaces between the rocks. The exposed surfaces would eventually become covered with kelp, *Laminaria* spp. and red and green sea weeds and would support a community similar to that existing today. The subtidal interstitial spaces would afford shelter for fish, such as cunner, *Tautogolabrus adspersus*, and black sea bass, *Centropristis striata*, previously seen occupying rock revetments at Seavey Island, Portsmouth Harbor. The interstitial spaces would also provide shelter for American lobsters, *Homarus americanus*, and other crustaceans. The portion of the barrier above the low tide line would add to the intertidal hard substrate habitat in the same way as the main barrier.

Most of the species listed in the Essential Fish Habitat (EFH) table (Table 4) are found at greater depths or on substrates other than those of the proposed locations of the main and smaller barriers. Conditions at the site are suitable for juvenile and adult winter flounder, *Pleuronectes americanus,* although none were seen at the time of the survey.

Conclusions

The installation of the main barrier would result in the permanent loss of the existing soft sand and silt habitat and associated community and would replace it with a large surface area of complex hard substrate habitat that would support an intertidal community similar to that of the existing *Fucus-Ascophyllum* ledge habitat.

The installation of the smaller barrier over existing hard bottom would expand the subtidal hard surface habitat and add to the intertidal hard substrate habitat. The greater complexity of the rock barrier and the interstitial spaces of the subtidal portion would provide additional protected habitat for fish and crustaceans, including the American lobster.

Due to the limited access to the lower intertidal area on the day of the survey as a result of the neap tide, additional work will be needed, preferably on a minus tide, to confirm the apparent absence of soft shell clams, *Mya arenaria*, in the soft sand silt within the proposed main barrier location.

A determination of the feasibility of the project will need to be made based on a comparison of the benefits of harbor protection and the habitat value of the hard substrate provided by the wave barrier structures weighed against the permanent loss of existing soft sand and silt habitat at the main barrier location and the temporary loss of the existing subtidal hard substrate habitat and addition of hard substrate intertidal habitat at the small barrier location.

References

Bigelow, H.B. and W.C. Schroeder, 1953. Fishes of the Gulf of Maine. U.S. Fish and Wildl. Serv. Bull. 53. 577 p.

Brinkhurst, R.O., L.E. Linkletter, E.I. Lord, S.A. Connors, and M.J. Dadswell. 1976. A preliminary guide to the littoral and sublittoral marine invertebrates of Passamaquoddy Bay. 166 pp. Biological Station Fish Mar. Serv. DOE.

Gosner, K.L., 1971. Guide to the Identification of Marine and Estuarine Invertebrates. Wiley-Interscience, John Wiley & Sons, Inc., New York., 693 p.

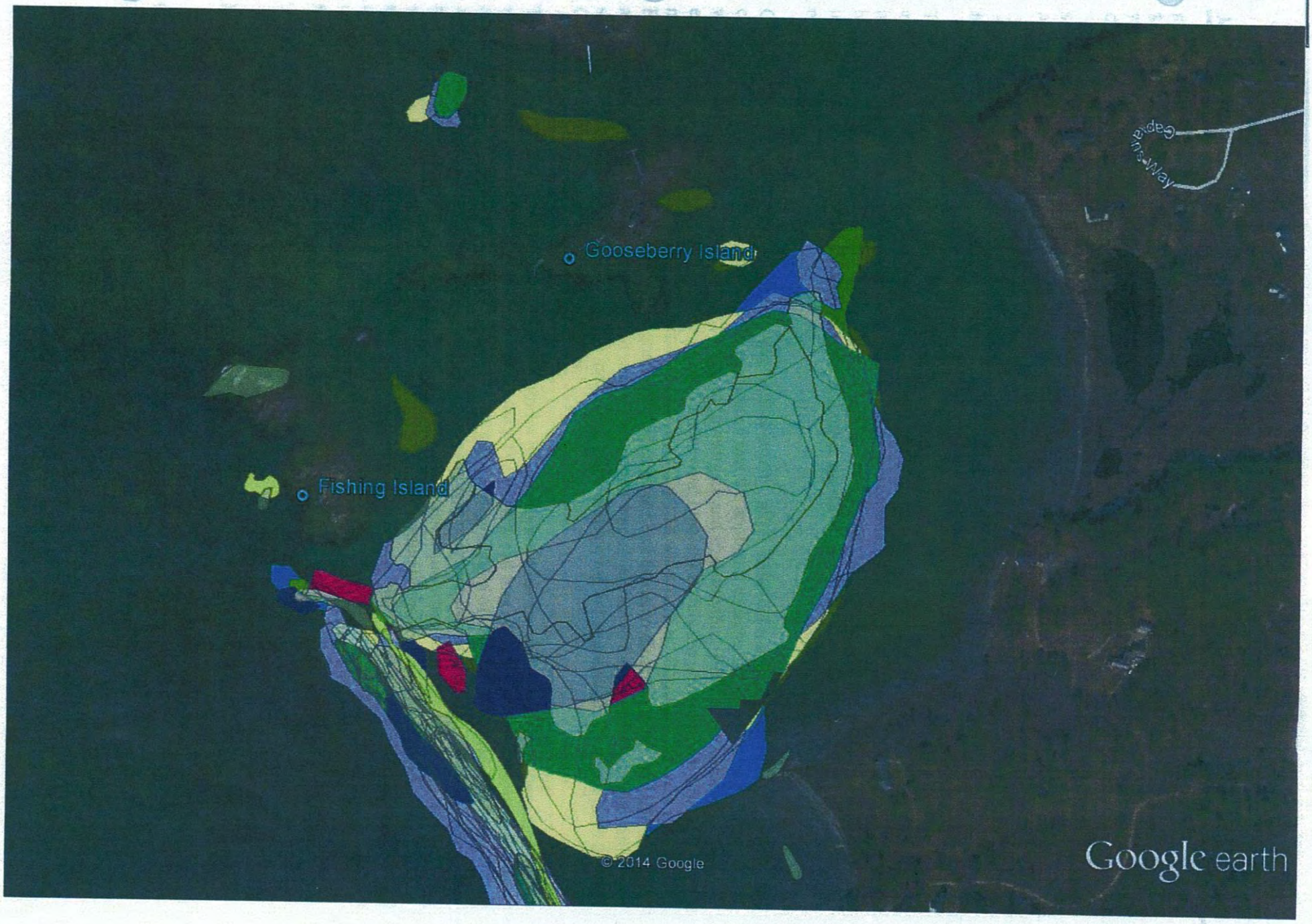
Hanic, L.A., 1974. A Guide to the Common Seaweeds of Prince Edward Island. Action Press, Charlottetown, P.E.I., Canada.

Miner, R.W., 1950. Field Book of Seashore Life. G.P. Putnam's Sons, New York, 888 p.

Pollock, L.W., 1998. A Practical Guide to the Marine Animals of Northeastern North America. Rutgers Univ. Press, New Jersey, 367 p.

Ropes, J. W., 1968. The Feeding Habits of the Green Crab, *Carcinus maenas* (L.). Bureau of Comm. Fisheries Biol. Laboratory Oxford, Maryland. Fish. Bull. Vol. 67 (2), 183-203.

Appendix C
Historic Limits of Eelgrass Beds


Gooseberry Island
Fishing Island
Gapua
Way
© 2014 Google
Google earth

Appendix D
Public Forum Presentation

Town of Kittery/KPA
Wave Attenuation Assessment

Public Meeting
September 4, 2014

Presented by:

WRIGHT-PIERCE
Engineering a Better Environment

Town of Kittery/KPA
Wave Attenuation Assessment

Agenda

- Study Purpose
- Acknowledge Funding
- Overview / Scope of Study
- Proposed Activities
- Piscataqua River Dredge Project
- Regulatory Elements
- Alternatives
- Timeline
- Public Comment/Questions
- Next Steps

Town of Kittery/KPA
Wave Attenuation Assessment

Purpose: To assess the feasibility of enhancing wave attenuation for the protection of Pepperell Cove.

Town of Kittery/KPA
Wave Attenuation Assessment

Project Funding: Funded in large part by the State of Maine, though a NOAA Grant from the Maine Coastal Program

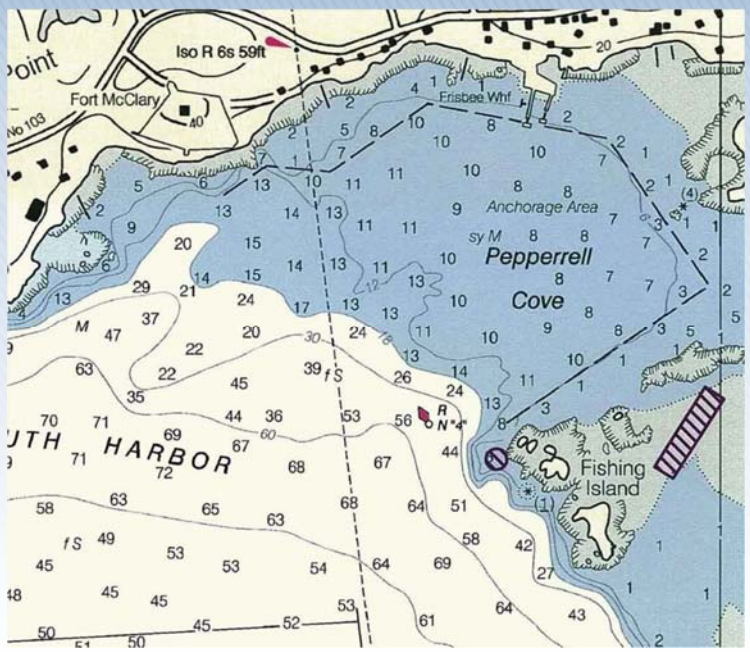
Wave Attenuation Assessment
Scope of the Evaluation

- Coord. with ACOE
- Initial Agency Contacts
- Habitat Assessment
- Agency Reviews
- Wave Action Review
- Alternatives Screening
- **Public Meeting (Sept.)**
- Issue Draft Plan
- Finalize Plan

Wave Attenuation Assessment
Proposed Scenario

- Construction of “artificial reefs”
- Use stone from Corps dredge project
- Adjacent to Fishing Island and Gooseberry Island

Proposed Activities

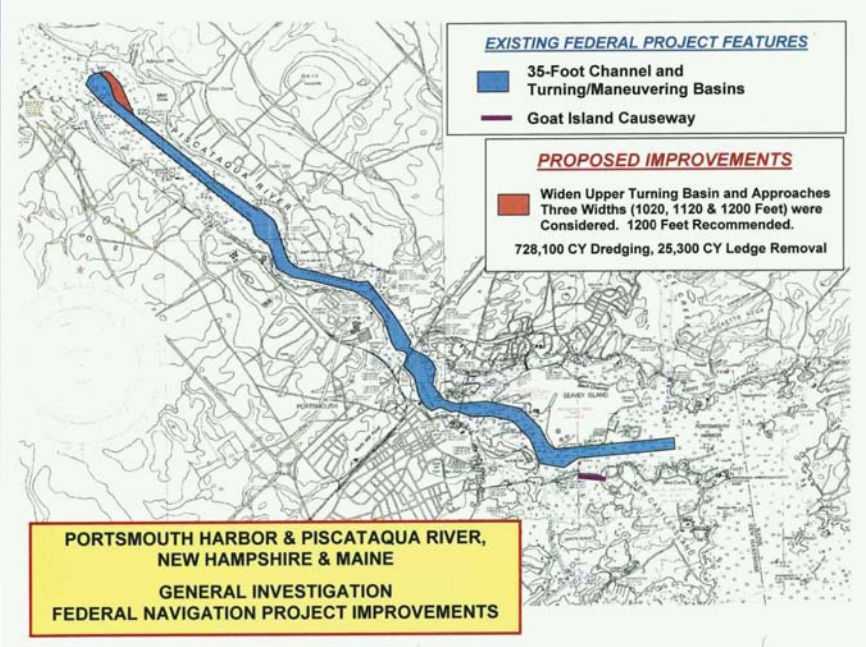


Wave Attenuation Assessment

Piscataqua River Dredge Project

- Corps plans to dredge portions of the existing federal Piscataqua River navigational project
- 400 foot wide channel extends to river mile 8.8
- Two turning basins
- Expansion of upper turning basin will create blasted rock, requiring disposal
- Timeline is still in flux

Piscataqua River Dredge Project



Applicable Regulations

State of Maine

- **Natural Resources Protection Act (NRPA)**

Federal Government

- **Section 404 of CWA**
- **Section 10 of Rivers and Harbors Act**

NEPA? (dredge spoils)

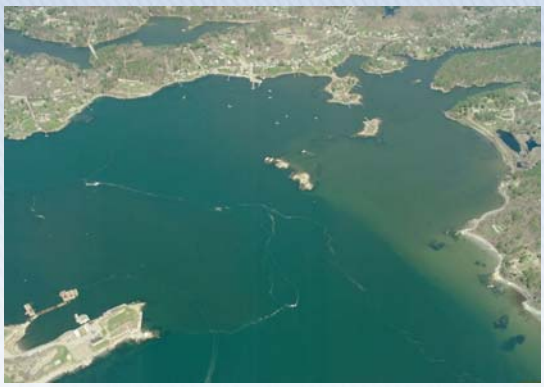
Wave Attenuation Assessment
Key Agencies Involved

State of Maine

- DEP
- DMR
- MGS

Federal Government

- Corps of Engineers
- NMFS
- USF&WS
- USCG



Wave Attenuation Assessment
Initial Agency Concerns

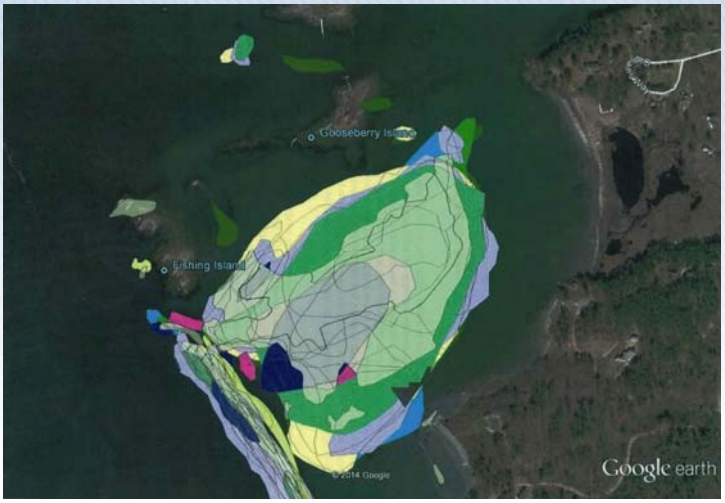
- Eelgrass
- Winter Flounder
- Sturgeon
- Shellfish beds
- Impacts from direct loss of habitat
- Impacts from changes in sediment deposition patterns

Wave Attenuation Assessment
Habitat Assessment

- Conducted video surveys
- Conducted on-foot surveilance of intertidal zones at low tide
- Confirmed lack of eelgrass
- Crabs, worms, oysters present
- No evidence of clams
- EFH likely limited to winter flounder

Wave Attenuation Assessment
Habitat Assessment

Historical assessment of eelgrass beds



Wave Attenuation Assessment
Habitat Assessment

Screening of Alternatives

- Required under Federal regulatory process
- Floating wave attenuation devices
- Coast Guard Facility

Wave Attenuation Assessment
Project Timeline

- Tied to federal dredge project timeline
- Study needs to be complete by December 31, 2014

Wave Attenuation Assessment Public Meeting

Questions and Comments?

Wave Attenuation Assessment Next Steps

1. Compile Public Feedback Results
2. Continued Agency Coordination
3. Prepare Draft Report
4. Review Draft with Town Staff/KPA
5. Finalize the Report

Appendix E
Public Forum Minutes and Attendance Log

UNAPPROVED

KITTERY PORT AUTHORITY

September 4, 2014 Meeting Minutes
Council Chambers, Town Hall

Members Present: Bob Melanson, Barry Bush, Vice Chairman, Kelly Philbrook, Tom Smith, Steve Lawrence, Ray Grenier
Members Absent: none
Staff: Acting Harbormaster Paul Bourque

Meeting began at 6:05 p.m.

1. Pledge of Allegiance

2. Minutes: August 7, 2014
   Mr. Bush moved to accept the minutes of August 7 as submitted
   Mr. Smith seconded
   Motion carried unanimously

3. Public Segment
   - Dick Draper: Asked about ramp and resolution for commercial fishermen. The assistant harbormasters (Paul Bourque and Alan Breton) have done a good job.
     Mr. Melanson: The ramp issue will be resolved to everyone's satisfaction.
   - Milton Hall:
     - Must be a resident of Kittery to serve on boards and committees.
     - Noticed involvement of Human Resources Department in seeking Harbormaster applications. Does the KPA still hire the Harbormaster?
       Mr. Melanson: Yes.
     - No speed sign in the Back Channel.
   - Dan Ford:
     - Returned 'no wake' sign to Harbormaster; needs to be replaced in Spruce Creek.
   - Ann Grinnell: If a boat is registered on line, would the Harbor Water Usage fee be paid, and was I supposed to pay the fee if I don't have a mooring or tie to a public dock?
     Mr. Melanson: If you register on-line, you can avoid the fee. He has met with the Town Clerk to address this problem.
   - Barry Fitzpatrick: Observed improvements and congratulates the Board. With the new transient pier system, more supervision and enforcement is needed.

   There was no further public comment.

4. Harbormaster Report
   - Launch fees collected at Traip and Pepperrell Cove - $6,887, with $5,672 from Traip.
   - Launch fees collected at transient facility: $3,663.
   - Float repaired at Pepperrell Cove.

- Government street panel box will be finished on September 5; the lock had been broken and was reported to the Police.
- Bathroom at Pepperrell Cove has motion a detector for light and fan, which is constantly running. Motion switch changed to turn off after 15 seconds.
- Replacement of water saving sink/toilet/urinal is estimated at $500; completion within next few weeks.
- Hurricane Season: Peak season end August to mid-September. Engineers assured new floats can be bridled to withstand winds.
- Earliest removal of floats is now October 21-22.
- Peter Walsh: Special KPA projects:
    1. Addition to internet connectivity at Harbormaster Shack; video streaming to Police/Dispatch and web site that can be accessed via cell phones. Adding enhanced wi-fi signal to edge of mooring field.
    2. Researched marketing opportunities for transient facility for free print and on-line placement, including Map-Tech to be added to marina directories; Maine Harbors; on-line website and marina directories. Boston Sailing Center has a web site for Kittery and KP, to be updated. Paid marketing includes: Points East, for $100, can be added to marina directory; Waterways Guide is too expensive, at $2700 for an advertisement.
    3. Working to link Kittery Harbormaster Website to Town Web site and vice-versa. Working on updating mooring database and waitlist, and convert from Access database to Excel. Mooring and waitlist database will be posted as PDF online.
    4. Facebook page for Kittery Harbormaster. Potential for feedback.

5. Marinas Piers and Floats - Discussion of In-Kind Repair and Replacement of pier at Badgers Island West.

   Ms. Philbrook: The existing pier is 9' x42'. 17'x42' is not in-kind replacement; does not believe it is grandfathered; the request should be submitted as an application before the KPA.
   Mr. Melanson: The two original bridge piers totaled 17 x 42; when westerly pier rebuilt, it was built as a 9'x42' pier, as it exists on the other side; photo evidence shows remnants of the original pier; the permit has been issued, and the CEO is comfortable with this decision.
   Ms. Philbrook: Thinks it is wrong and disagrees with the decision; others who have pilings in place should then get the same treatment; the Knight Avenue property was in kind, but when they added a ramp, they came before the Board; if the Army Corp has an issue, the fault will be with the Board, not the owner. Precedent has now been set.
   Mr. Lawrence: Assumed it was grandfathered, but doesn't want to set a precedent by not following the rules.
   Mr. Melanson: He will be more prudent in the future and put such requests before the Board.

6. Public Hearing: Wave Attenuation Project

Discussion of the potential use of blasted rock/dredge spoils from the Eliot Turning Basin/Piscataqua River dredge project for the purpose of enhanced wave mitigation for Kittery's principal anchorage at Pepperrell Cove.
Jonathan Edgerton, Wright-Pierce Engineers, provided an update and presentation (attached).

Public Comment:
Mark Drummond, Kittery Point: Will this extend to buoy at Fishing Island?
Mr. Edgerton: The details have not been completed; depends upon footprint allowed and amount of material needed. If no constraints, extending would be the goal. The farther out, impact on current ebbs and flows increases, along with sediment deposits . There are no hard and fast answers at this stage.
Dick Draper: Biggest issue is the southerlies; the goal is to knock some of these waves down.
Mr. Melanson: Communication has been made with owners of Fishing and Gooseberry Islands.
Ms. Philbrook: What is the potential cost to the taxpayer?
Mr. Edgerton: The actual disposal could cost nothing; the report is 80% paid via NOA funding so the town can arrive at a decision; habitat assessment will need to be made.
Mr. Melanson: There is no cash outlay by the Town for the report.
Discussion followed regarding sediment control in the waters.
Eddie Howells: How long will structure last? Concerned about impact on Fishing Island, causing erosive effects on the Island due to larger waves.
Mr. Edgerton: Depending on the size of the rock material, benefit could be 50-100 years. The Maine Geological Survey is reviewing the proposal and will address the impact on currents and land areas. The more shallow areas will have less velocity than the main part of the channel.
Mr. Melanson: Easements may be needed for riparian rights areas where these deposits will be made.
Kathy Wolf, Foreside: What is the possibility of contaminate material deposited at Pepperrell Cove, and what is the degree/purpose of wave attenuation?
Mr. Edgerton: If there is the potential for upstream contaminants (i.e. heavy metals), analysis by ACOE will be conducted to understand risks. Blasted ledge material and overburden is where contaminants settle, rather than bedrock. NEPA approval will be required, including additional analysis of what the material is composed of, and where it is going before it is deposited. The purpose of the project is to attenuate waves and provide anchorage protection, primarily from due south/southeast.
Milton Hall: Size of material/tonnage? Need 4-5 ton to hold.
Mr. Edgerton: The material will be a mixed bag.

7. Pepperrell Pier Project - No further discussion.

8. New & Old Business
- Update of KPA Application
- Mr. Melanson: Workshop with Council on September 15 at 6:00.

- Mr. Lawrence: Security camera at Traip. He will follow up on this.
- Ms. Philbrook: Schedule workshop for update of Rules and Regulations before the end of the year. Mr. Melanson: This will be added to the October agenda.
- Mr. Melanson: Harbormaster interviews will be held on September 9.

9. Adjourn

Ms. Philbrook moved to adjourn
Mr. Smith seconded
Motion carried unanimously

The September 4, 2014 Port Authority meeting ended at 7:22 p.m.
Submitted by Jan Fisk, September 23, 2014

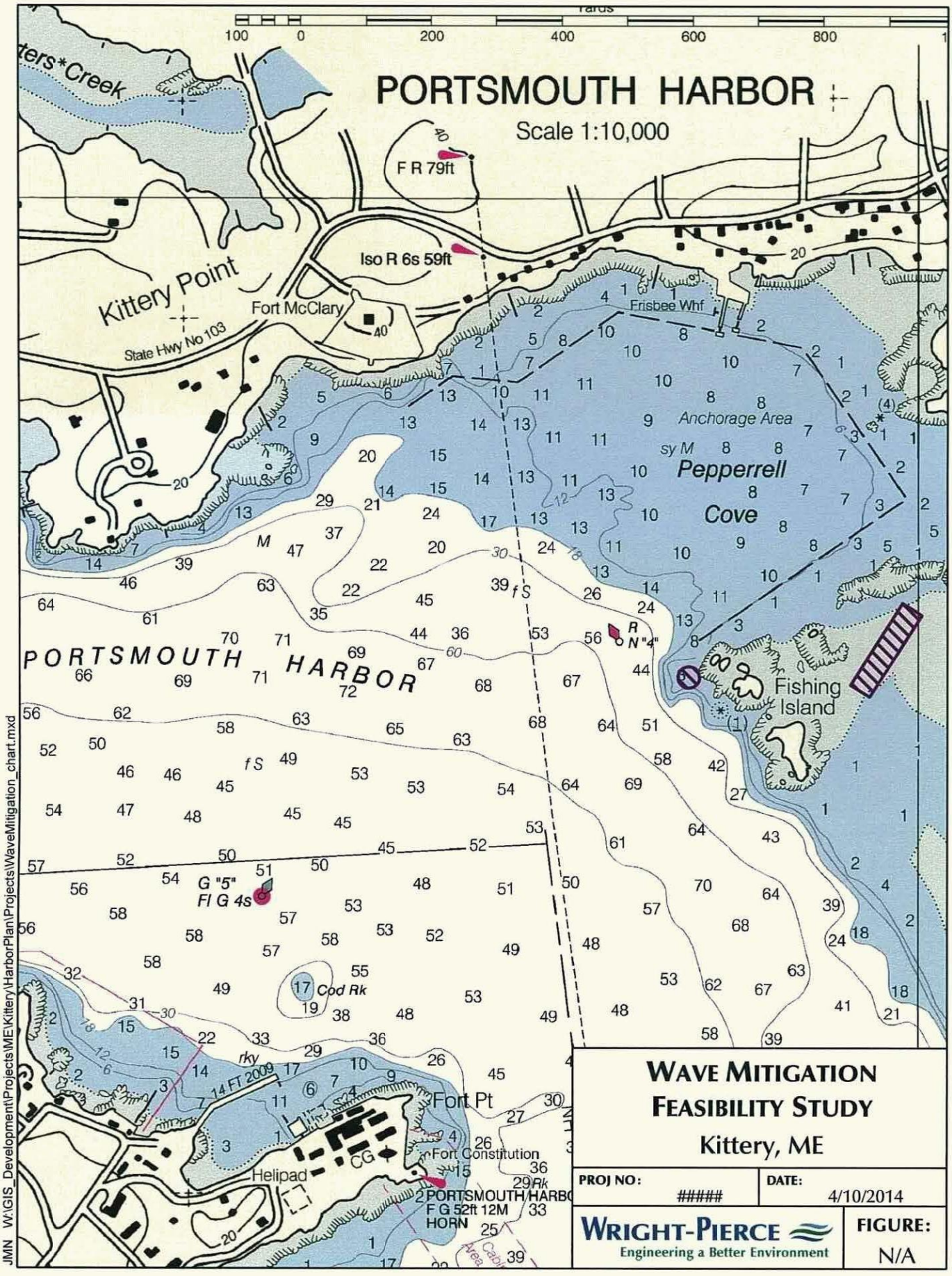
KPA 4 Sept 2014 Meeting

Public Hearing - WAVE ATTENUATION

Sign In:

NAME	Address (Town)
James Forbes	Kittery
Milton Hall	Kittery
Debbie Driscoll Davis	Kittery Point
Allen Brito	ASST/HM
CATHY WOLFF	FORESIDE
Terry Lockhead	"
Ed Howells	K.P.
MARK DRUMMOND	K.P.
DICK DYER	K.P.

Appendix F
Conceptual Design Materials



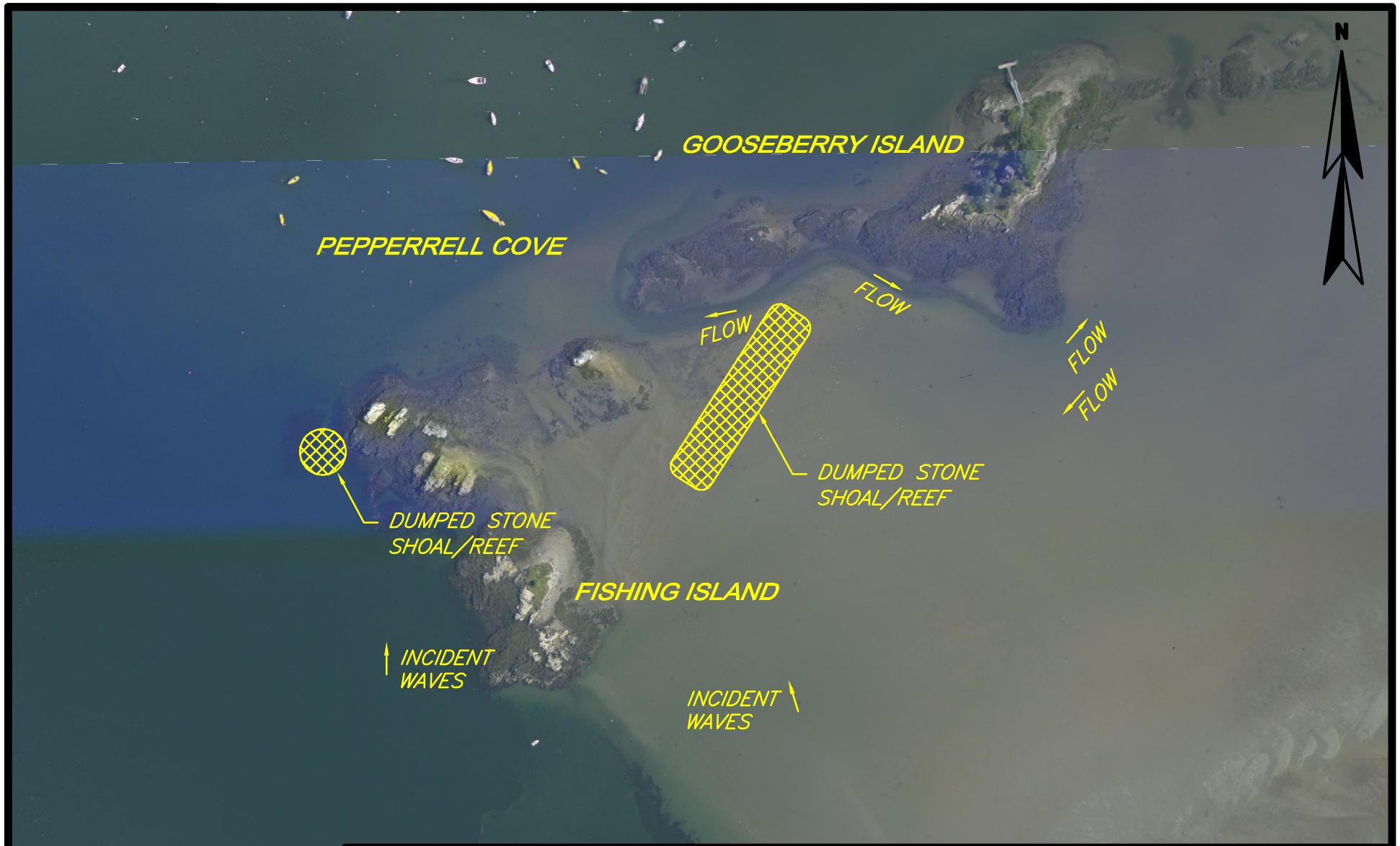
WAVE MITIGATION FEASIBILITY STUDY

Kittery, ME

PROJ NO:	DATE:
#####	4/10/2014

WRIGHT-PIERCE
Engineering a Better Environment

FIGURE: N/A



GRAPHIC SCALE

300 0 150 300

(IN FEET)

1 inch = 300ft.

TOWN OF KITTERY
PEPPERRELL COVE
KITTERY POINT, MAINE
YORK COUNTY

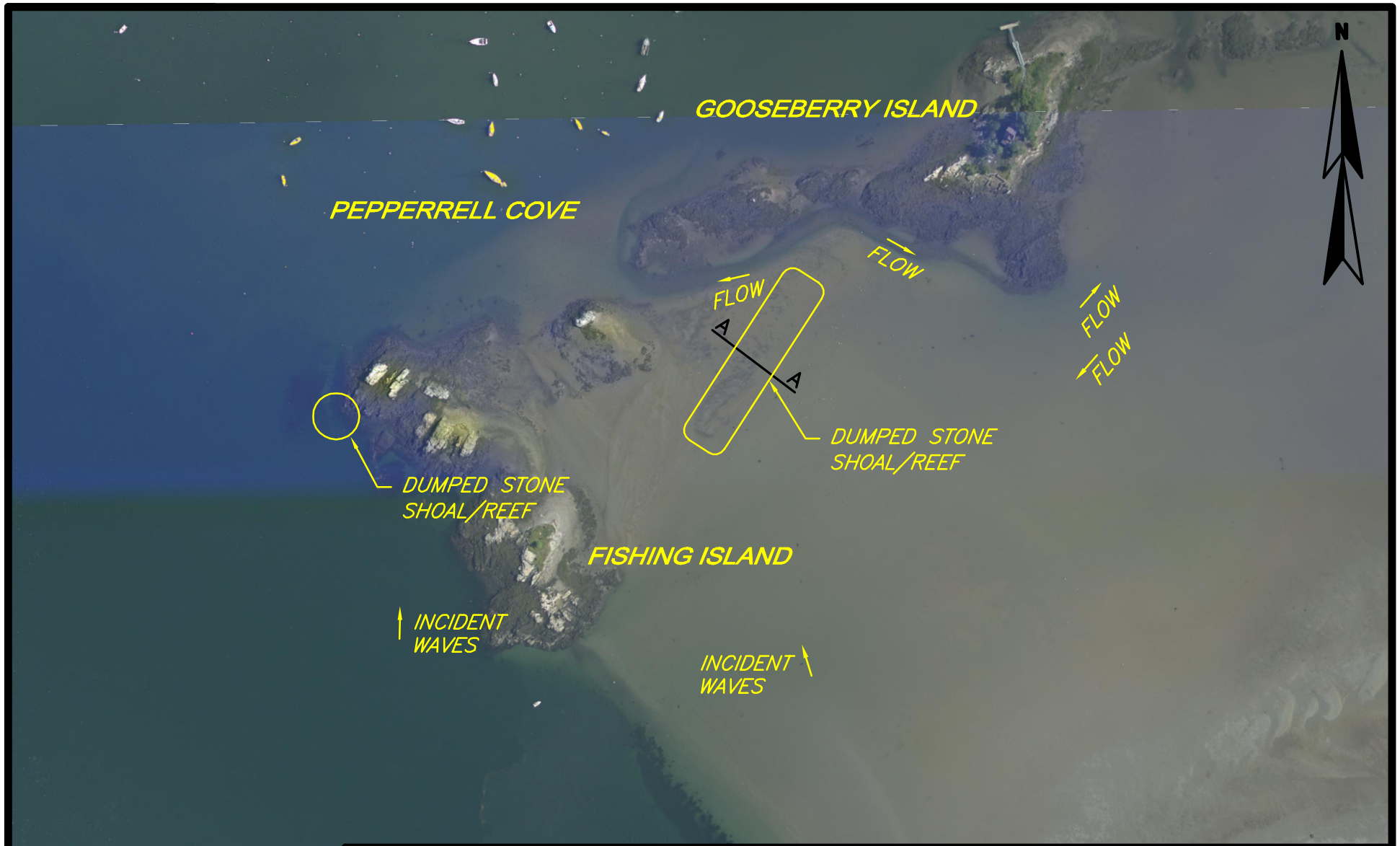
PROJ NO: MTB13 | DATE: OCTOBER 2013

WRIGHT-PIERCE
Engineering a Better Environment

NO.	REVISIONS	APP'D
1		
2		
3		

PEPPERRELL COVE WAVE PROTECTION

FIGURE: 1



GRAPHIC SCALE

300 0 150 300

(IN FEET)

1 inch = 300ft.

TOWN OF KITTERY
PEPPERRELL COVE
KITTERY POINT, MAINE
YORK COUNTY

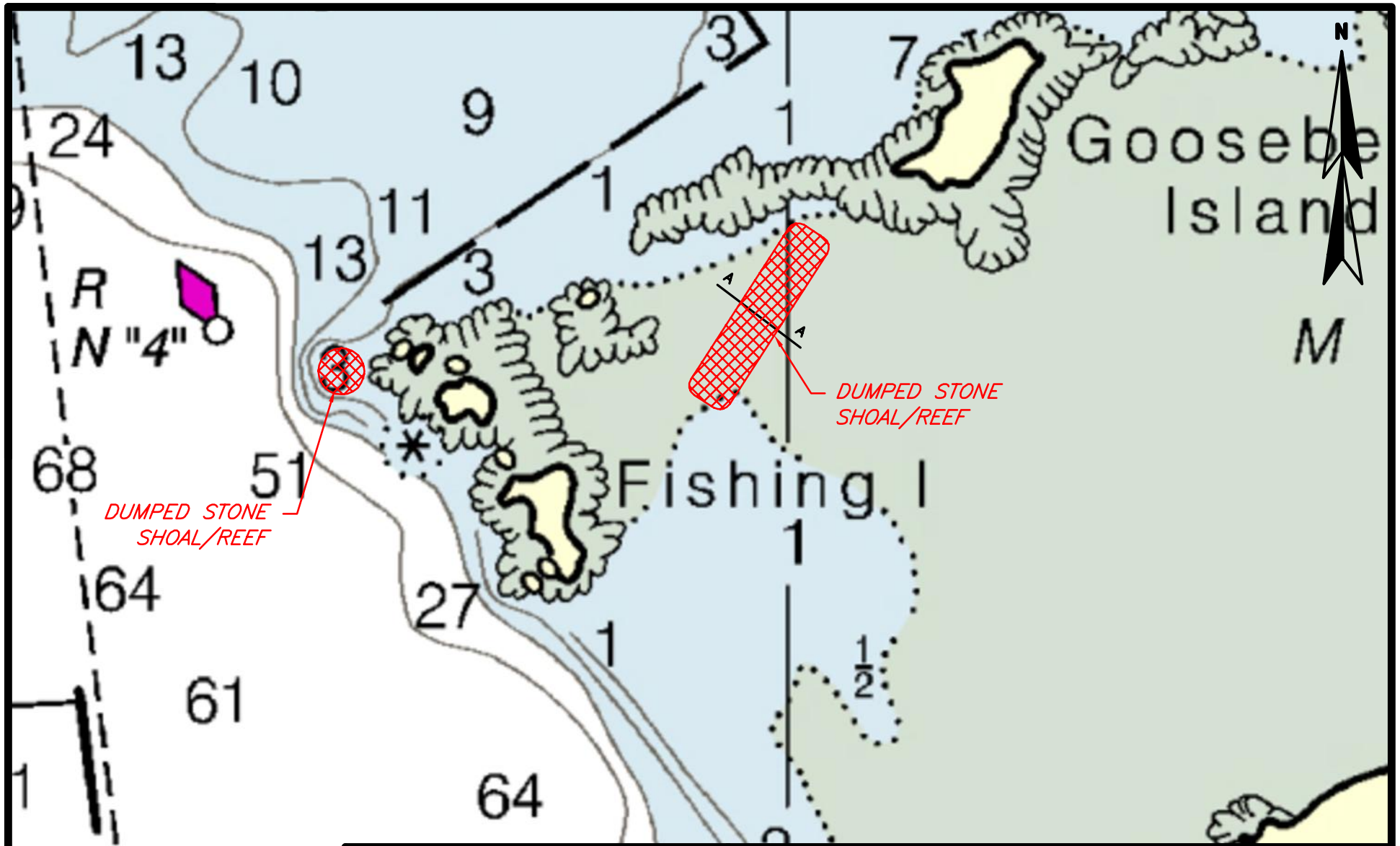
PROJ NO: MTB13 | DATE: OCTOBER 2013

WRIGHT-PIERCE
Engineering a Better Environment

NO.	REVISIONS	APP'D
1		
2		
3		

PEPPERRELL COVE WAVE PROTECTION

FIGURE: 2



NOTES:

1. FIGURE IS NOT TO SCALE

TOWN OF KITTERY
PEPPERRELL COVE
KITTERY POINT, MAINE
YORK COUNTY

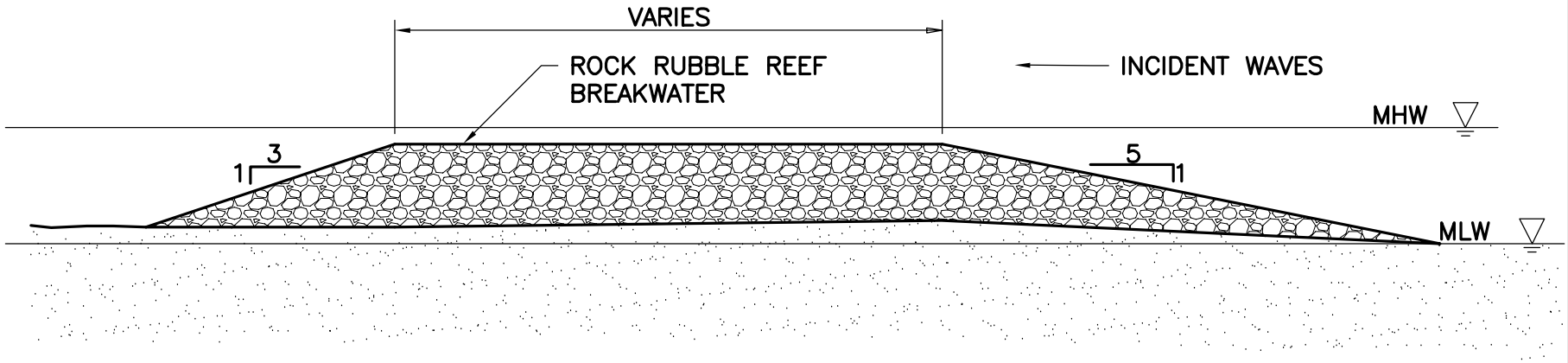
PROJ NO: MTB13 | DATE: OCTOBER 2013

WRIGHT-PIERCE
Engineering a Better Environment

NO.	REVISIONS	APP'D
1		
2		
3		

PEPPERRELL COVE WAVE PROTECTION

FIGURE: 3



NOTE:

1. EXISTING ELEVATIONS ARE APPROXIMATE

GRAPHIC SCALE

10 0 5 10

(IN FEET)
1 inch = 10ft.

TOWN OF KITTERY
PEPPERRELL COVE
KITTERY POINT, MAINE
YORK COUNTY

PROJ NO: MTB13 | DATE: OCTOBER 2013

WRIGHT-PIERCE
Engineering a Better Environment

NO.	REVISIONS	APP'D
1		
2		
3		

SECTION A-A

FIGURE: 4

Appendix G
USCG Wave Suppression System

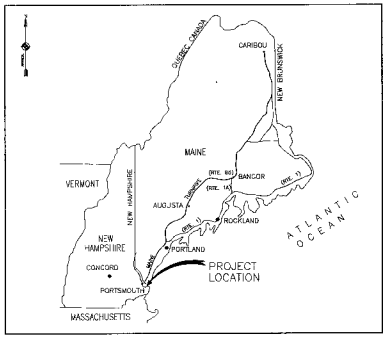
USCG STATION PORTSMOUTH HARBOR

NEW CASTLE, NH

ROCKINGHAM COUNTY

WAVE SUPPRESSION SYSTEM

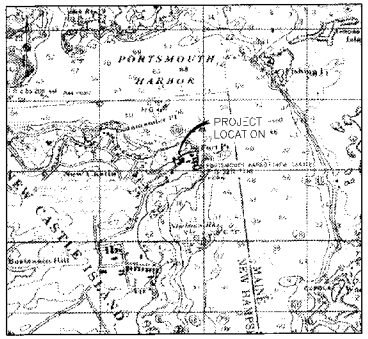
MAY 2011



VICINITY MAP
NTS

LIST OF DRAWINGS

SHEET NO.	DRAWING TITLE
	GENERAL
1 OF 7	COVER SHEET
2 OF 7	GENERAL NOTES
	GEOTECHNICAL
3 OF 7	BORING LOGS
4 OF 7	ROCK CONTOUR PLAN
	CIVIL
5 OF 7	HYDROGRAPHIC SURVEY
	STRUCTURAL
6 OF 7	WAVE ATTENUATOR PLAN AND ELEVATION
7 OF 7	WAVE ATTENUATOR DETAILS



LOCATION MAP
NTS

TIDAL DATA:	MLLW PROJECT DATUM	NAVD 1988
100 YR FLOOD RECURRENCE FLOOD WAVE ZONE (BFE) (V ZONE)	15.10'	10.14'
100 YEAR RECURRENCE FLOOD ZONE (STILL WATER)	13.10'	8.14
HIGHEST OBSERVED WATER LEVEL (02/07/1978)*	12.78'	7.82'
PREDICTED ANNUAL HIGH WATER*	11.30'	6.34'
MEAN HIGHER HIGH WATER (MHHW)	9.39'	4.89'
MEAN HIGH WATER (MHW)	8.96'	4.00'
NORTH AMERICAN VERTICAL DATUM (NAVD) 1988	4.96'	0.00'
NATIONAL GEODETIC VERTICAL DATUM (NGVD) 1929	4.19'	-0.77'
MEAN LOW WATER (MLW)	0.33'	-4.63'
MEAN LOWER LOW WATER (MLLW)	0.00'	-4.96'
PREDICTED ANNUAL LOW WATER*	-2.00'	-6.96'
LOWEST OBSERVED WATER LEVEL (12/10/1977)*	-3.00'	-7.96'

NOTES:
1. TIDAL FLUCTUATIONS PRODUCE EBB & FLOOD CURRENTS AT THIS SITE.
2. VESSEL NAVIGATION PRODUCES VESSEL WAKES, WHICH CAN AFFECT CONSTRUCTION.

REFERENCE:
NOAA/NOS TIDE STATION #842 3890, FORT POINT, NEW CASTLE 1983 TO 2001 TIDAL EPOCH
* EXTREME TIDAL DATA TAKEN FROM NOAA/NOS TIDE STATION #841 9870, PNSY, SEAVEY ISLAND 1960 TO 1978 TIDAL EPOCH

LEGEND

APPROX	APPROXIMATE	MIN	MINIMUM
℄	CENTERLINE	MLLW	MEAN LOWER LOW WATER
CY	CUBIC YARD	MLW	MEAN LOW WATER
DIA	DIAMETER	NTS	NOT TO SCALE
EL	ELEVATION IN FEET	PCF	POUNDS PER CUBIC FOOT
HDG	HOT DIPPED GALVANIZE	PSF	POUNDS PER SQUARE FOOT
LBS	POUNDS	REF	REFERENCE
MAX	MAXIMUM	SF	SQUARE FEET
MHW	MEAN HIGH WATER	TYP	TYPICAL
MHHW	MEAN HIGHER HIGH WATER	UON	UNLESS OTHERWISE NOTED

ELEVATION, SECTION OR DETAIL SYMBOLS

SHEET NUMBER WHERE ELEVATION IS SHOWN — A4 / C-201 — INDICATES REFERENCE QUADRANT ON DESTINATION SHEET

EXTERIOR ELEVATION/SECTION

SHEET NUMBER WHERE SECTION IS SHOWN — A4 / C-201 — INDICATES REFERENCE QUADRANT ON DESTINATION SHEET

INTERIOR ELEVATION/SECTION

SHEET NUMBER WHERE DETAIL IS SHOWN — A4 / C-201 — INDICATES REFERENCE QUADRANT ON DESTINATION SHEET

DETAIL

Appledore Marine Engineering Inc.
600 State Street, Suite E
Portsmouth, New Hampshire 03801
(603) 766-1870 amei@appledoremarine.com

CONSULTANTS

NOAH J. ELWOOD No. 10534 — STATE OF NEW HAMPSHIRE — PROFESSIONAL ENGINEER

U. S. COAST GUARD
CIVIL ENGINEERING UNIT
PROVIDENCE

USCG CEU PROVIDENCE
300 METRO CENTER BLVD.
WARWICK, RI 02886

MARK	DATE	DESCRIPTION

A/E PROJECT NO:	7012
CAD FILE NAME:	P2213074D01
DESIGNED BY:	ZDJ
DRAWN BY:	ZDJ
EDITED BY:	
CHECKED BY:	NJE

SCALE: AS SHOWN PLOT SCALE: 1:1

SHEET TITLE:
WAVE SUPPRESSION SYSTEM
CG STA PORTSMOUTH HARBOR
NEW CASTLE NEW HAMPSHIRE
GENERAL
COVER

REVIEWED BY:	REVIEWED BY:	REVIEWED BY:
D. CASS	M. GUAY	A. JACOBS P.E.
PROJECT ENG.	BRANCH CHIEF	TECH. DIRECTOR

A. JACOBS P.E. / BY DIR — 4/13/11
APPROVING OFFICER — DATE

PROJECT NUMBER	DRAWING NUMBER
2213074	P2213074
DISCIPLINE/SHT NO.	
G-001	SHEET 1 OF 7

GENERAL NOTES:

1. THE WORK UNDER THIS CONTRACT SHALL INCLUDE THE CONSTRUCTION OF A WAVE ATTENUATOR IN ACCORDANCE WITH THESE CONTRACT DRAWINGS.
2. THE CONTRACTOR IS ADVISED THAT THE SPECIFICATIONS FORM A PART OF THE CONTRACT DOCUMENTS AND ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE SPECIFICATIONS AND THE DRAWINGS. THE CONTRACTOR SHALL KEEP A COPY OF THE CONTRACT DOCUMENTS ON SITE AT ALL TIMES DURING THE WORK.
3. ELEVATIONS AND SOUNDINGS ARE IN FEET BASED ON MEAN LOWER LOW WATER (MLLW) PROJECT DATUM FOR THE 1983–2001 TIDAL EPOCH.
4. ALL EXISTING DIMENSIONS, ELEVATIONS AND CONDITIONS RELATING TO THE WORK SHALL BE FIELD VERIFIED BY THE CONTRACTOR. ALL DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE CONTRACTING OFFICER BEFORE ORDERING MATERIALS AND STARTING THE WORK.
5. CONTRACTOR SHALL MAINTAIN ADEQUATE SURVEY CONTROL AT ALL TIMES TO ESTABLISH AND MAINTAIN ALL LINES AND ELEVATIONS.
6. THE SIZE AND LOCATION OF ALL EXISTING UTILITIES IMPACTED BY THE WORK SHALL BE FIELD VERIFIED AND PROTECTED BY THE CONTRACTOR. THE CONTRACTOR MAY RELOCATE UTILITIES TO ACCOMMODATE CONSTRUCTION AS APPROVED BY THE CONTRACTING OFFICER, AT NO ADDITIONAL COST TO THE GOVERNMENT. THE CONTRACTOR SHALL LOCATE BY DIVERS THE EXISTING SEAWATER INTAKES, MARK WITH BUOYS, AND PROTECT DURING CONSTRUCTION.
7. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE ERECTION PROCEDURES AND SEQUENCE TO ENSURE THE SAFETY OF THE FACILITIES. THE CONTRACTOR IS RESPONSIBLE TO ERECT, MAINTAIN AND REMOVE TEMPORARY SHORING TO COMPLETE THE WORK. ALL PROPOSED STAGING AREAS SHALL BE COORDINATED WITH THE GOVERNMENT BEFORE STARTING THE WORK.
8. THE CONTRACTOR IS RESPONSIBLE FOR ALL DAMAGE DONE TO STRUCTURES, UTILITIES, AND VESSELS OR INJURIES TO THE PUBLIC AND FACILITY PERSONNEL DURING THE PERFORMANCE OF THE WORK. ANY DAMAGE CAUSED DURING CONSTRUCTION OPERATIONS SHALL BE REPAIRED AT NO ADDITIONAL COST TO THE GOVERNMENT.
9. THE CONTRACTOR SHALL PROVIDE AND MAINTAIN ENVIRONMENTAL CONTROLS AS REQUIRED BY FEDERAL, STATE AND MUNICIPAL REGULATIONS AND PERMITS. ENVIRONMENTAL CONTROLS SHALL INCLUDE BUT NOT BE LIMITED TO TURBIDITY AND DUST.
10. THE CONTRACTOR SHALL FOLLOW ALL APPLICABLE FEDERAL, STATE AND MUNICIPAL REGULATIONS, INCLUDING THE FEDERAL DEPARTMENT OF LABOR, SAFETY, HEALTH ACT, U.S. ARMY CORPS OF ENGINEERS, STATE/LOCAL WETLANDS CONTROL, AND PERMITS.
11. STORAGE, FUELING AND LUBRICATION OF EQUIPMENT AND MOTOR VEHICLES SHALL BE CONDUCTED IN A MANNER THAT AFFORDS THE MAXIMUM PROTECTION AGAINST SPILL AND EVAPORATION. FUEL, LUBRICANTS AND OIL SHALL BE MANAGED AND STORED IN ACCORDANCE WITH ALL FEDERAL, STATE, REGIONAL, AND LOCAL LAWS AND REGULATIONS. THERE SHALL BE NO STORAGE OF FUEL ON THE PROJECT SITE. FUEL MUST BE BROUGHT TO THE PROJECT SITE AS NEEDED.
12. CONTRACTOR SHALL COORDINATE WORK WITH UNIVERSITY OF NEW HAMPSHIRE PIER AND USCG STATION PORTSMOUTH HARBOR OPERATIONS DAILY TO ENSURE ROUTINE OPERATIONS ARE NOT HINDERED.
13. STANDARD CONSTRUCTION WORK HOURS ON THE SITE SHALL BE BETWEEN 6 AM AND 6 PM TO MINIMIZE NOISE AND LIGHT DISTURBANCE TO NEARBY RESIDENTIAL PROPERTIES. SPECIAL WORK OUTSIDE OF THESE HOURS SHALL BE SCHEDULED WITH THE OWNER. PILE DRIVING AND/OR DRILLING OPERATIONS ARE LIMITED TO THE HOURS BETWEEN 7 AM AND 6 PM.
14. INSPECTION OF COMPLETED WORK WILL BE PERFORMED FOLLOWING NOTIFICATION FROM THE CONTRACTOR THAT A SPECIFIED PORTION OF THE WORK HAS BEEN COMPLETED. THE CONTRACTOR MAY BE CHARGED ANY ADDITIONAL COST OF REINSPECTION OR RETEST WHEN REJECTION MAKES REINSPECTION OR RETEST NECESSARY.

SURVEY NOTES:

1. THE BEDROCK CONTOURS SHOWN ON SHEET B–101 ARE APPROXIMATE BASED ON LINEAR INTERPOLATION BETWEEN SOIL BORING LOCATIONS TAKEN FROM ARCHIVE DRAWINGS.
2. THE HYDROGRAPHIC CONTOURS SHOWN ON SHEET C–101 ARE APPROXIMATE BASED ON LINEAR INTERPOLATION BETWEEN ELEVATIONS FROM A POST DREDGE SURVEY CONDUCTED BY BOURNE CONSULTING AGENCY, DECEMBER 2006.

PILE NOTES:

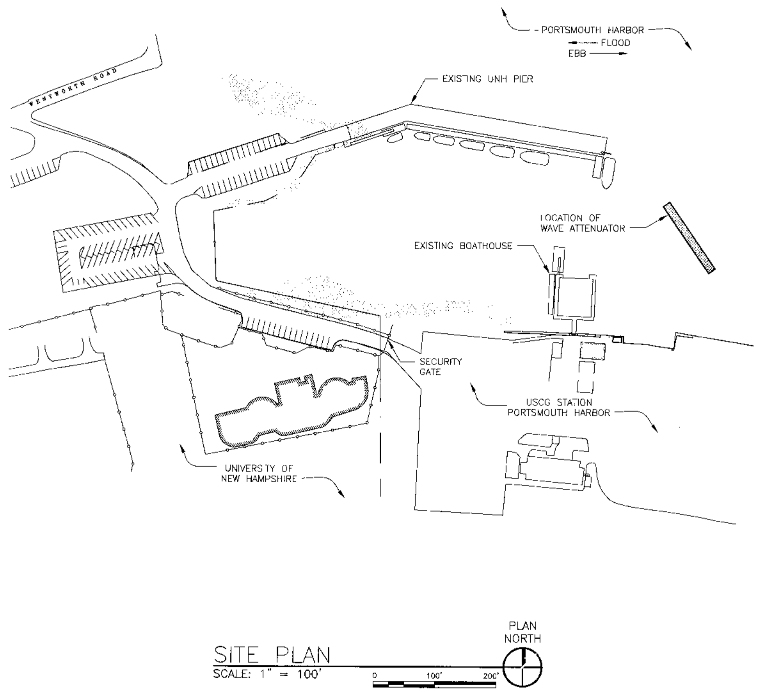
1. STEEL PIPE PILES SHALL BE IN ACCORDANCE WITH ASTM A252 GRADE 3 (SEAMLESS OR STRAIGHT SEAM), WITH MINIMUM YIELD STRENGTH OF 45 KSI.
2. PIPE SPLICES SHALL NOT BE ALLOWED FOR THIS PROJECT.
3. PIPES SHALL BE COATED IN ACCORDANCE WITH THE SPECIFICATIONS.
4. PILES SHALL BE SET TO THE CUT–OFF ELEVATIONS AS INDICATED ON THE DRAWINGS, WITH A MINIMUM ROCK SOCKET DEPTH OF 10–FT.
5. EXISTING ABANDONED RUBBER TIRES HAVE BEEN IDENTIFIED ON THE OCEAN FLOOR IN THE VICINITY OF THE PROJECT LOCATION. IT IS THE CONTRACTORS RESPONSIBILITY TO REMOVE ANY TIRES OBSTRUCTING ROCK SOCKET LOCATIONS PRIOR TO DRILLING, AND LOCATE AND REMOVE ANY ADDITIONAL OBSTRUCTIONS ENCOUNTERED DURING DRILLING.

CONCRETE FLOAT SYSTEM NOTES:

1. FLOAT MODULES WILL BE ERECTED IN A SEVERE WAVE ENVIRONMENT AND CONTRACTOR SHALL ANALYZE, DESIGN AND CONSTRUCT ACCORDINGLY. DESIGN LOADS ARE AS FOLLOWS.
2. WIND: 73 MPH, 30 SECOND DURATION AT 33 FEET ABOVE SEA LEVEL FROM ANY DIRECTION.
3. WAVES: 5 FOOT DESIGN WAVE WITH A PEAK PERIOD OF 3 SECONDS ORIENTED TO THE DOCK TO PRODUCE THE MAXIMUM STRESS.
4. VERTICAL LOADS:
   a. DEAD LOAD TO INCLUDE FLOAT MODULE SELF WEIGHT PLUS ALL PERMANENTLY ATTACHED HARDWARE AND EQUIPMENT INCLUDING PILE GUIDES.
   b. LIVE LOAD OF 50 PSF UNIFORMLY DISTRIBUTED OVER ENTIRE FLOAT DECK PLUS 400 LB. CONCENTRATED LOAD AS SPECIFIED.
5. HORIZONTAL LOADS:
   SUM OF LOADS DUE TO DESIGN ENVIRONMENTAL CONDITIONS INCLUDING:
   WIND PLUS WAVES PLUS CURRENTS ACTING ON ONE SIDE OF THE FLOAT, BUT NOT LESS THAN 600 PLF ACTING HORIZONTALLY AT DECK LEVEL ALONG ENTIRE LENGTH OF FLOAT.
6. FLOAT MODULE PILE GUIDE ASSEMBLIES SHALL BE DESIGNED TO RESIST ALL LOADING APPLIED TO THE FLOAT MODULES AND SHALL BE OF THE WEAR PAD CONFIGURATION.
7. CLEAT LOADS: 3000 LB HORIZONTAL MOORING LINE LOAD APPLIED IN ANY DIRECTION AND UP TO 45 DEGREES VERTICALLY.
8. CLEATS AND SHALL BE HDG CAST STEEL AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS TO ACCOMMODATE THE LOADS SPECIFIED ON THESE DRAWINGS. ALL HARDWARE SHALL BE HDG OR STAINLESS STEEL.
9. D–FENDERS SHALL BE 6" EXTRUDED RUBBER FENDERS AND INSTALLED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.

SYMBOLS INDEX:

- CONCRETE SECTION
- SAND SECTION
- STEEL SECTION
- RIPRAP
- BEDROCK



SITE PLAN
SCALE: 1" = 100'

Appledore Marine Engineering Inc.
600 State Street, Suite E
Portsmouth, New Hampshire 03801
(603) 766–1870 amei@appledoremarine.com

CONSULTANTS

STATE OF NEW HAMPSHIRE — NOAH J ELWOOD No 10534 LICENSED PROFESSIONAL ENGINEER

U. S. COAST GUARD
CIVIL ENGINEERING UNIT
PROVIDENCE

USCG CEU PROVIDENCE
300 METRO CENTER BLVD.
WARWICK, RI 02886

ISSUE		
MARK	DATE	DESCRIPTION

A/E PROJECT NO: 7012
CAD FILE NAME: P2213074D02
DESIGNED BY: ZDJ
DRAWN BY: ZDJ
EDITED BY:
CHECKED BY: NJE

SCALE: AS SHOWN — PLOT SCALE: 1:1

SHEET TITLE
WAVE SUPPRESSION SYSTEM
CG STA PORTSMOUTH HARBOR
NEW CASTLE — NEW HAMPSHIRE

GENERAL
GENERAL NOTES

REVIEWED BY:	REVIEWED BY:	REVIEWED BY:
D. CASS	D. GLASS P.E.	A. JACOBS P.E.
PROJECT ENG.	BRANCH CHIEF	TECH. DIRECTOR

A. JACOBS P.E./BY DIR — 5/25/11
APPROVING OFFICER — DATE

PROJECT NUMBER	DRAWING NUMBER
2213074	P2213074

DISCIPLINE/SHT NO: G–002 — SHEET 2 OF 7

GZA GEOENVIRONMENTAL INC.
140 BROADWAY, PROVIDENCE, RHODE ISLAND
GEOTECH/GEOHYDROLOGICAL CONSULTANTS
GEOTECHNICAL BORING LOG

PROJECT	REPORT OF BORING NO.	AB-1
UNH Pier Replacement	SHEET	1 of 2
New Castle, New Hampshire	FILE NO.	32539
	CHKD BY	SJB

BORING CO. GZA Drilling
FOREMAN Norman Stuard
GZA ENG. Joel Moulton

BORING LOCATION See Exploration Location Plan
GROUND SURFACE ELEV. 14.5' DATUM MLW
DATE START 05-10-02 DATE END 05-13-02

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 IN.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING A 300 lb. HAMMER FALLING 24 IN.
CASING SIZE: NW (3") OTHER: --

GROUNDWATER READINGS

DATE	TIME	WATER	CASING	STABILIZATION TIME

DEPTH	CASING BLOWS	SAMPLE NO.	PEN./REC.	DEPTH (FT)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	REMARK	STRATUM DESCRIPTION
							1	±0.4' CONCRETE SLAB
							2	±1.4' CONCRETE PANEL
								OPEN SPACE BETWEEN DECK AND SEAFLOOR
								MEAN LOW WATER LEVEL 14.5' (EL. 0')
								±27'
		S-1	24/3	28-30	6-9 / 11-13	Medium dense, black, fine to coarse SAND, little Silt, trace Gravel		FINE TO COARSE SAND (SEDIMENT)
30	65/0.5'						3	±30'
	7.5	R-1	36/16	31-32.5	RQD=0%	Fractured pieces of BEDROCK		
	11	R-2	48/43	32.5-36	RQD=[illegible]	Fresh, hard, light gray to gray, fine grained GNEISS with moderately dipping, close, smooth, closed joints		
	3.5							
35	4							
	6	R-3	54/36	36-40.5	RQD=82%	Fresh, hard, light gray to gray, fine grained GNEISS with moderately dipping, close, smooth, closed joints, frequent Calcite stringers		GNEISS BEDROCK
	4.5							
	3.5							
	3.5							
40	5							
	7.5						4	
						End of Exploration at ±40.5'		

GRANULAR SOILS BLOWS/FT	DENSITY	COHESIVE SOILS BLOWS/FT	DENSITY
0-4	VERY LOOSE	<2	VERY SOFT
4-10	LOOSE	2-4	SOFT
10-30	MEDIUM DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	VERY DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:
1. Reinforced concrete slab and prestressed concrete decking panel was cored using a 4-inch diameter concrete core barrel.
2. Boring advanced from 0 to 32.5 using NW casing and spin and wash techniques, and from 32.5' to 40.5' using an NQ2 core barrel.
3. Top of bedrock inferred at 30'.
4. Bedrock core sample obtained using a series 6 express core bit.

NOTES: 1) STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE AT TIMES AND UNDER CONDITIONS STATED. FLUCTUATIONS OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

GZA BORING NO. AB-1

GZA GEOENVIRONMENTAL INC.
140 BROADWAY, PROVIDENCE, RHODE ISLAND
GEOTECH/GEOHYDROLOGICAL CONSULTANTS
GEOTECHNICAL BORING LOG

PROJECT	REPORT OF BORING NO.	AB-2
UNH Pier Replacement	SHEET	1 of 2
New Castle, New Hampshire	FILE NO.	32539
	CHKD BY	SJB

BORING CO. GZA Drilling
FOREMAN Norman Stuard
GZA ENG. Joel Moulton

BORING LOCATION See Exploration Location Plan
GROUND SURFACE ELEV. 14.5 DATUM MLW
DATE START 05-10-02 DATE END 05-13-02

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. HAMMER FALLING 30 IN.
CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING A 300 lb. HAMMER FALLING 24 IN.
CASING SIZE: NW (3") OTHER: --

GROUNDWATER READINGS

DATE	TIME	WATER	CASING	STABILIZATION TIME

DEPTH	CASING BLOWS	SAMPLE NO.	PEN./REC.	DEPTH (FT)	BLOWS/6"	SAMPLE DESCRIPTION BURMISTER CLASSIFICATION	REMARK	STRATUM DESCRIPTION
							1	±0.5' CONCRETE SLAB
							2	±1.5' CONCRETE PANEL
								OPEN SPACE BETWEEN DECK AND SEAFLOOR
								MEAN LOW WATER LEVEL 14.5' (EL. 0')
								±27'
		S-1	24/3	28-30	26-9 / 13-15	Medium dense, black, fine to coarse SAND, little Silt, trace Gravel, trace Steel fragments (sediment)		FINE TO COARSE SAND (SEDIMENT)
30	min/ft							±30'
	4	R-1	30/	31-32.5	RQD=0%	Approximately 12-inch sections of Rip Rap		RIP RAP AND SAND SEDIMENT
	3.5							
	2							
35	4.5/6"	R-2	54/50	35.5-40	RQD=33%	Fresh, hard, light gray, fine grained GNEISS with moderately dipping, close, smooth, closed joints; healed joints are infilled and cemented with Calcite		±35.5'
	3.5							
	35.5							
	35.5							GNEISS BEDROCK
	30.5							
40	7	R-3	60/60	40-45	RQD=[illegible]	Fresh, hard, light gray, fine grained GNEISS with moderately dipping, close, smooth, closed joints		
	7.5							
	8.5							
	7							
45	7						3	
						End of Exploration at ±45		

GRANULAR SOILS BLOWS/FT	DENSITY	COHESIVE SOILS BLOWS/FT	DENSITY
0-4	VERY LOOSE	<2	VERY SOFT
4-10	LOOSE	2-4	SOFT
10-30	MEDIUM DENSE	4-8	M. STIFF
30-50	DENSE	8-15	STIFF
>50	VERY DENSE	15-30	V. STIFF
		>30	HARD

REMARKS:
1. Reinforced concrete slab and prestressed concrete decking panel was cored using a 4-inch diameter concrete core barrel.
2. Boring advanced from 0 to 33.5 using NW casing and spin and wash techniques, and from 35.5' to 45 using an NQ2 core barrel.
3. Bedrock core sample obtained using a series 6 express core bit.

NOTES: 1) STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE AT TIMES AND UNDER CONDITIONS STATED. FLUCTUATIONS OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

GZA BORING NO. AB-2

SUBSURFACE EXPLORATION RECORD

PROBING LOGS

EL	PC11	PD11	PC12	PD12
0 (MLW)				
−10	EL −8.1 PUSH REFUSAL		EL −10.8 PUSH	
−20		EL −15.3 NO PENETRATION		EL −15.5 PUSH REFUSAL
−30				
−40				

NOTES:
1. PROBES MADE APRIL, 1968.
2. SEE SHEET B-101 FOR BORING AND PROBE LOCATIONS.

Appledore Marine Engineering Inc.
600 State Street, Suite E
Portsmouth, New Hampshire 03801
(603) 766-1870 amei@appledoremarine.com

CONSULTANTS

STATE OF NEW HAMPSHIRE
NOAH J ELWOOD
No. 10534
LICENSED PROFESSIONAL ENGINEER

U. S. COAST GUARD
CIVIL ENGINEERING UNIT
PROVIDENCE

USCG CEU PROVIDENCE
300 METRO CENTER BLVD.
WARWICK, RI 02886

ISSUE		
MARK	DATE	DESCRIPTION

A/E PROJECT NO: 7012
CAD FILE NAME: P2213074D03
DESIGNED BY: ZDJ
DRAWN BY: ZDJ
EDITED BY:
CHECKED BY: NJE

SCALE: AS SHOWN PLOT SCALE: 1:1

SHEET TITLE
WAVE SUPPRESSION SYSTEM
CG STA PORTSMOUTH HARBOR
NEW CASTLE NEW HAMPSHIRE

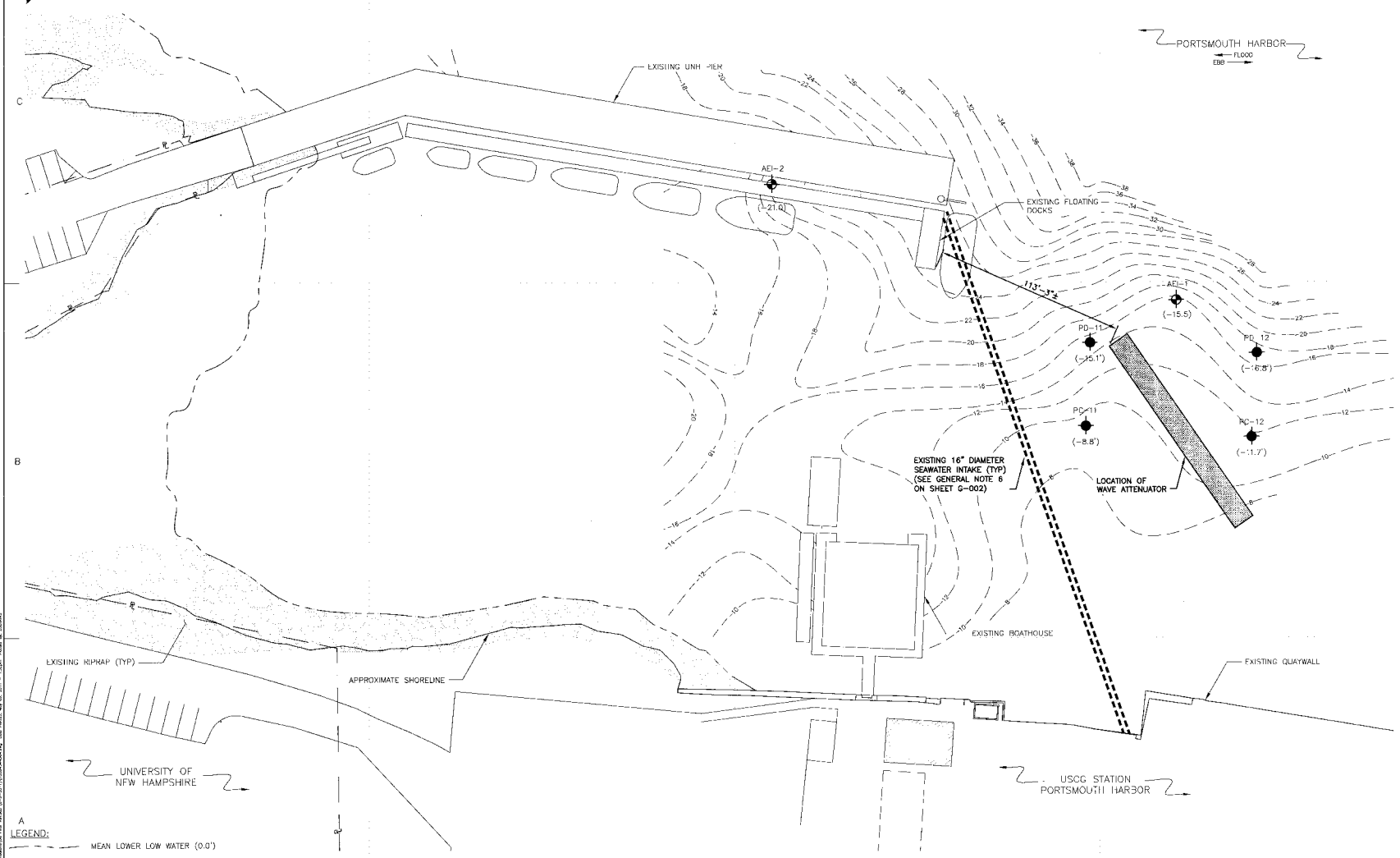
GEOTECHNICAL
BORING LOGS

REVIEWED BY:	REVIEWED BY:	REVIEWED BY:
D. CASS	D. CASS P.E.	A. JACOBS P.E.
PROJECT ENG.	BRANCH CHIEF	TECH. DIRECTOR

A. JACOBS, P.E. BY/DIR — APPROVING OFFICER — DATE 5/23/11

PROJECT NUMBER	DRAWING NUMBER
2213074	P2213074

DISCIPLINE/SHT NO. B-001 SHEET 3 OF 7



A1 ROCK CONTOUR PLAN
SCALE: 1"=30'

Appledore Marine Engineering Inc.
600 State Street, Suite E
Portsmouth, New Hampshire 03801
(603) 766-1870 email@appledoremarine.com

CONSULTANTS

STATE OF NEW HAMPSHIRE — NOAH J ELWOOD No 10534 — LICENSED PROFESSIONAL ENGINEER

U. S. COAST GUARD
CIVIL ENGINEERING UNIT
PROVIDENCE

USCG CEU PROVIDENCE
300 METRO CENTER BLVD.
WARWICK, RI 02886

ISSUE		
MARK	DATE	DESCRIPTION

A/E PROJECT NO: 7012
CAD FILE NAME: P2213074D04
DESIGNED BY: ZDJ
DRAWN BY: ZDJ
EDITED BY:
CHECKED BY: NJE

SCALE: AS SHOWN PLOT SCALE: 1:1

SHEET TITLE

WAVE SUPPRESSION SYSTEM
CG STA PORTSMOUTH HARBOR
NEW CASTLE NEW HAMPSHIRE

GEOTECHNICAL
ROCK CONTOUR PLAN

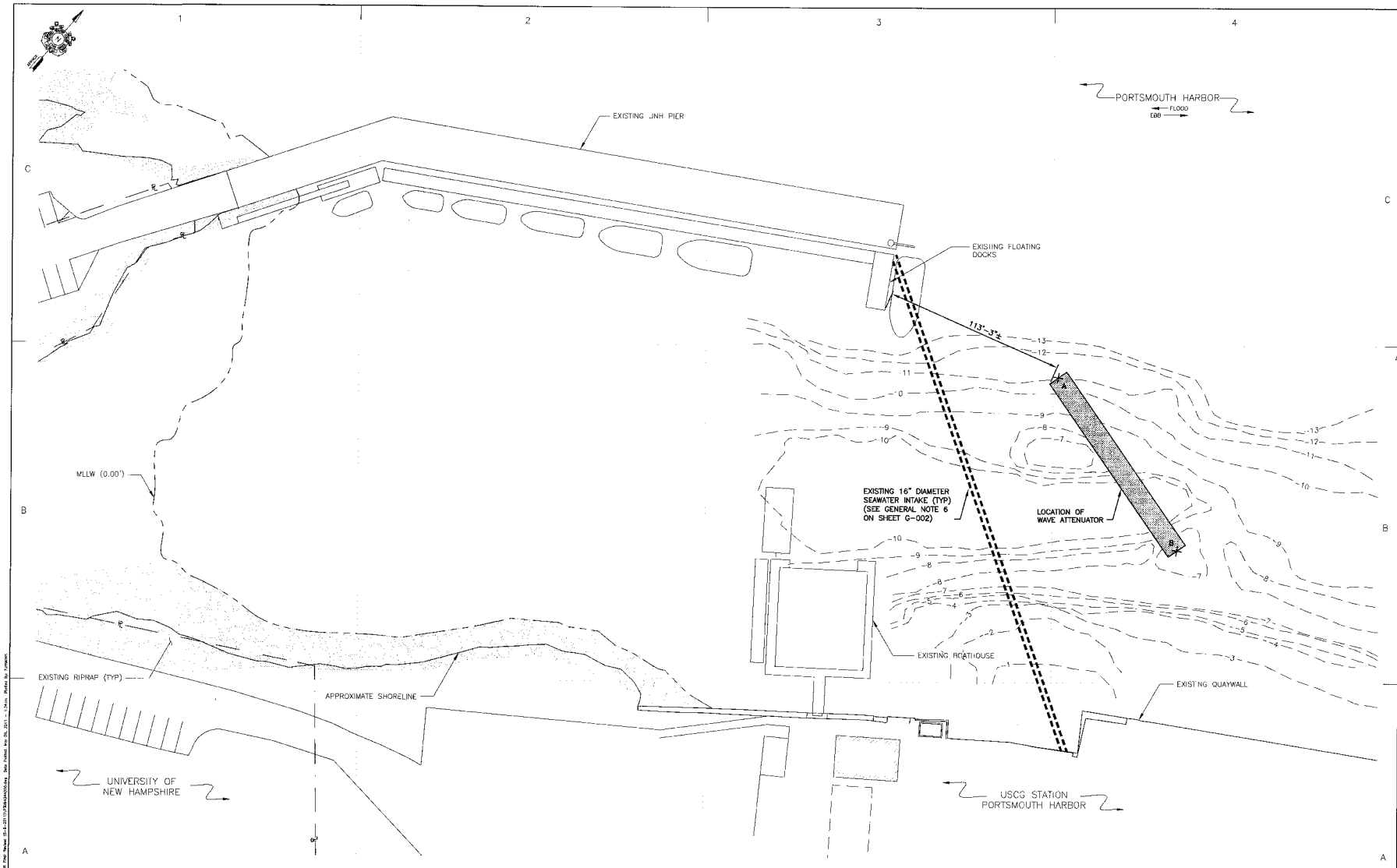
REVIEWED BY:	REVIEWED BY:	REVIEWED BY:
D. CASS	B. GOLEN P.E.	A. JACOBS P.E.
PROJECT ENG.	BRANCH CHIEF	TECH. DIRECTOR

A. JACOBS P.E. BY DIR
APPROVING OFFICER — DATE

PROJECT NUMBER	DRAWING NUMBER
2213074	P2213074

DISCIPLINE/SHT NO
B-101

SHEET 4 OF 7



A1 HYDROGRAPHIC SURVEY
SCALE: 1"=30'

LEGEND:
- MEAN LOWER LOW WATER (0.0')
- APPROXIMATE SHORELINE
- PROPERTY LINE
- 1-FT CONTOUR LINE
- BX REFERENCE POINT OF ATTENUATOR

ATTENUATOR LOCATION		
REF. POINT	NORTHING	EASTING
A	209990.477	1239738.991
B	209945.240	1239862.146

NOTE: HORIZONTAL DATUM BASED ON NAD83 (1996), NEW HAMPSHIRE STATE PLANE COORDINATES.

NOTE: A LICENSED SURVEYOR SHALL LAYOUT THE FLOATING DOCK BY INSTALLING A TEMPORARY BUOY AT EACH END FOR APPROVAL, BY CONTRACTING OFFICER PRIOR TO COMMENCING WITH DRILLING THE ROCK SOCKETS.

Appledore Marine Engineering Inc.
600 State Street, Suite E
Portsmouth, New Hampshire 03801
(603) 766-1870 amei@appledoremarine.com

CONSULTANTS

NOAH J ELWOOD No. 10534 STATE OF NEW HAMPSHIRE PROFESSIONAL ENGINEER

U. S. COAST GUARD
CIVIL ENGINEERING UNIT
PROVIDENCE

USCG CEU PROVIDENCE
300 METRO CENTER BLVD.
WARWICK, RI 02886

ISSUE

MARK	DATE	DESCRIPTION

A/E PROJECT NO: 7012
CAD FILE NAME: P2213074D05
DESIGNED BY: ZDJ
DRAWN BY: ZDJ
EDITED BY:
CHECKED BY: NJE

SCALE: AS SHOWN PLOT SCALE: 1:1

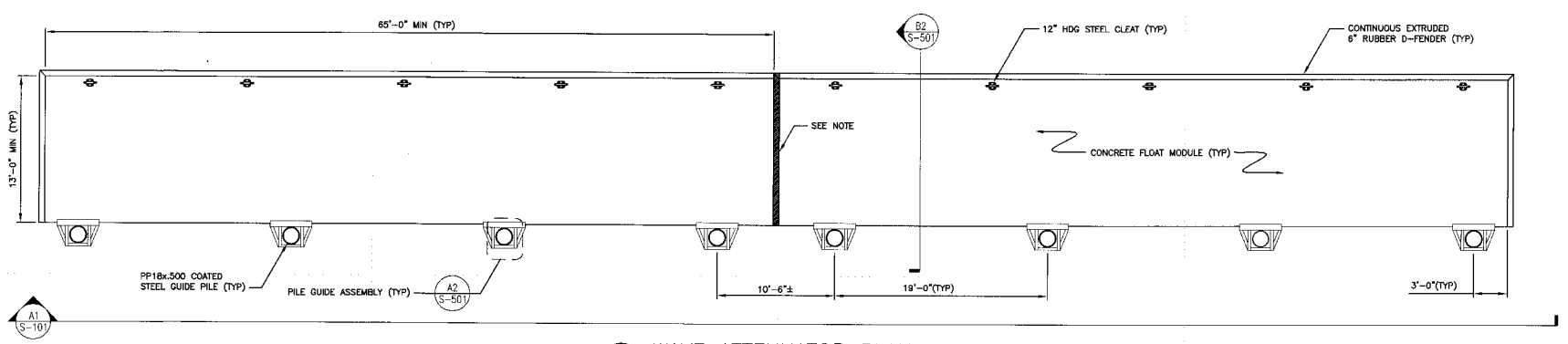
SHEET TITLE

WAVE SUPPRESSION SYSTEM
CG STA PORTSMOUTH HARBOR
NEW CASTLE NEW HAMPSHIRE

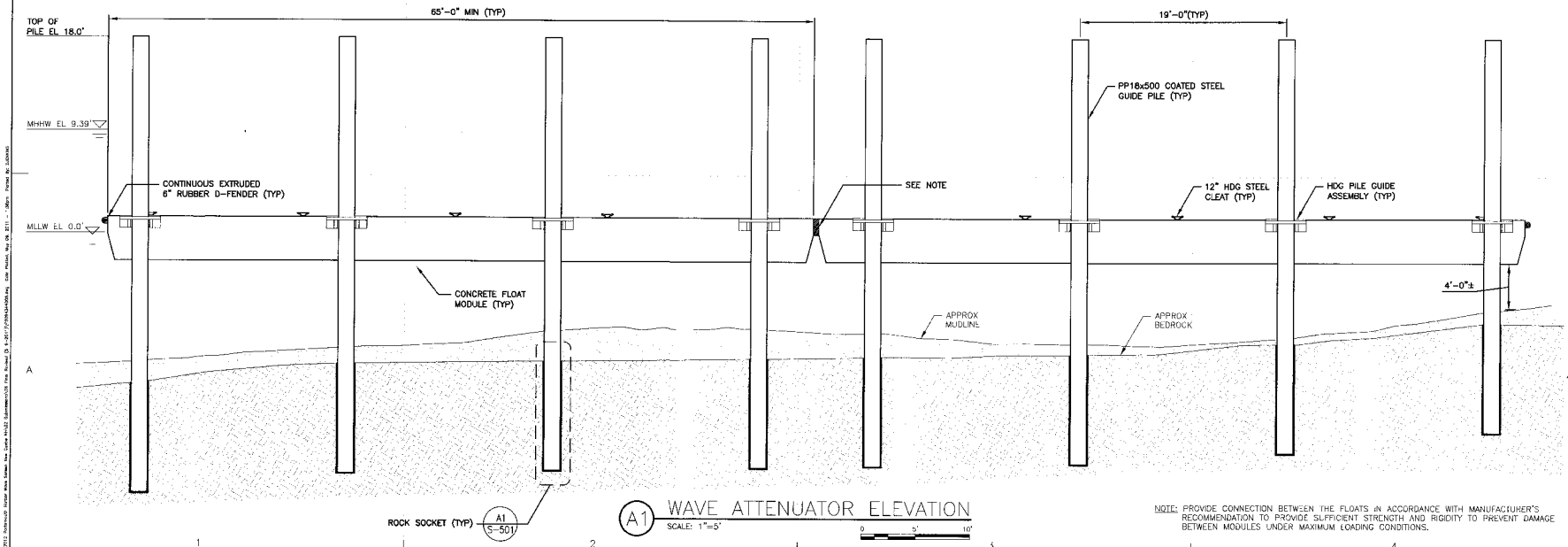
CIVIL
HYDROGRAPHIC SURVEY

REVIEWED BY: D. CASS PROJECT ENG.	REVIEWED BY: D. CASS P.E. BRANCH CHIEF	REVIEWED BY: A. JACOBS P.E. TECH. DIRECTOR
A. JACOBS, P.E. BY DIR APPROVING OFFICER		DATE

PROJECT NUMBER	DRAWING NUMBER
2213074	P2213074
DISCIPLINE/SHT NO. C-101	SHEET 5 OF 7



B1 WAVE ATTENUATOR PLAN
SCALE: 1"=5'



A1 WAVE ATTENUATOR ELEVATION
SCALE: 1"=5'

NOTE: PROVIDE CONNECTION BETWEEN THE FLOATS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATION TO PROVIDE SUFFICIENT STRENGTH AND RIGIDITY TO PREVENT DAMAGE BETWEEN MODULES UNDER MAXIMUM LOADING CONDITIONS.

Appledore Marine Engineering Inc.
600 State Street, Suite F
Portsmouth, New Hampshire 03801
(603) 766-1870 email@appledoremarine.com

CONSULTANTS

STATE OF NEW HAMPSHIRE — NOAH J ELWOOD No 10534 — LICENSED PROFESSIONAL ENGINEER

U. S. COAST GUARD
CIVIL ENGINEERING UNIT
PROVIDENCE

USCG CEU PROVIDENCE
300 METRO CENTER BLVD.
WARWICK, RI 02886

ISSUE		
MARK	DATE	DESCRIPTION

A/E PROJECT NO:	7012
CAD FILE NAME:	P2213074D06
DESIGNED BY:	ZDJ
DRAWN BY:	ZDJ
EDITED BY:	
CHECKED BY:	NJE
SCALE: AS SHOWN	PLOT SCALE: 1:1

SHEET TITLE

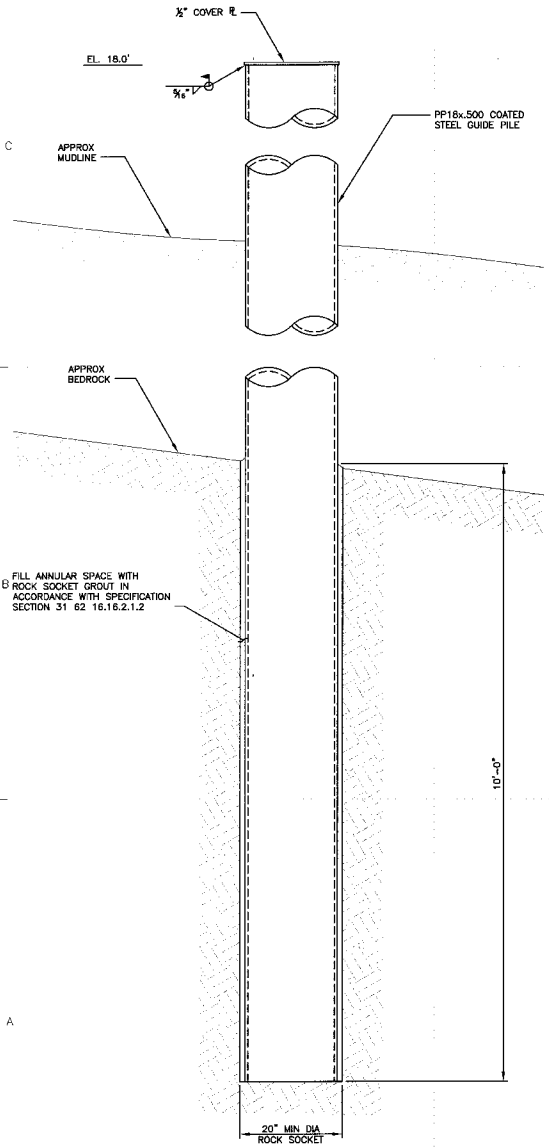
WAVE SUPPRESSION SYSTEM
CG STA PORTSMOUTH HARBOR
NEW CASTLE NEW HAMPSHIRE

STRUCTURAL
WAVE ATTENUATOR PLAN AND ELEVATION

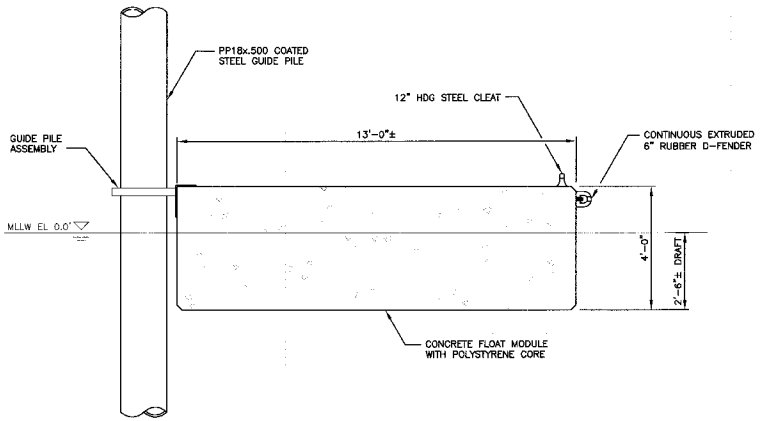
REVIEWED BY:	REVIEWED BY:	REVIEWED BY:
D. CASS	D. GLASS P.E.	A. JACOBS P.E.
PROJECT ENG.	BRANCH CHIEF	TECH. DIRECTOR

A. JACOBS P.E. BY/DJR — APPROVING OFFICER — 5/23/11 DATE

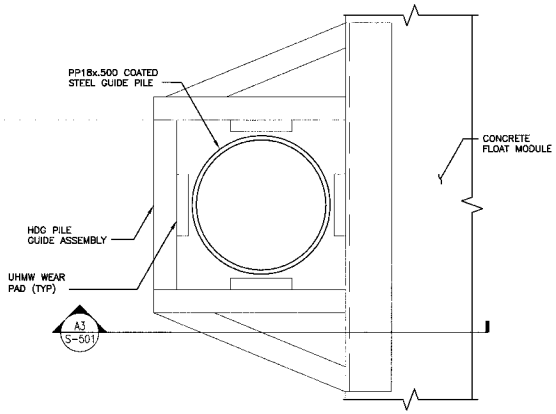
PROJECT NUMBER	DRAWING NUMBER
2213074	P2213074
DISCIPLINE/SHT NO	SHEET 6 OF 7
S-101	



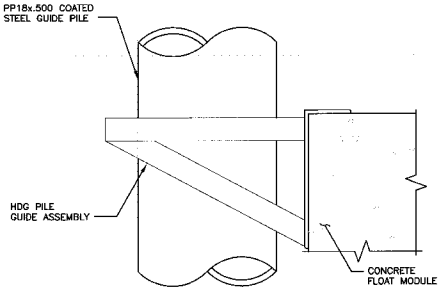
A1 ROCK SOCKET DETAIL
SCALE: 1"=1'-0"



B2 FLOAT MODULE SECTION
SCALE: ½"=1'-0"



A2 PILE GUIDE ASSEMBLY PLAN
SCALE: 1½"=1'-0"



A3 PILE GUIDE ASSEMBLY ELEVATION
SCALE: 1½"=1'-0"

Appledore Marine Engineering Inc.
600 State Street, Suite E
Portsmouth, New Hampshire 03801
(603) 766-1870 amei@appledore-marine.com

CONSULTANTS

NOAH J ELWOOD No. 10542 STATE OF NEW HAMPSHIRE PROFESSIONAL ENGINEER

U. S. COAST GUARD
CIVIL ENGINEERING UNIT
PROVIDENCE

USCG CEU PROVIDENCE
300 METRO CENTER BLVD.
WARWICK, RI 02886

ISSUE		
MARK	DATE	DESCRIPTION

A/E PROJECT NO:	7012
CAD FILE NAME:	P2213074007
DESIGNED BY:	ZDJ
DRAWN BY:	ZDJ
EDITED BY:	
CHECKED BY:	NJE
SCALE: AS SHOWN	PLOT SCALE: 1:1

SHEET TITLE

WAVE SUPPRESSION SYSTEM
CG STA PORTSMOUTH HARBOR
NEW CASTLE NEW HAMPSHIRE

STRUCTURAL
WAVE ATTENUATOR DETAILS

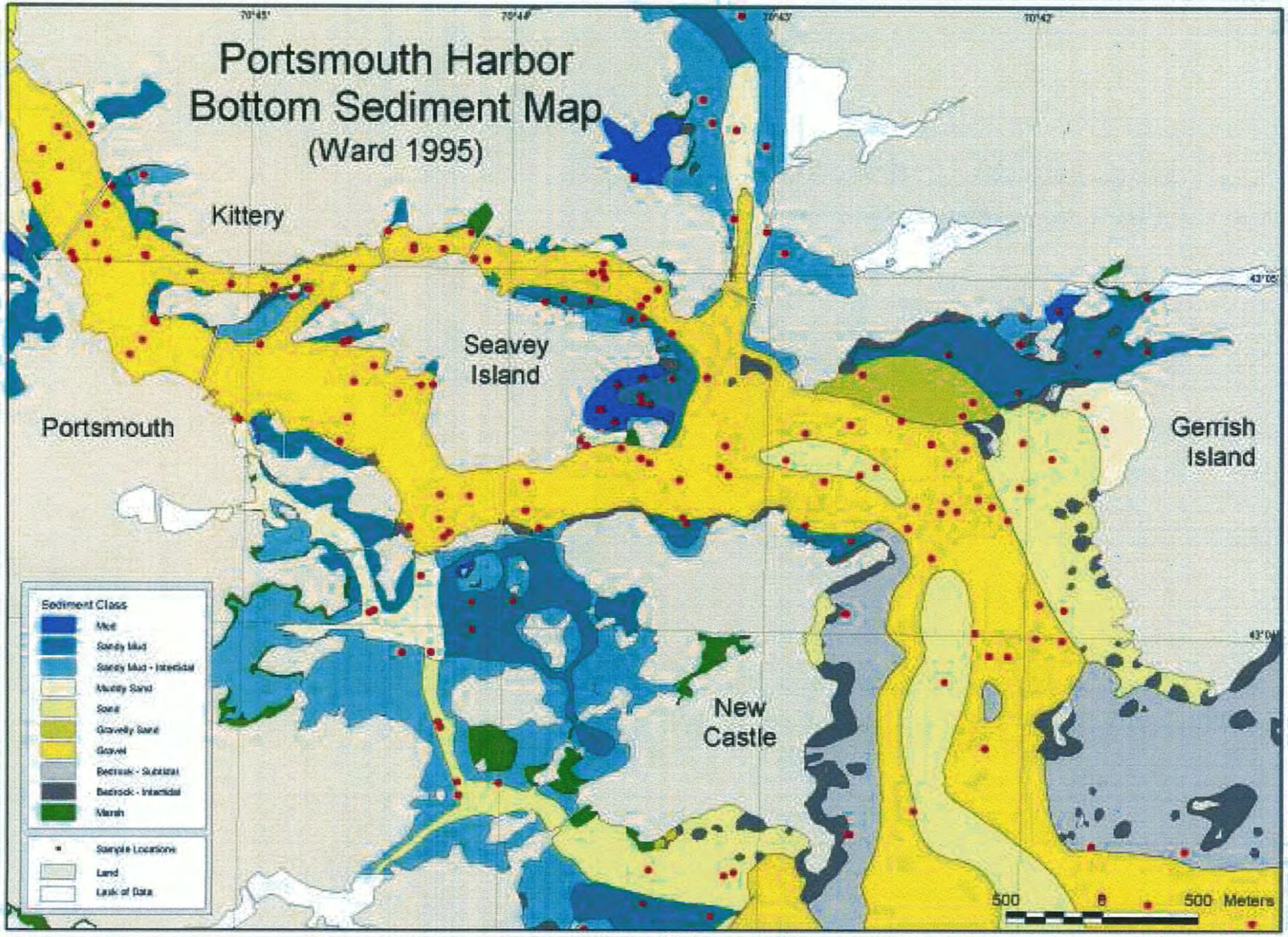
REVIEWED BY:	REVIEWED BY:	REVIEWED BY:
D. CASS P.E.	A. JACOBS P.E.	A. JACOBS P.E.
PROJECT ENG.	BRANCH CHIEF	TECH. DIRECTOR

A. JACOBS P.E. BY/DIR
APPROVING OFFICER — DATE

PROJECT NUMBER	DRAWING NUMBER
2213074	P2213074

DISCIPLINE/SHT NO. S-501 SHEET 7 OF 7

Appendix H
Portsmouth Harbor Sediment Mapping


Portsmouth Harbor
Bottom Sediment Map
(Ward 1995)
Kittery
Seavey
Island
Portsmouth
Gerrish
Island
New
Castle
Sediment Class
Mud
Sandy Mud
Sandy Mud - Intertidal
Muddy Sand
Sand
Gravelly Sand
Gravel
Bedrock - Subtidal
Bedrock - Intertidal
Marsh
Sample Locations
Land
Lack of Data
500
0
500 Meters

www.wright-pierce.com