CAMP ELLIS BEACH, SACO, MAINE
SHORE DAMAGE MITIGATION PROJECT

PUBLIC DRAFT
ENVIRONMENTAL ASSESSMENT AND
CLEAN WATER ACT SECTION 404 (B) (1) ANALYSIS

US Army Corps
of Engineers®
New England District

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FINDING OF NO SIGNIFICANT IMPACT (FONSI)

CLEAN WATER ACT SECTION 404 (b) (1) EVALUATION

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ENVIRONMENTAL ASSESSMENT
SHORE DAMAGE MITIGATION
CONTINUING AUTHORITY PROGRAM SECTION 111
CAMP ELLIS BEACH, SACO, MAINE

1.0 INTRODUCTION

This Environmental Assessment (EA) evaluates the environmental impacts of the Federal action to mitigate shoreline damage along Camp Ellis Beach in Saco, Maine. Camp Ellis Beach is located directly north of the Saco River. The two Federal jetties that form the mouth of the Saco River have accelerated erosion of Camp Ellis Beach by disrupting the normal sediment shoal complex that forms at the mouth of the river, the littoral transport of sediment from the south of Saco River to the north, and has exacerbated the wave energy at the intersection of the north jetty and Camp Ellis Beach (see Figure 1-1).

This EA addresses alternatives to alleviate the erosion, and subsequent property and infrastructure damages, occurring on the Camp Ellis Beach shoreline. These alternatives contain all or parts of the following components: (1) modifications to the existing north jetty, (2) construction of an off-shore breakwater(s) and/or a spur jetty to prevent or impede the coastal wave and hydrologic processes that contribute to beach erosion, (3) beach nourishment to restore lost sand along the Camp Ellis Beach shoreline, and (4) other non-structural solutions.

This report meets the requirements for compliance with the National Environmental Policy Act (NEPA) of 1969 and all applicable Federal environmental regulations and laws, and Federal Executive Orders, including an evaluation to meet the requirements of Section 404 (b) (1) of the Clean Water Act. The U.S. Army Corps of Engineers (USACE) prepares an EA for Federal actions that do not necessarily require the preparation of an Environmental Impact Statement pursuant to 33 Code of Federal Regulations 230.7. Methods used to evaluate the impacts to environmental resources of the area include local and regional wave modeling, field evaluations, review of available environmental data, historical knowledge and evaluations, and extensive coordination with Federal, State, and local environmental resource agencies and private individuals.

1.1 PROJECT HISTORY AND BACKGROUND

This proposed project is located in the coastal community of Camp Ellis Beach in Saco, Maine (see Figure 1-2). Saco, Maine is located approximately 40 miles north of Portsmouth, New Hampshire and 16 miles south of Portland, Maine. The project area is located on Saco Bay which contains about seven miles of sandy beaches. Its crescent shape forms a semi-enclosed bay system with Prouts Neck headland to the north, Fletchers Neck headland (Biddeford Pool) to the south and Stratton, Bluff, Eagle, Ram and Wood Islands forming the seaward edge of the three mile wide bay. The Saco River empties into the southern end of Saco Bay. See Figure 1-3.

Figure 1-1

Saco River Federal Navigation Project North Jetty and Spur Viewed from Camp Ellis Beach's High Erosion Area

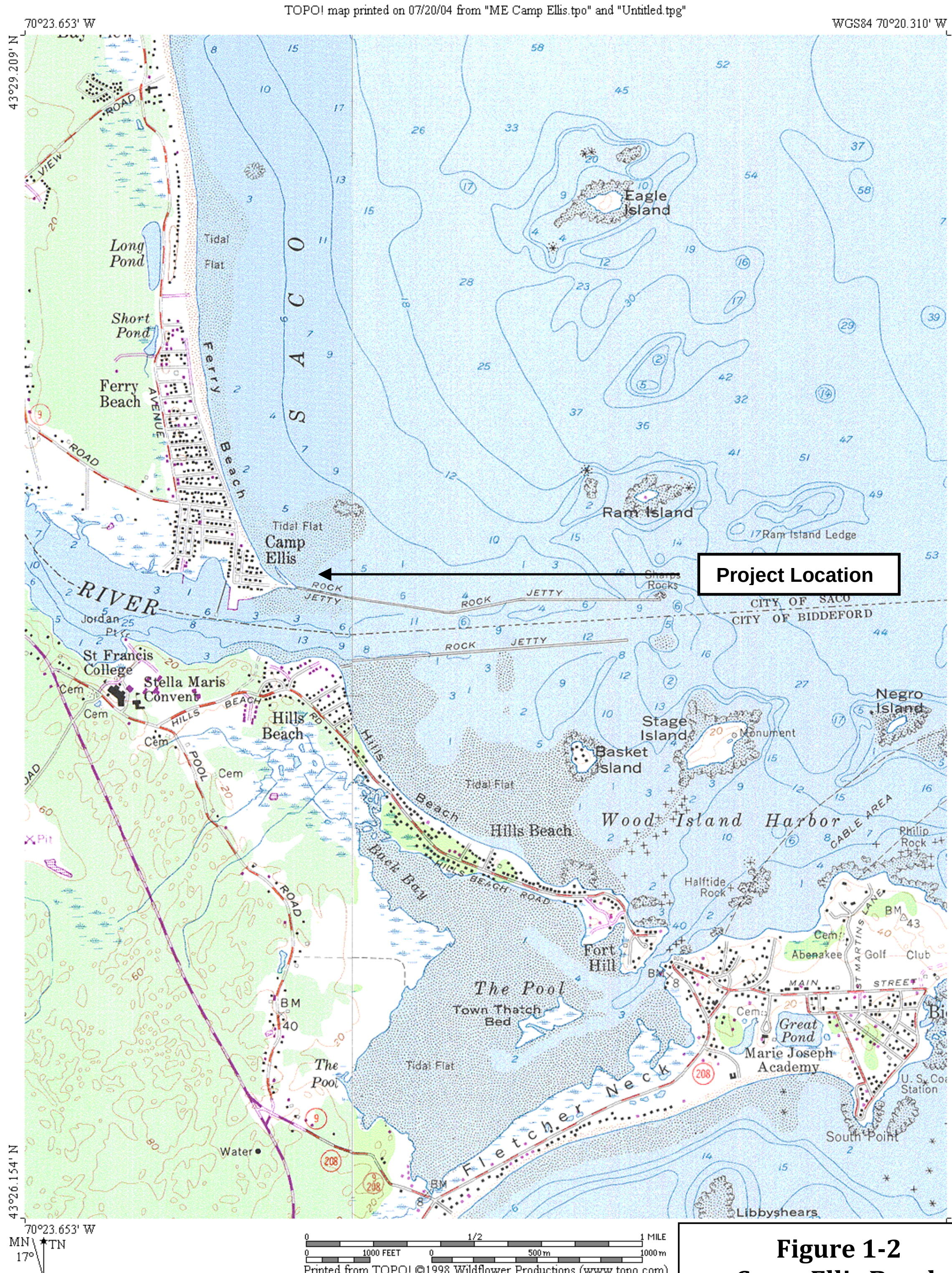

Figure 1-2
Camp Ellis Beach
Saco, Maine
Project Location

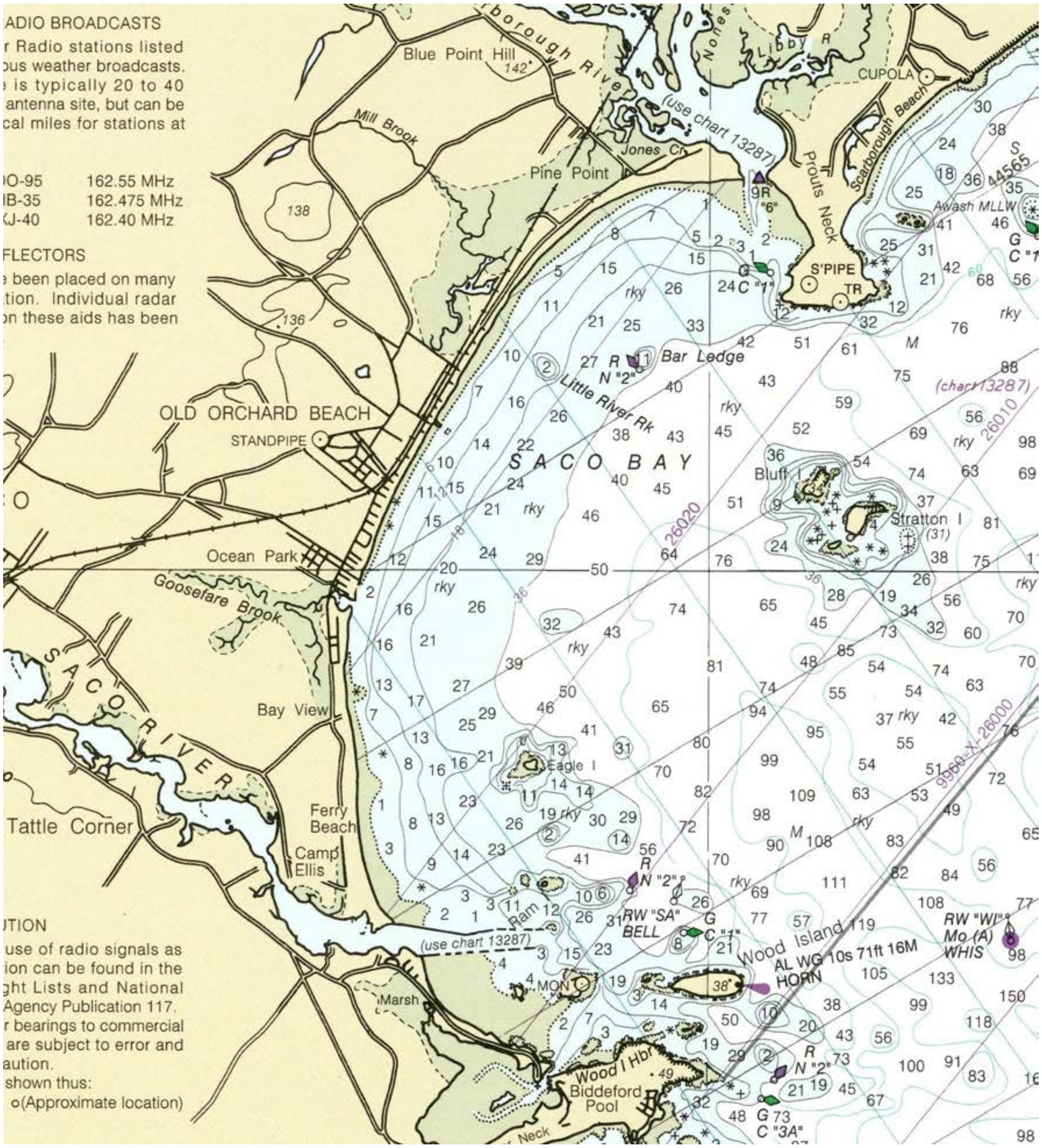

Figure 1-3 - Saco Bay, Maine

A Federal navigation channel is maintained from the mouth of Saco River upstream to Biddeford, Maine. This channel is dredged periodically and the sandy material disposed on adjacent beaches.

In the 19th century, navigation at the mouth of the Saco River became difficult due to the presence of tidal deltas in front of the inlet. In response to increasing marine traffic, the USACE began altering the inlet in 1824. In 1867, a 4,200-foot long breakwater north of the river mouth was constructed in order to maintain a clear navigation channel at the inlet and to provide wave energy reduction in the harbor and channel entrance. Between 1885 and 1969, the northern jetty was extended to a maximum length of approximately 6,600 feet, and heightened with a varying crest elevation of one foot at the seaward end to 12.5 feet (mean tide level) at the landward end. In addition, construction of a stone jetty on the south side of the river entrance began in 1891, which was eventually lengthened to approximately 4,800 feet and heightened with a varying crest elevation between one foot at the seaward end and 6.6 feet (mean tide level) at the landward end. In 1912, a 400-foot long spur jetty was added to the north face of the north jetty to prevent flanking and separation of the north jetty from the beach.

Based on the 2006 Woods Hole Report, which evaluated shoreline changes between 1864 and 1998, a number of important changes took place around the southern portion of the Saco embayment, in particular in the area to the north and south of the Saco River jetties. One of the most notable changes was the erosion that has incurred on the northern side of the jetties near Camp Ellis. Localized erosion rates near the north jetty were in excess of 3.41 ft/year. This erosion rate decreased as one moves northward until the erosion rate reverses and sediment begins to accrete in the northern portion of Saco Bay. The greatest amount of accretion at the northern end of the bay is at Pine Point, near Prouts Neck, where accretion rates are nearly 4.0 feet/year.

In the past 50 years, erosion at Camp Ellis has caused the loss of over 30 buildings and residential structures and two local roads. Armoring the shoreline in some of this area in response to erosion caused by the Federal navigation project has slowed the rate of erosion. However, as Maine State law precludes construction of coastal structures, additional rock cannot be placed in these areas and continued erosion will lead to undermining and eventual failure of these revetments. In 2007, a section of rock revetment was undermined and collapsed resulting in the loss of a section of roadway, two residences and significant damage to other structures. Since 1998, then study area has undergone significant changes. The loss of beach in front of these temporary revetments has been significant. Conversely, the area directly north of Camp Ellis Beach, which over the entire time period had been stable, is now experiencing erosion. This may be due to the armoring of the Camp Ellis beach directly to the south, which limits the amount of available sand for transport. Rates of erosion during the recent time period are approximately one ft/year for Ferry Beach. The actual erosion rate varies depending on the frequency and severity of yearly storms. As an example, Ferry Beach, located just north of Camp Ellis Beach, has not recovered from the Patriot's Day storm in April 2007, except for one beach nourishment area, based on beach profile surveys performed in 2009 (Slovinsky and Dickson, 2009).

1.2 PURPOSE AND NEED FOR THE PROJECT

The purpose of this project is to prevent and reduce the potential for damages to structures, residential homes, roadways, and utilities from shoreline erosion compounded by wave action reflecting off the Federal jetty and the disruption of the sediment load to Camp Ellis Beach. Due to the interaction between the jetties and local coastal processes, it has been concluded that the beach north of the jetties (Camp Ellis Beach) is being adversely affected by these navigation structures. Currently, the most acute erosion is taking place within a 3,250-foot stretch of beach just north of the jetties. Studies (see Feasibility Report) have indicated that the beach is being deprived of sand because the sand moving out of the mouth of the Saco River is deposited too far offshore by the jetties to become part of the littoral system. These studies also indicate that the north jetty is magnifying erosion from reflected wave energy, and to a lesser extent, Mach Stem waves (waves that travel along the structure). The goal of the overall project is to mitigate the increased erosion induced by the Federally constructed Saco River structures by (1) reducing the increased wave energy caused by the reflected and Mach Stem waves from the northern structure, and (2) provide a sediment source to the beach that was once provided by the Saco River sediment flux that discharged in the nearshore region.

The intent of the project is to address the erosion problem caused by the jetties. It should be understood that the proposed project is not a flood damage and risk reduction project. In basic terms, the jetties are increasing shoreline erosion, and the various alternatives were designed to address this shoreline erosion issue. Any flood prevention or risk reduction is a byproduct of reducing erosion on Camp Ellis Beach and was not analyzed further by USACE staff.

1.3 PURPOSE AND SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

This EA is designed to serve as a concise public document that briefly provides sufficient evidence and analysis for determining whether to prepare an Environmental Impact Statement (EIS) or to reach a Finding of No Significant Impact, in compliance with the National Environmental Policy Act. This document includes brief discussions of the need for the proposal and the alternatives as required by NEPA, the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted.

1.4 PUBLIC REVIEW AND COMMENT

The Saco Bay Implementation Team (SBIT) was formed by local citizens, homeowner groups, and members of several Federal and State agencies to develop and identify acceptable fill sources and project designs to alleviate erosion problems at Camp Ellis Beach. The SBIT representatives include the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service (FWS), U.S. National Marine Fisheries Service (NMFS), Maine Geological Survey (MGS), Maine State Planning Office (MSPO), Maine Coastal Zone Program (MCZP), the Maine Department of Environmental Protection (MDEP), Audubon Society, regional planning commissions, and Saco and Camp Ellis Beach homeowners and citizen action groups. The SBIT met frequently to review progress, discuss Federal action on mitigation efforts for erosion at Camp Ellis Beach, and provide valuable public feedback on the process. The USACE' preferred action is a result of the coordination and intense public involvement of the SBIT. Several State and Federal natural resource agencies were also coordinated with in the development of this EA. See the Coordination Section of the Feasibility Report for comment letters.

A Public Notice on the availability of the draft EA will be mailed to individuals, organizations, and corporations. A draft EA initiates a 30-day public review period in accordance with the Council of Environmental Quality regulations (40 CFR Parts 1500-1508). A final EA will be prepared based on the comments received.

1.5 AUTHORITY

1.5.1 CONTINUING AUTHORITIES PROGRAM, SECTION 111, SHORE DAMAGE ATTRIBUTABLE TO FEDERAL NAVIGATION WORKS

The initial project review and Environmental Assessment was conducted under the Continuing Authority of Section 111 of the 1968 River and Harbor Act, as amended, 33 U.S.C. § 426i. The Continuing Authorities Program (CAP) is focused primarily on water resource related projects of relatively smaller scope, cost and complexity. Unlike the traditional USACE civil works projects that are of wider scope and complexity and require specific authorization and appropriations, the Secretary of the Army, acting through the Chief of Engineers, has been delegated the authority to plan, design, and construct certain types of water resource and environmental restoration projects without specific Congressional authorization, pursuant to various legislative authorities.

Section 111 provides authority for the USACE to investigate, study, and implement structural and non-structural measures for the prevention or mitigation of shore damages attributable to Federal navigation works. The USACE does not use this authority to restore shorelines to historic dimensions, but only to reduce erosion to the level that would have existed without the construction of a Federal navigation project. The maximum limit of Federal participation for Section 111 CAP projects is $5 million, including all pre-construction study costs and design, construction, and periodic re-nourishment.

1.5.2 WATER RESOURCES DEVELOPMENT ACT 2007

Federal expenditures for Section 111 projects are limited to $5 million without specific Congressional authorization. As the projected cost to alleviate the erosion problem were expected to exceed the $5 million limit, Congress provided specific authority under Section 3085 of the Water Resources Development Act of 2007 to increase this Federal limit to a maximum $26.9 million for Camp Ellis Beach.

1.6 PERMITS, APPROVALS, AND REGULATORY REQUIREMENTS

In addition to compliance with the National Environmental Policy Act, the USACE must ensure that projects completed under its authority comply with all applicable Federal laws. For example, compliance with the Endangered Species Act, the Fish and Wildlife Coordination Act, the National Historic Preservation Act, the Clean Water Act, etc., is always mandatory for Federal actions.

Table 1-1 outlines the major environmental permits and reviews (Federal and State) for the Camp Ellis Beach Shoreline Damage Mitigation Project; Section 10 *Compliance with Environmental Laws and Regulations* summarizes the project's compliance with applicable Federal laws, regulations, Executive Orders, and Executive Memoranda.

Clean Water Act (CWA)

Applicable Federal requirements of the CWA include compliance with Sections 401 and 404. The Federal government has delegated jurisdiction of Section 401 (Water Quality Certification) to the State of Maine, and the USACE will satisfy this requirement prior to construction. Under Section 404, the discharge of dredged or fill material associated with the construction of project is administered by the USACE. Since the USACE of Engineers does not issue permits to itself for its own activities, the USACE completes an evaluation of the proposed project's compliance with Section 404 of the CWA. A Section 404 (b) (1) compliance form is included in this project's NEPA document.

Endangered Species Act

The U.S. Army Corps of Engineers is required to ensure compliance with the interagency cooperation provisions of Section 7 of the Endangered Species Act (ESA), 16 U.S.C. § 1536. The regulations implementing these provisions, 50 C.F.R. Part 402, outline the procedures for Federal interagency cooperation to conserve Federally-listed species and designated critical habitats and to ensure that Federal agency actions are not likely to jeopardize the continued existence of any species listed as endangered or threatened pursuant to the ESA.

TABLE 1-1* Major Environmental Permits and Reviews for the Camp Ellis Beach Shoreline Damage Mitigation Project	
Agency	**Permit/Review**
Federal	
U.S. Department of the Army Corps of Engineers	Clean Water Act Section 404 (b)(1) Evaluation
U.S. Department of the Interior Fish and Wildlife Service	Endangered Species Act Section 7 Consultation, Fish and Wildlife Coordination
U.S. Department of Commerce National Marine Fisheries Service	Essential Fish Habitat Consultation - Magnuson-Stevens Fishery Act (MSFCMA), Endangered Species Act Section 7 Consultation, Fish and Wildlife Coordination
State of Maine	
Dept. of Environmental Protection Bureau of Land and Water Quality	CWA Section 401 Water Quality Certificate Fish and Wildlife Coordination
Office of State Planning	Coastal Zone Management Consistency Determination
Historic Preservation Commission	Review/Comments on construction activities affecting cultural resources (Section 106, NHPA)
* Section 10, *Compliance with Environmental Laws and Regulations*, summarizes the project's compliance with applicable Federal laws, regulations, Executive Orders, and Executive Memorandum	

Pursuant to Section 7, the USACE is required to consult with the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) to determine whether its actions are likely to adversely affect any ESA listed endangered or threatened species or their designated critical habitat. If, upon review of existing data, the USACE and FWS and/or NMFS determine that such species or habitats are likely to be adversely affected by the project, the USACE is required to prepare a biological assessment to identify the nature and extent of adverse impact, and to recommend mitigation measures that would avoid impacts to the habitat and/or species or that would reduce potential impact to acceptable levels. If the two agencies determine that no Federally-listed or proposed endangered or threatened species or their designated critical habitat would be adversely affected by the project, no further action is necessary. If the biological assessment indicates that there will be adverse impacts, the USACE will then engage in formal consultation with FWS and/or NMFS, which will culminate with a biological opinion from FWS and/or NMFS on whether the action is likely to jeopardize the continued existence of ESA-listed species.

Fish and Wildlife Coordination Act

The purpose of the Act is to recognize the contribution of wildlife resources to the Nation, and to ensure that wildlife conservation receives equal consideration with other features of water-resources development programs. The terms "wildlife" and "wildlife resources", as used in this Act, "include birds, fishes, mammals and all other classes of wild animals and all types of aquatic and land vegetation upon which wildlife is dependent". The FWS and NMFS are authorized to assist and cooperate with Federal, State, and public or private agencies, and organizations in the conservation and rehabilitation of wildlife whenever the waters of any stream or other body of water are proposed to be impounded, diverted, the channel deepened or otherwise controlled or modified. The USACE shall consult with the FWS, and the NMFS, as appropriate, and with the State agency administering the wildlife resources of the State. The consultation shall consider conservation of wildlife resources with the view of preventing loss of and damages to such resources as well as providing for development and improvement in connection with such water resources development.

Any reports and recommendations of the wildlife agencies shall be included in authorization documents for construction or for modification of projects. The USACE shall give full consideration to the reports and recommendations of the wildlife agencies, and include such justifiable means and measures for wildlife mitigation or enhancement as the USACE finds should be adopted to obtain maximum overall project benefits.

Essential Fish Habitat Consultation under the Magnuson-Stevens Fisheries Conservation Act

The consultation requirements in the Magnuson-Stevens Act direct Federal agencies to consult with NMFS when any of their activities may have an adverse effect on Essential Fish Habitat (EFH). The EFH regulations define an *adverse effect* as “any impact which reduces quality and/or quantity of EFH...[and] may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.” 50 C.F.R. § 600.910(a). EFH consultations can be incorporated into interagency procedures previously established, such as an agency’s process for implementing the National Environmental Policy Act. An “EFH Assessment” is a review of the proposed project and its potential impacts to EFH which is prepared by the Federal action agency. As set forth in the NMFS regulations, EFH Assessments must include (1) a description of the proposed action; (2) an analysis of the effects, including cumulative effects, of the action on EFH, the managed species, and associated species by life history stage; (3) the Federal agency's views regarding the effects of the action on EFH; and (4) proposed mitigation, if applicable. The regulations require NMFS to provide EFH Conservation Recommendations in a timely manner. These recommendations may include measures to avoid, minimize, mitigate, or otherwise offset adverse effects on EFH. Federal agencies are required to respond to EFH Conservation Recommendations in writing within 30 days. An EFH assessment is included as part of this EA.

Coastal Zone Management Act

The Federal Coastal Zone Management Act (CZMA) establishes a Federal-State partnership and the related legal framework for management of the nation's coastal resources. The CZMA grants Maine and other coastal States with a Federally approved coastal management program the authority to review Federal activities, Federally licensed or funded activities, and Federally funded activities to ensure that those Federal actions meet the "enforceable policies" of the State's coastal program. The Maine State Planning Office (SPO) serves as a coordinator and point of contact for Federal consistency review (Maine Coastal Program, 2004a).

As a Federal agency, the USACE is obligated to satisfy the CZMA consistency provisions for activities in the Maine coastal zone that involve dredging, channel works, breakwaters, other navigation works, erosion control structures, beach replenishment and dams (Maine Coastal Program, 2002).

Section 106 of the National Historic Preservation Act (NHPA)

Section 106 of the NHPA requires the USACE to take into account the effects of its undertakings on any prehistoric or historic sites, districts, buildings, structures, objects, or properties of traditional religious or cultural importance to Native Americans listed on or eligible for listing on the National Register of Historic Places (NRHP), and to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on the undertaking. In accordance with the ACHP procedures, the USACE is required to consult with the appropriate State Historic Preservation Officers (SHPOs) regarding the NRHP eligibility of cultural resources and the potential effects of the proposed undertaking on those NRHP-listed or -eligible cultural resources.

2.0 ALTERNATIVES

2.1 GENERAL

This section presents the benefits and impacts of the proposed action and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public. The intent of this section is to explore and objectively evaluate reasonable alternatives, and briefly discuss the reasons why some alternatives were eliminated from detailed study.

With the complexity of the erosion forces at Camp Ellis, the USACE established a model to evaluate the physical processes occurring in the Saco Bay area, specifically the Camp Ellis Beach region. The modeling results consist of simulating the existing conditions in the vicinity of Camp Ellis, verifying the model's performance with observed data, and subsequently, utilizing the verified model to simulate various alternatives for shoreline protection. The numerical modeling ultimately evaluates the performance of each of the many alternatives and the ability to sustain a beach at Camp Ellis. There are some intense coastal processes that occur within the project area that have been documented and demonstrated in the wave modeling effort. Evaluation of the sea surface model results for the existing conditions revealed: (1) the significant wave reflection off of the northern jetty indicating the beach is impacted not only by the incident wave energy, but also by the reflected wave energy, (2) regardless of the offshore approach direction, the nearshore waves propagated directly towards the Camp Ellis Beach region and the northern jetty, (3) Mach-Stem waves propagating along the northern jetty can be seen in most cases, (4) waves are refracted towards the northern jetty due to the jetty-parallel bottom contours, and (5) variations between annual average approach directions are important to understand the processes occurring at Camp Ellis Beach.

The USACE developed and refined the alternatives through a series of meetings and discussions with key stakeholders including the Maine Geological Survey, Woods Hole Group, and members of the Saco Bay Implementation Team. In this public forum, the stakeholders evaluated in detail many engineering alternatives that could best serve to maximize protection for commercial and residential interests, minimize erosion, and minimize or avoid environmental impacts to the marine ecosystem. During this iterative process, many viable solutions were discussed and considered, and an initial series of alternatives was selected for the analysis procedure. Careful consideration was given to all factors associated with each alternative. For example, potential impacts on the neighboring shoreline, engineering feasibility, likelihood of success, etc. were all considered in the final selection process. The alternatives that were viewed as the most highly effective were jointly selected for further analysis. Initially, a total of 11 alternatives were considered; however, this was expanded to 17 through the discussion and meeting process. Following some of the initial modeling results, the alternatives were expanded to a total of 23. Subsequent geotechnical evaluation resulted in the addition of six more alternatives. The buy-out alternative, which was not amenable to wave modeling, was also included. In the end 32 potential solutions, mostly structural, and one non-structural alternative, a buy-out plan, were developed.

Table 2-1 presents a list of the alternatives considered. The base alternative is a beach nourishment alone project. However, since beach nourishment alone does not directly address the impact caused by the northern jetty (increased energy due to wave reflection and a reduction in sediment supply through pushing sediment further offshore) additional project elements were considered in order to create a more sustainable beach. Therefore, each alternative presented in Table 2-1 includes a beach nourishment component (to stabilize the shoreline and provide the lost sediment supply), constructed in concert with the alternative. In the table, reference to the northern jetty refers to the northern jetty of the Saco River, which is comprised of three distinct segments. Segment 1 is the shore-attached portion of the jetty that is exposed during all normal tide levels. Segment 1 is approximately 2,985 ft (910 m) in length. Segment 2 represents the northeast/southwest shift in jetty orientation and is approximately 1,050 ft (320 m) long and is also exposed during all normal tide cycles. Segment 3 is comprised of the half-tide (i.e., exposed at low tide and submerged at high tide) portion of the northern jetty and is approximately 2,300 ft (700 m) in length. A spur jetty refers to a structure attached to the existing northern jetty, typically oriented perpendicular to the existing structure. A groin refers to a shore-attached structure that is built perpendicular to the shoreline and intended to trap sand flowing in the alongshore direction. In addition, references to an optimized location in Table 2-1 represent an iterative procedure performed during the modeling effort to identify the optimal performing location, if possible.

As part of the alternatives analysis, a process was developed to perform an initial screening of all the alternatives presented above in order to streamline the modeling and analysis evaluation, focusing on only the alternatives that could reasonably meet the performance goals. This initial screening process focused on wave height changes and energy reduction within the local region. Potential adverse impacts to neighboring beaches, navigation, and the Camp Ellis region were also evaluated. The alternatives that indicated the best potential for performance success were passed forward by the project team (WHG, USACE, SBIT, MGS) to a more detailed alternatives analysis and final assessment. The final screening and alternatives analysis consisted of a more detailed level of wave evaluation and assessment of the sediment transport. Due to the number of alternatives

TABLE 2-1 Initial Project Alternatives - Camp Ellis Beach, Saco, Maine	
Alternative Identification	**Description**
No Action	No Action would be taken by the Federal Government to halt erosion
Base	Beach nourishment alone
Buyout	Buyout, demolish and remove properties, utilities, and roads
0	Northern jetty removal (segments 1, 2, and 3)
1	Northern jetty removal (segment 3)
2	Northern jetty removal (segment 3) and additional lowering of 600 m (1,970 ft)
3	Seaward location of a 750 ft spur jetty
4	Optimized location of a 500 ft spur jetty
5	Optimized location of dual 500 ft spur jetties
6	Inshore location of a 750 ft spur jetty
7	Inshore location of a 750 ft spur jetty coupled with northern jetty extension (segment 3) removal
8	Inshore location of a 750 ft spur jetty coupled with shore-based terminal groin
9	1st configuration of T-head groins
10	2nd configuration of T-head groins
11	Offshore breakwater (seaward location)
11a	Offshore breakwater (nearshore location)
11b	Offshore breakwater (intermediate location)
12	Offshore breakwater (landward location) coupled with seaward location of a 500 ft spur jetty
13	Comb configuration of 50 ft spur jetties
14	Offshore borrow pit
15	Seaward location of a 750 ft spur jetty with an angled orientation
16	Northern jetty roughening (segments 1, 2, and 3)
17	Submerged shoal/rock outcrop
18	Offshore breakwater (landward location) coupled with landward location of a 500 ft spur jetty
19	Seaward location of a 750 ft spur jetty, northern jetty extension removal, and jetty roughening
20	Alternative 11a with estimated full salient formation
21	Alternative 11a with estimated partial salient formation
22	Combination of 750 ft spur jetty with two 375 ft segmented breakwater components
23	Combination of 500 ft spur jetty with three 325 ft segmented breakwater components
24	Alternative 23 with additional northern breakwater segment
25	Secondary configuration of 500 ft spur jetty with three 325 ft segmented breakwater components
25a	Secondary configuration of 500 ft spur jetty with two 325 ft segmented breakwater components
26	Alternative 24 with a different configuration for the segmented breakwaters

investigated, only the final array of alternatives is presented below. For a full review of the numerous alternatives, refer to Section 10 of Appendix C in the Feasibility Report.

2.2 NO ACTION ALTERNATIVE

The No Action Alternative is required for review by Federal regulations (40 CFR Part 1502.14(d)). If no action is taken by the USACE to alleviate the processes that erode the shoreline of the Camp Ellis community, the residents and their property would be subject to increased economic losses, financial hardships, and potential loss of life or serious injury. Under the No Action Alternative the Federal government would not initiate any soft or hard-structural alternatives, or non-structural alternatives to eliminate coastal damages caused by the loss of the beach. Impacts to the coastal environment and the existing marine habitat from these alternatives would not occur. The area would remain in its current state and the State and local government agencies and local citizens would be the sole proponent of erosion mitigation along Camp Ellis Beach.

It is anticipated that some shore protection activity would be initiated on the part of the locals as erosion of the shoreline continues. This is evident by the permit and funding received by the City of Saco to place geotubes along a 330-foot section of Surf Street that was severely damaged in the Patriot's Day Storm of 2007. The geotubes are covered by sand, sand which must be replaced by the City when it is washed out by storms. This "soft" solution to erosion was approved by the State as the sand covering the structure acts like a normal beach profile during storm events. Some homeowners may seek to initiate shore protection activities, but Maine's Natural Resources Protection Act would most likely prohibit construction of coastal structures. As a result, no cohesive plan to ameliorate the continued erosion of the shoreline would be implemented and the property on Camp Ellis Beach would continue to be jeopardized.

Since the Federal government has determined that the existence of the jetties for the Saco River navigation channel have contributed significantly in the loss of coastal shoreline at Camp Ellis Beach, the No Action Alternative is an unacceptable alternative and dropped from further consideration.

2.3 FINAL ALTERNATIVES

Alternatives demonstrating the greatest potential for successfully reducing wave energy (and thus sediment transport), without resulting in negative impacts, were passed forward to the final screening analysis. Addition criteria such as constructability, geotechnical foundation stability, cost, environmental permitting were also considered. The following final alternatives are carried forward and summarized in Table 2-2 below. The No Action Alternative was evaluated above in Section 2.2.

TABLE 2-2 Final Alternatives Screening	
Alternative	**Type**
Beach Nourishment	Place approximately 712,000 cy of sand on the beach
Alternative 6	750-foot long spur jetty and beach nourishment
Alternative 25a	500-foot long spur jetty, two nearshore breakwaters and beachfill
Buyout Plan	Purchase and demolish homes within the 50-year erosion zone, shoreward extension of the north jetty, and North Street relocation

2.3.1 BEACH NOURISHMENT ONLY ALTERNATIVE

The Beach Nourishment Only Alternative consists of placing sand between the supratidal and subtidal zones along the Camp Ellis Beach shoreline from the Federal jetty north for a distance of about 3,250 feet (see Figure 2-1). No hard structures are associated with this alternative. The volume of sand required for the Beach Nourishment Only and other Alternatives was developed based on effectiveness. Design of a beach fill cross section was based on several steps. Initially, a cross section that approximated that of a healthy beach just north of Camp Ellis Beach was selected as a template for the design. This top elevation of this cross section was increased slightly, to 12 feet NAVD (about 17.4 feet MLLW), based on modeling results. The next step involved development of non-sacrificial and sacrificial components of the beach berm. The width of the non-sacrificial portion of the berm was defined as a width necessary to prevent shoreline loss during a 10-year storm. The width of this non-sacrificial berm varied between 20 and 30 feet along Camp Ellis Beach. The width of the sacrificial portion of the berm was developed by evaluating width of 20, 30 and 40 feet.

During this evaluation, it was concluded that beach fills that have short renourishment intervals were not feasible based on resiliency and risk of failure. This removed the 20-foot berm from further consideration. It was also determined that the Beach Fill Only alternative required much more frequent renourishments when compared to Alternatives 6 and 25A for all berm widths evaluated. Based on discussions concerning comparability and effectiveness of alternatives, it was determined that the beach fill volume for the Beach Fill Only alternative should be increased to a level that would result in a renourishment interval that more closely approximated Alternatives 6 and 25A. Based on the performance of Alternatives 6 and 25A for 30 and 40 foot berm widths, a 10-year renourishment interval was

Figure 2-1 – Beach Fill Only

chosen for the Beach Fill Only alternative, and initial and renourishment fill volumes were calculated based on this interval.

This analysis determined that the initial fill requirement for the beach fill only plan would be 712,000 cubic yards, and the beach would have a berm width of about 150 feet. In addition, based on the time required between renourishment fills, a 40 foot sacrificial berm width was selected for alternatives 6 and 25A. Table 2-3 provides the volume of material needed for the initial fill (which includes the sacrificial and non-sacrificial amount), the volume of subsequent renourishment, and the number of renourishments needed for each alternative over the 50-year project life.

Three sea level change scenarios were calculated pursuant to EC 1165-2-211. These sea level rise scenarios are "low" or historic, "intermediate" and "high". Projected sea level change over 50 years is a rise of 0.3 feet for the historic rate, a rise of 1.5 feet for the intermediate rate, and a rise of 2.2 feet for the high rate. As increased sea level rise rates will accelerate beach erosion, renourishment volumes were calculated for each rate of sea level rise for each alternative. Renourishment volumes are approximately 432,000 cubic yards for the historic rate of rise, 505,000 cubic yards for the intermediate rate, and 548,000 cubic yards for the high rate of rise for the Beach Fill Only alternative.

TABLE 2-3
Beach Fill Volumes and Frequencies for Each Alternative Over 50 Years

Alternative	Initial Fill (cy)	Renourishment Fills cy*	Renourishment Fills Interval (years)	Number of Renourishments	Total Sand Volume (cy)
Beach fill	712,000	432.000	10.0	5.0	2,873,000
6	365,000	116,000	11.6	4.3	865,000
25A	328,000	123,000	19.0	2.6	652,000
* The volumes shown are for the historic rate of sea level rise					

The advantage of this stand-alone beach nourishment alternative is that it provides much needed sand on a highly erodible shoreline without placing new hard structures on- or off-shore. This avoids permanent conversion of soft intertidal and subtidal habitat. It also avoids visual impacts associated with hard solutions.

However, the plan does not contain any features that would reduce wave reflection, incident wave energy, or Mach-Stem waves. Therefore, there would be no change to the wave climate in the project area. In addition, the large amount of sand introduced into the littoral system could have unforeseen impacts on areas to the north, such as potential clogging of the Goosefare Brook outlet.

2.3.2. ALTERNATIVE 6: 750-FOOT SPUR JETTY

Alternative 6 would provide for the construction of a 750-foot long spur jetty, attached to the existing northern jetty, located about 1,475 feet from the shoreline (see Figure 2-2). The spur jetty location was optimized through multiple simulations. Oriented in a shore parallel (jetty perpendicular) direction, this alternative would intercept the reflected wave energy, breakup a portion of the incident wave energy, and block Mach-Stem wave effects from transferring energy along the structure. Therefore, this alternative would potentially reduce the overall wave energy arriving at Camp Ellis Beach. In addition, the spur jetty should assist in reducing cross-shore sediment transport from the beach seaward along the existing northern jetty. This alternative represents the optimal placement location of all spur alternatives.

The spur jetty would have a top elevation of 14.5 feet MLLW and side slopes of 1 vertical on 2 horizontal. Since the spur and jetty junction will experience increased turbulence, about 400 feet of the existing jetty would require slope and toe reinforcement.

This alternative includes the placement of beach fill along Camp Ellis Beach from the

Figure 2-2 – Alternative 6

existing north jetty to a point about 3,250 feet to the north. The beach berm would be at 17.4 feet MLLW and the minimum width of the berm would be 60 feet at the south end and 70 feet at the north end. The seaward slope of the beach would be 10 horizontal on 1 vertical. The total volume of sand required to construct this beach profile would be about 365,000 cubic yards.

The volume of beach renourishment required for the historic rate of sea level change would be about 116,000 cubic yards every 12 years. The renourishment rate for the intermediate rate of sea level change would be 192,000 cubic yards, and 236,000 cubic yards for the high rate of change.

2.3.3 ALTERNATIVE 25A: 500-FOOT SPUR JETTY AND TWO NEARSHORE BREAKWATERS

This alternative consists of a spur jetty and two detached breakwaters. The spur jetty would be 500 feet long and would be attached to the existing north jetty approximately 985 feet from the shoreline (see Figure 2-3). This alternative

Figure 2-3 – Alternative 25A

would reduce wave energy in the nearshore zone, impede the reflected wave energy from the existing northern jetty, extend beach nourishment life, and produce salient formations that do not create a significant interruption in the littoral zone.

The spur would have a top elevation of 14.5 feet MLLW and side slopes of 1 vertical on 2 horizontal. Due to increased turbulence at the spur and jetty junction, about 400 feet of the existing jetty would require slope and toe reinforcement. The two breakwaters would be placed about 900 feet from shore. The southern breakwater would be 395 feet long, and the northern breakwater would be 410 feet in length. Each breakwater would have a top elevation of 14.5 feet MLLW, a seaward slope of 1 vertical on 2 horizontal and landward slope of 1 vertical on 1.5 horizontal. This alternative also includes the placement of beach fill along Camp Ellis Beach from the existing jetty to a point about 3,250 feet to the north. The horizontal beach berm would be at 17.4 feet MLLW and have a minimum width of 50 feet at the south end and 60 feet at the north end. The seaward slope of the beach would be 1V:10H horizontal. The total volume of sand required to construct the beach is about 328,000 cy.

This alternative would reduce wave energy in the nearshore zone, impede the reflected wave energy from the existing northern jetty, extend beach nourishment life, and produce salient formations that do not create a significant interruption in the littoral transport. This alternative would reduce wave energy reaching Camp Ellis Beach more than Alternative 6, spur jetty. This alternative would reduce wave energy reaching the beach, especially in the area closest to the north jetty. As this additional reduction in wave energy would further reduce beach erosion, beach nourishment would only be needed every 19 years.

2.3.4 BUYOUT ALTERNATIVE

The buy-out plan consists of the purchase of all property within the 50-year erosion zone. All buildings would be demolished and the debris disposed of at an approved off site location. In addition, all public roads, utilities and other improvement will be removed within this area and disposed of at an appropriate location. After removal of all structures and improvements, the area would be restored to a natural condition. As erosion would be allowed to continue, the north jetty would be extended landward to prevent flanking and impacts to the Saco River navigation project. This would be accomplished by stabilizing the north side of Bay Avenue with stone or other suitable material. Continued erosion would also wash out existing access roads and prevent access to the City pier and remaining properties on North and Bay Avenues. North Avenue would be relocated to provide continuous access. If North Avenue is not relocated and protected, all commercial and recreational activities at the pier would have to be relocated, and all remaining properties at the south end of Camp Ellis would need to be purchased. Figure 2-4 shows the geographical extent of the buy-out plan and other plan features for the historic sea level rise scenario. Highlighted properties would be purchased. Additional properties would be purchased for the intermediate and high rates of sea level change.

2.3.5 TRANSPORT OF BEACH MATERIAL

Identifying sources of sand for beach nourishment involved an assessment of both offshore and upland sources. Offshore sources were found to be inadequate as geotechnical surveys determined that the bay is only covered by a thin layer of sand near the project site. Upland sources, however, were found to be plentiful as there are numerous sand and gravel operations in the project area. Methods of transporting sand to the beach became the next consideration. The sand could be trucked directly to the beach or trucked to Portland, ME, placed on a barge, towed to Camp Ellis and either dumped offshore for subsequent pumping to the beach or pumped directly to the beach. Based on cost, and impacts to nearshore resources, trucking sand directly to the beach is the recommended method of transport.

Figure 2-4 – Buyout Alternative

2.4 SCREENING OF FINAL ALTERNATIVES

As specified in the Planning Guidance Memorandum for this study, dated 15 September 2011, the recommended alternative for this study will be based on the least costly, technically feasible, and environmentally acceptable alternative. In addition, the analysis of alternatives addressed sea level change. Since the No Action Alternative does not satisfy the Federal objective of mitigating for erosion caused by the Saco River Federal Navigation Project, it was eliminated from further consideration. The remaining four alternatives were then evaluated based on based on the four criteria established in the Principles and Guidelines. These criteria are completeness, effectiveness, efficiency and acceptability. Completeness is the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities. Effectiveness is the extent to which the alternative plans contribute to achieve the planning objectives. Efficiency is the extent to which an alternative plan is the most cost effective means of achieving the objectives. Acceptability is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations and public policies. The following paragraphs describe how each alternative satisfies these four evaluation criteria.

Completeness – Completeness is the extent to which an alternative plan accounts for all necessary investments or other actions to ensure the realization of the planned effects. To address completeness, each alternative was evaluated based on the three rates of sea level change. For the study area, expected rates of sea level change for the next 50 years were 0.3 feet for the historic or "low" rate, 1.5 feet for the "intermediate" rate and 2.2 feet for the "high" rate. For the three alternatives that include beach fill, the initial fill volumes were developed based on existing conditions. However, as projected future sea level change occurred, different volumes of renourishment were developed for each sea level change scenario to provide beach profiles that would withstand future water levels. For the buy-out alternative, projected shoreline positions were developed for each sea level change scenario and the appropriate number of homes included on the buy-out list.

When assessing completeness, the ability of an alternative to prevent further erosion damages must be considered. Alternatives 6 and 25A reduce wave energy reflected off of the north jetty and require renourishment at 11.6 and 19 year intervals respectively. The beach nourishment only alternative, with its requirement for a significant initial placement of sand and renourishment every 10 years is also complete even though reflected wave energy remains unabated. Each provides a complete and manageable solution to coastal erosion. The buy-out plan can also be considered complete, but as erosion progresses on an unprotected shoreline, unexpected property could be subject to erosion.

Effectiveness – Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified objectives. An effective plan is responsive to the identified needs and makes a significant contribution to the solution of the problem. Alternatives 6 and 25A are considered effective as they address wave energy increases caused by the north jetty and provide a beach profile that will prevent further shoreline losses. In Addition, although beach fill only does not reduce wave energy increases, it is considered effective as it prevents further shoreline losses. The buy-out plan is effective in preventing property losses within the areas of projected erosion.

Efficiency – Efficiency is the extent to which an alternative is the most cost effective means of solving the identified problems and realizing specified opportunities. The following table presents the total annual cost of each alternative for each sea level rise scenario. In the case of the beach fill only alternative and Alternatives 6 and 25A, costs of periodic renourishment are included. These costs were developed based on a 50-year project life and an interest rate of 3-3/4 percent. Table 2-4 below shows that beach fill only has the lowest life cycle annual costs and the buy-out plan has the highest costs. For a complete breakdown of these costs see Appendix F in the Feasibility Report.

TABLE 2-4
Total Annual Cost for Each Alternative for Three Sea Level Rise Scenarios

Alternative	Historic Sea Level	Intermediate Sea Level	High Sea Level
Beach Fill Only	$1,466,900	$1,598,400	$1,675,500
6	$1,295,600	$1,406,200	$1,470,300
25A	$1,464,200	$1,536,600	$1,579,400
Buyout	$1,703,600	$2,294,900	$2,651,300

Acceptability - Acceptability is the workability and viability of an alternative with respect to acceptance by Federal and non-Federal entities and the public and compatibility with existing laws, regulations and public policies. Two primary elements of acceptability are implementability and satisfaction. To be implementable, an alternative must be feasible from a technical, environmental, financial, political, legal, institutional and social perspective. The second element of acceptability is the satisfaction a plan brings to government agencies and the public. All alternatives are acceptable from technical and environmental perspectives, but the buy-out plan is not 100 percent acceptable when political and social perspectives are considered. The buy-out alternative will cause major disruption to the Camp Ellis community as a large percentage of homes are purchased and demolished. It is also expected that condemnation procedures would be necessary to acquire all property within the 50-year erosion zone. When alternatives are evaluated regarding the satisfaction that they bring to government entities and the public, the buy-out alternative is not considered an acceptable solution by all study stakeholders. The buyout plan does nothing to mitigate for increased shoreline erosion, it simply purchases and demolishes those homes that would be lost over a 50-year period. Conversely, since the beach fill only plan and Alternatives 6 and 25A prevent further shoreline losses, they offer a more satisfactory response to the erosion problem.

2.5 SELECTION OF RECOMMENDED PLAN

Table 2-5 below summarizes the results of the alternatives evaluated under all four Principles and Guidelines criteria. Based on the results of this evaluation, Alternative 6 (750 foot long spur jetty plus beach fill) was selected as the recommended plan. It is the most cost effective plan and satisfies all other Principles and Guidelines criteria. Alternative 6 provides direct mitigation for the effects of the Federal navigation project by substantially reducing wave energy caused by the north jetty, and also provides for renourishment of Camp Ellis Beach.

TABLE 2-5
Evaluation Criteria Ranking for Each Alternative

Alternative	Completeness	Effectiveness	Efficiency Ranking	Acceptability
Beach Fill Only	Y	Y	2	Y
6	Y	Y	1	Y
25A	Y	Y	3	Y
Buyout	P	Y	4	P

Y – Meets Criteria
P – Partially Meets Criteria

3.0 THE FEDERALLY PREFERRED ALTERNATIVE – ALTERNATIVE 6

The Federally recommended plan, also referred to as Alternative 6, consists of a 750-foot long spur jetty and beach fill along Camp Ellis Beach. This alternative is intended to prevent further shoreline losses north of the existing northern jetty located at the mouth of the Saco River. These two project features are described in the following paragraphs:

The spur jetty would be attached, and placed perpendicular to the existing north jetty, at a point about 1,475 feet from the shoreline. The top of the structure would be about 15 feet wide and at an elevation of 14.5 feet MLLW. The seaward and landward side slopes of the jetty would be 1 vertical on 2 horizontal. The spur consists of an outer layer of armor stone which would be about 10 feet thick with average weight of 10 – 13 tons. This armor layer is underlain by smaller stones with an average weight of two tons that form the core of the structure. The seaward side and head section of the structure would include a layer of toe stone about six feet thick and 10 feet wide to prevent underscour. For overall stability, the stone structure would be placed on two layers of marine mattress. Marine mattresses are rock-filled containers constructed of high-strength geogrid. These mattresses would be laced together to form a stable foundation for the spur jetty. Cross sections of the spur jetty are shown below.

Due to increased turbulence at the spur and jetty junction, and the potential for damage to the existing north jetty, about 400 feet of the existing jetty seaward of the spur jetty would require reinforcement. Modifications to the first 200 feet of the north jetty include, raising the top elevation to prevent a large increase in overtopping, flattening the slope from the current 1 vertical to 1.5 horizontal to 1 vertical on 2 horizontal, adding armor stone, and reinforcing the toe to prevent scour. The toe of the existing structure would be reinforced an additional 200 feet for scour protection. North jetty reinforcement would also be placed on two layers of marine mattress for stability. Cross sections of the north jetty reinforcements are also shown below.

Alternative 6 also includes placing beach fill along Camp Ellis Beach. Beach fill would be placed from the existing north jetty to a point about 3,250 feet to the north. The proposed beach berm elevation is about 17.4 feet MLLW, the same approximate height as the natural beach berm to the north. The berm width would vary based on topography, but the minimum beach berm width required in the southern section is 60 feet and the minimum width required in the north section is 70 feet. Sand placed on the beach will have a 1:10 beach slope which, at low tide, would create a beach width of about 170 feet. Approximately 365,000 cubic yards of sand would be needed to create the beach. Placement of beach fill would begin at the north end of the project and continue to the south to avoid potential impacts to nesting piping plovers at Ferry Beach. Beach fill placement would occur between September 1 and March 31. Sand fill would be transported to the site by trucks.

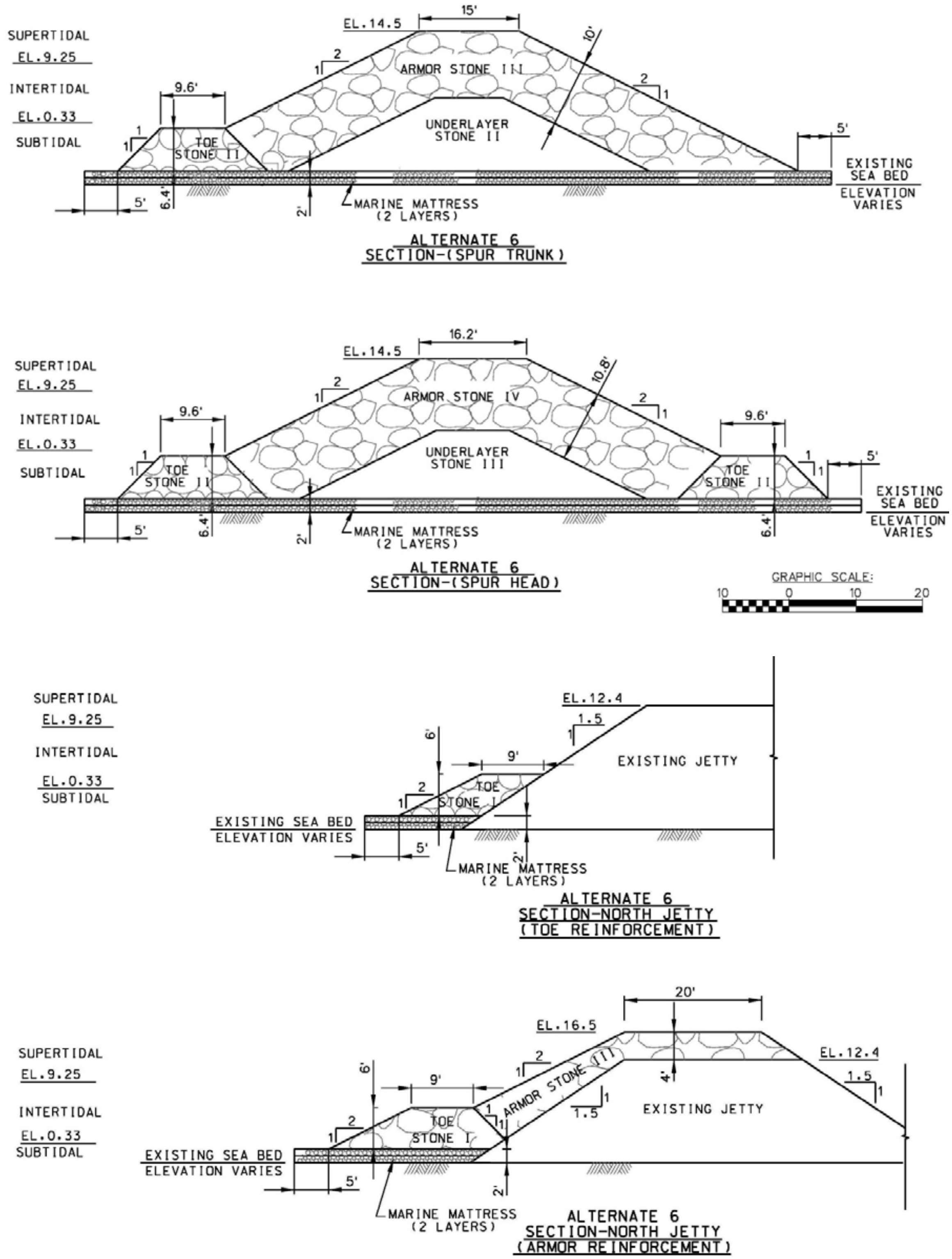

Figure 3-1 – Cross-Section of Spur Jetty and North Jetty

4.0 AFFECTED ENVIRONMENT

4.1 GEOLOGY

4.1.1 PHYSIOGRAPHY

The project area is in the New England physiographic province of southeastern Maine. The New England physiographic province has three major sections: the White Mountains, New England Uplands and the Seaboard Lowlands. York County, where the project is located, contains two of the three major sections: the New England Uplands and the Seaboard Lowlands.

The Camp Ellis area is located in the Seaboard Lowland section. The Seaboard Lowland section rises uniformly from sea level to an elevation of about 300 to 400 feet with occasional hills rising above this elevation. Relief is generally low with rivers flowing southeasterly to the Atlantic Ocean (Flewelling and Lisante, 1982).

4.1.2 MARINE GEOLOGY AND GEOPHYSICS

Bedrock geology defines the overall shape of the Maine coastline by controlling the location and orientation of islands, bays, and peninsulas. The surficial materials of Maine's inner continental shelf of the northwestern Gulf of Maine are the most complex of any place along the Atlantic continental margin of the United States (Kelly and Dickson, 1996).

Table 4-1 lists Saco Bay's marine surficial geology by type and characteristic. The project area is generally a sandy bottom with mixtures of mud, gravelly-sand, and gravel. "Sand" bottoms or sand with other

TABLE 4-1
Surficial Geology (Bottom Types) of Maine's Inner Continental Shelf *

Type	Characteristics
Rocky	Rugged, high relief seafloor dominated by bedrock outcrops (ledge) and is the most common type of geology at depths of < 200 ft. on the Maine inner continental shelf.
Gravelly	Generally flat-lying areas that are covered by course grained sediment, with clasts up to several yards in diameter. Gravel and boulders directly overlie bedrock in some areas.
Sandy	Generally smooth seafloor consists primarily of sand-sized particles derived from rivers, reworked glacial deposits and/or biogenic shell production. This bottom type, although well represented in southwestern areas, is the least common on the Maine inner continental shelf. Sandy seafloors occupy about 8 percent of the inner shelf of the northwestern part of Maine.
Muddy	Deposits of fine-grained material form a generally flat and smooth seabed commonly found in sheltered bays and estuaries and at depths greater than 200 ft.

* Adapted from Kelly, J.T., Dickson, S.M., Barnhardt, W.A. Belknap, D.F., and Kelley, A.R. 1996. Surficial Geology of the Maine Innner Continental Shelf: Department of Conservation, Maine Geological Survey, Natural Resources Information and Mapping Center, Open-File Map 96-8

materials frequently contain sediment where the sand is mixed with mud, gravel, and varieties of shell fragments (Kelly, J.T., Dickson, S.M., Barnhardt, W.A. Belknap, D.F., and Kelley, A.R., 1996).

Saco Bay, Maine is an eight mile long curved stretch of shoreline bound to the south by Fletcher's Neck and the Saco River and to the north by the Scarborough River and Prouts Neck. The majority of Saco Bay's coastline is densely developed consisting of small beachfront communities. The Bay represents the largest sand beach and salt marsh system in Maine.

4.2 SOILS AND SEDIMENTS

The following subsections outline the development of the soils and sediments associated with the Camp Ellis area of Saco, Maine.

4.2.1 ONSHORE (UPLAND) SOILS

The U.S. Department of Agriculture, Soil Conservation Service soil surveys (Flewelling, L.R. and Lisante, R.H., 1982) were used to determine and characterize the soils that are affected by the construction of the proposed project. These soils characterize the upland in and around the Camp Ellis beach and community.

The project will affect several acres of Beaches (Ba). Beaches consist of sand, gravel, and cobble coastal areas that are partially or entirely covered by water during high tides or stormy periods. They are narrow strips (three acres to about 50 acres) with slope ranges from 0 to eight percent. Beaches are used for recreation such as surf fishing, sunbathing, walking, and wildlife habitat.

Backshore upland soils consist of Udipsamments-Dune land complex (UD) and Urban land (Ur). UD soils are undulating to rolling areas of stable and unstable dunes along the coast. The areas are narrow and range from about three acres to about 100 acres, with slopes from 0 to 15 percent. Udipsamments are stable dunes. They are excessively well drained and dominated with fine sands. Dune land is unstable sand mounds and troughs with no plant cover. Urbanized land (Ur) consists of areas where about 85 percent of the surface is covered by urban structures, including houses, parking lots, and shopping and business centers. These areas are in cities and towns mainly on a coastal plain and on uplands. They are normally three acres to about 300 acres in size on nearly level terrain. Included in this unit are small lawns, parks, vacant lots, and playgrounds that are Adams, Buxton, Croghan, or Scantic soils. Also included are small area of miscellaneous fill that has been placed over depressions, swamps, and tidal marshes. UD and Ur soils are highly erodable soils and have contributed to the severe erosion on which many of the residences are constructed.

4.2.2 MARINE SEDIMENTS

The primary source of sediments to the Saco Bay/Camp Ellis area is from sediment transport in the Saco River. Fitzgerald et al. (2002) concluded that the Saco River contributed sand to the nearshore zone in Saco Bay during periods of high riverine discharge. Detailed studies of the sediments in the outer Saco Bay, the Saco River estuary, and the beach systems of the bay provide substantial evidence that the Saco River is the main source of sediment to the region (Woods Hole Group and Aubrey Consulting, Inc., 2006).

The majority of the Saco embayment just eastward of the beaches is covered by Holocene sand with large ripple fields or narrow linear bands (Kelley et al. (1995) Woods Hole Group and Aubrey Consulting, Inc., 2006). The Holocene period is the name for the last 10,000± years of the Earth's history, the time since the end of the last major glacial epoch, or "ice age" (University of California Berkley, 2005). Seaward of these sand bedforms, bedrock and gravel is predominant north of Biddeford Pool and Wood Island, rippled gravel is prevalent south of Prouts Neck, and the center of the bay is dominated by muddy sand and bedrock outcrops (Woods Hole Group and Aubrey Consulting, Inc., 2006; Kelley et al., 1995).

A total of 20 borings were collected from both onshore and offshore in the project area between December 2004 and November 2005 (GEI, 2006) confirm the above observation. See the Geotechnical Appendix of the Feasibility Report for location of the borings. The purpose of the boring collection was to obtain information on the subsurface condition for the design of several different structural alternatives to protect Camp Ellis Beach from further erosion.

The surface conditions encountered at all boring locations was of a loose to medium dense sand with silt and gravel at or near the surface, generally two to 4 and ½ feet thick. The exception is the layer of sand near the north jetty and on Camp Ellis Beach which is between nine to 23 feet thick. Under this layer of poorly sorted sand is a compressible layer of organic silt/clay and/or a layer of lean clay which varies widely in thickness throughout the project area. This compressible layer of silt/clay is underlain by a layer of medium dense/dense sand with silt and gravel. Refusal (which could be bedrock) was encountered in ten of the twenty borings. Refusal was encountered in the borings at depths ranging from 25 to 50 feet.

4.3 WATER RESOURCES

4.3.1 GENERAL

The Saco River watershed covers an area of about 1,700 square miles: 863 in Eastern New Hampshire and 837 square miles in Western Maine. The basin encompasses all or parts of 63 municipalities within the two states. Elevations in the basin range from 6,288 feet, the summit of Mount Washington located in Sergent's Purchase, New Hampshire, to sea level at the mouth of the river in Saco and Biddeford, Maine (Saco River Corridor Commission, 2004). There are many dams within the watershed, including several on the mainstem that offer varying degrees of fish passage facilities. The creation of impoundments and the regulation of river flows affect the suitability of fisheries habitat (FWS, 2002). The Saco River enters into the Gulf of Maine at the project site. To support a navigation channel and provide safe anchorage, the USACE maintains a Federal breakwater at the confluence of the river with the ocean.

4.3.2 OCEANOGRAPHY AND MARINE WATER QUALITY

4.3.2.1 WATER CIRCULATION AND LITTORAL PROCESS

Since construction of the Saco River jetties, sand has accreted on the south side of the southern jetty and erosion has occurred to the north (Camp Ellis Beach) of the jetties. The area directly north of Saco River has experienced significant erosion for a distance of approximately 2,500 to 3,250 feet north of the northern jetty. Not until the placement of shore protection features in the 1970s and 1980s did the erosion rate decline. Currently, Maine state law does not allow shore attached structures and these revetments were placed in response to the emergency conditions. It is expected that without these structures, the erosion would continue. The shoreline north of this 2,500 to 3,000 foot stretch has been stable throughout the time period evaluated; however in more recent times (after 1998) this area has also shown erosion likely due to increased storm events and the lack of available sediments from beaches to the south (Camp Ellis). In April 2007, a long duration coastal storm caused significant erosion in this area and resulted in the loss of two homes and more than 400 feet of Surf Street.

In the northern section of Saco Bay, just south of Scarborough River, the shoreline has grown and accreted. The accretion of sand near the Scarborough Inlet was thought to be contributed by sediment from the Scarborough River transported by tidal currents.

Extensive modeling studies completed by The Woods Hole Group and Aubrey Consulting, Inc. (2006) for the USACE has indicated that sediment transport in the project area and Saco Bay is from south to north. This has produced significant accretion at Pine Point just south of the Scarborough River. Waves were determined to be the primary mechanism for sand movement in Saco Bay. The hydrodynamics of Saco River has had little influence on the sediment transport dynamics at Camp Ellis Beach; although Saco River is a significant sand contributor to the southern section of Saco Bay. With the construction of the jetties, sand transported by the Saco River is carried out past the effective littoral system, effectively limiting a significant source of sand for nourishment of Camp Ellis Beach.

Most waves coming into Saco Bay during non-storm events approach from the eastern and southern direction. Storms, although short-lived, can have a dominant influence on sediment transport in the region. On a regional scale, the offshore islands have a larger influence on the waves as they propagate towards the shore than the jetties. On the local scale, the structures, as well as the small islands (e.g. Eagle and Ram Islands), affect the wave energy at Camp Ellis Beach.

Modeling of the waves in the project area showed several factors affect erosion of the Camp Ellis Beach. One factor is that nearshore waves propagate directly towards the Camp Ellis Beach region and the northern jetty, irrespective of the offshore direction. The complex bathymetry between the islands, and the islands themselves, resulted in a nearly uniform approach towards the area of highest erosion and reflection. The processes causing the waves to be redirected towards the beach are complex, and are due to both diffraction and refraction mechanisms through the gap between Ram and Eagle Islands, as well as the highly irregular bathymetry between the islands. The presence of a deep channel and various submerged shoals/outcrops in the region produce a nearly unidirectional wave approach landward of the islands. The amount of energy redirected towards the Camp Ellis region varies based on the offshore direction of approach, but this channeling effect is evident in all average annual wave approach cases.

Mach-Stem waves (waves that travel along a structure) spread along the northern jetty in response to most of the offshore waves approaching the structure. Although this does not represent a large amount of energy, it does produce an additional wave process that impacts the coastline, specifically the corner where the shoreline and northern jetty meet. In addition, waves approaching the jetty are reflected back towards Camp Ellis Beach. Therefore, for a portion of the shoreline directly adjacent to the northern jetty, the beach is impacted not only by incident (natural) wave energy, but also by the reflected wave energy off the jetty.

The alternatives section above discusses the alternatives that best deflect and/or reduce wave energy that reaches Camp Ellis Beach.

4.3.2.2 MARINE WATER QUALITY

The tidal waters of the Saco River and its tidal tributaries and the coastal waters of Saco Bay Beach area are classified as SC waters by the State of Maine. Class SC waters are suitable for recreation in and on the water, fishing, aquaculture, propagation of shellfish, industrial process and cooling water supply, hydroelectric power generation, navigation, and as habitat for fish and other estuarine and marine life. Shellfish harvesting is restricted (Maine Revised Statutes Annotated, Title 38, Section 465-B).

4.4 BIOLOGICAL RESOURCES

4.4.1 GENERAL

Biological resources in the Camp Ellis Beach project area, including populations of benthos, fish resources, essential fish habitats, marine and coastal birds, and upland/terrestrial wildlife, are typical of southeastern Maine coastal and marine habitats. A team of environmental researchers from the U.S. Army Corps of Engineers collected data on benthic resources and habitats from Camp Ellis Beach and subtidal area in May of 2002. The team returned in August 2004 to collect additional data on benthic resources and habitats, eelgrass, and surf clam populations. Data collection methods included a series of strategically placed benthic grab samples to document the existing benthic infaunal community and the presence of eelgrass (*Zostera marina*) within the project area. In addition, a surf clam (*Spisula solidissima*) survey in the intertidal area parallel to Camp Ellis Beach was also conducted. This information as well as information from other data sources is used to describe the natural resources in the project area.

4.4.2 EELGRASS

Eelgrass is a saltwater angiosperm found in estuaries and shallow coastal areas. It produces organic material that becomes part of the marine food web; helps cycle nutrients; stabilizes marine sediments; and provides important habitat including breeding areas and protective nurseries for fish, shellfish, and crustaceans. Eelgrass is particularly susceptible to sedimentation and human activity.

Between the period of 1992-2005, eelgrass bed locations were mapped along the coast of Maine by the Maine Department of Marine Resources (ME DMR). Verification was carried out by boat, on foot, and by plane. Dense patches of eelgrass approximately six meters in diameter and less could be identified under good conditions and in some cases were mapped. However, a conservative estimate by ME DMR of the minimum eelgrass mapping unit is 150 square meters. This represents a stand of approximately 14 meters in diameter (ME DMR website). Based on this mapping effort, the closest patches of eelgrass in the project area are to the south of Saco River near Wood Island. A small patch is also noted north of Camp Ellis Beach near Eagle Island.

In addition to the eelgrass mapping effort of the ME DMR, benthic grab samples were also checked for the presence of eelgrass upon collection in 2002, 2004, and 2005 (samples from 2005 were collected but not analyzed for benthos). Except for occasional sprouts observed in grab samples collected in 2004 from the proposed breakwater BW2, BW3, and BW4 sample locations, no eelgrass beds were observed during the collection of benthic samples within the project area. See the Benthic Resources Section below for locations.

4.4.3 BENTHIC RESOURCES

Benthic organisms are good indicators of environmental disturbances as their sessile nature precludes them from fleeing areas with declining environmental quality. Benthic communities can therefore provide a useful environmental monitoring tool to evaluate estuarine systems. Table 4-2 lists the general characteristics of the benthic resources occurring at the Camp Ellis Beach/Saco Bay area. This table presents a synthesis of habitat characteristics with analysis of the substrate derived from side-scan sonar interpretations and other geophysical investigations. Biological samples and visual observations round out the benthic characterization of the site. A narrow band of shallow rock (less than six inches high) was visually observed at extreme low tide along a portion of Camp Ellis Beach near the north jetty. Seaweeds and other benthic fauna could be observed attached to these rocks.

To determine the specific benthic community in the project area, benthic population samples were collected from the proposed impact areas by USACE biologists in May 2002, August 2004, and August 2005. Samples were taken intertidally with a beach core at random locations within or near initially proposed T-groins, and subtidally (nearshore and offshore) with a VanVeen grab at the initial, and subsequent locations, for the offshore breakwaters, potential tombolo/salient features, and the jetty spur.

TABLE 4-2 Characteristic Benthic Habitats within the Camp Ellis-Saco Bay Marine Ecosystem		
Substrate	**Benthic Infauna**	**Benthic Macrofauna**
Intertidal		
Sandy	Low-to-moderate taxa richness; moderate-to-high abundances; polychaete dominated	Amphipods, decapods, bivalves, blue mussels, polychaetes, and other commercially important species, such as lobsters and crabs that exist within bedrock exposures.
Mixed-grained	Low-to-moderate taxa richness; low-to-moderate abundances; polychaete dominated	Predominately populated with sessile filter feeders and grazers, such as starfish, sea urchins, lobsters, amphipods, and crabs.
Rocky	Low taxa richness; low-to-high abundances; barnacles; mytilids	Hard bottom benthic community including mytilids, gastropods, echinoderms, crustaceans, and other sessile fauna.
Subtidal		
Sandy	High species richness; moderate-to-high abundances; mid successional stage, polychaetes; crustaceans and bivalves	Amphipods, decapods, bivalves, blue mussels, polychaetes, and other commercially important species, such as lobsters and crabs that exist within bedrock exposures.
Rocky	Moderate species richness; moderate-to-high abundances mytilids and crustaceans in association with macroalgae	Hard bottom benthic community including mytilids, gastropods, echinoderms, crustaceans, and other sessile fauna.
Coarse Sand and Pebbles	High species richness, moderate abundances; mid-to-late successional stage; dominated by polychaetes and amphipods	Predominately populated with sessile filter feeders and grazers, such as starfish, sea urchins, lobsters, amphipods, and crabs.

Specifically, benthic samples were collected in 2002 at a proposed jetty spur location and also at the mouth of the Saco River to determine if this area may provide a source of sand for beach nourishment (see Figure 4-2). The 2004 samples were taken at proposed T-groins and breakwater locations for four promising alternatives (Alternative 6: Spur Alternative, Alternative 10: Secondary T-Head Layout, Alternative 11a: Secondary Offshore Breakwater, and Alternative 18: Combination of Spurs and Breakwater) and their potential salient/tombolo features (see Figure 4-2). After each collection, the benthic samples were washed through a 0.5 mm sieve, stained with the biological stain rose bengal, and fixed in 10% buffered formalin.

Locations, depths, and sediment descriptions for each of the subtidal benthic samples are summarized in Table 4-3. Overall sediment type for the project area can be characterized as mixture of fine-grained sediment (very fine sand and fine sand). The intertidal samples consisted of sandy material.

Attachment A provides detailed reports of the benthic species collected and identified in the project area by class, genus and species, and sampling location for samples collected in 2002 and 2004. Based on analysis of a single replicate from each station, it is apparent that the community is dominated by a typical assemblage of sandy nearshore and intertidal beach species.

Seventy-nine species were identified in the samples collected in 2002. This is a relatively high number considering the small number of samples. The highest diversity occurred in the subtidal samples. These samples contained between 10 and 54 species with a mean number of 29 species. Likewise, these stations exhibited a fairly high density on a per square meter basis with a mean of over sixteen thousand. By contrast, the intertidal samples were sparsely populated by a very few species. Beach sediments are characteristically colonized by few species. Whereas abundances can reach high numbers in many cases, the low densities encountered here are not considered unusual. Dominant species in the subtidal zone are the arthropod *Photis macrocoxa*, and the polychaetes *Aricidea jeffreysii*, *Pygospio elegans*, and *Paraonis fulgens*. In the intertidal zone, the dominant species are again the polychaetes *Pygospio elegans* and *Paraonis fulgens*, as well as the arthropod *Pseudoleptocuma minor*.

Thirty-nine benthic species were identified in the 2004 benthic collection in the intertidal and subtidal ranges of the project area. The dominant species in the beach core samples included the arthropod *Haustorius canadensis* and the polychaetes *Pygospio elegans* and *Paraonis fulgens*. Dominant species in the subtidal grab samples included the polychaetes *Pygospio elegans* and *Paraonis fulgens*. Stations SA-4(A), SA-4(B), and SA-5 were dominated by oligochaetes and nematodes.

Subtidal samples in the salient area, located between the proposed breakwater and Camp Ellis Beach, are dominated by oligochaetes and nematodes.

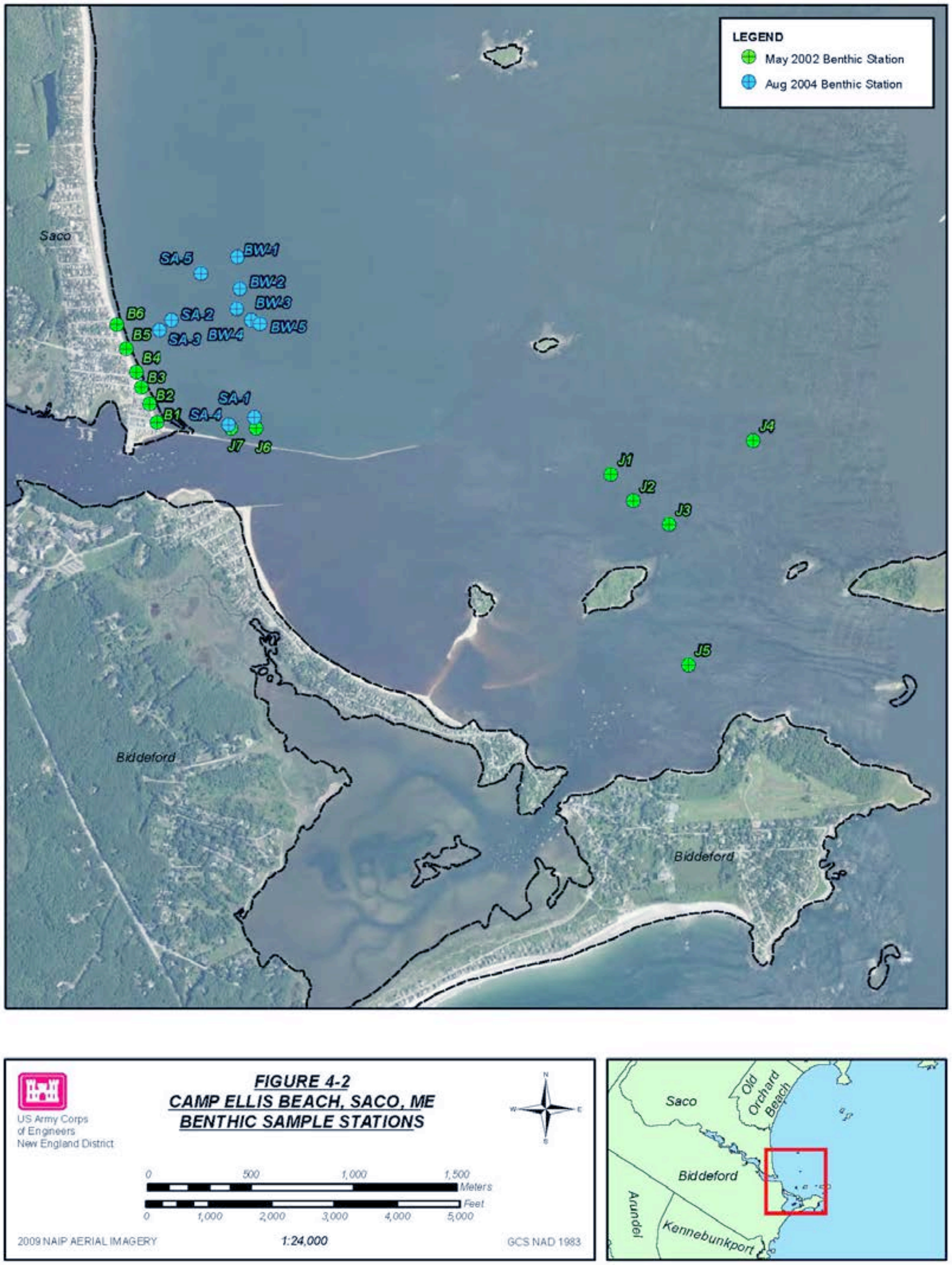

TABLE 4-3 Benthic Grab Sample Description				
Station ID	Location (NAD 83)		Depth (ft)	Substrate
May 2002 Samples				
Station J1	-70.352833	43.461333		Fine sand
Station J2	-70.351500	43.460167	18.0	Fine sand
Station J3	-70.349333	43.459167	22.0	Fine sand
Station J4	-70.344333	43.462833	42.0	Fine sand
Station J5	-70.348167	43.453000		Fine sand
Station J6	-70.374167	43.463333	7.1	Sand-very fine sand
Station J7	-70.375667	43.463333		Coarse sand/cobble
Station B1	-70.380084	43.463567	Mid-tide	Sand
Station B2	-70.380552	43.464390	Low Tide	Sand
Station B3	-70.381043	43.465117	High Tide	Sand
Station B4	-70.381356	43.465762	Low Tide	Sand
Station B5	-70.381936	43.466795	Mid-Tide	Sand
Station B6	-70.382517	43.467860	Mid-Tide	Sand
August 2004 Samples				
Station BW-1	-70.352833	43.461333	10.4	Very fine sand
Station BW-2	-70.351500	43.460167	9.1	Very fine sand/eelgrass
Station BW-3	-70.349333	43.459167	9.5	Very fine sand/ eelgrass
Station BW-4	-70.344333	43.462833	9.0	Very fine sand/ eelgrass
Station BW-5	-70.348167	43.453000	10.0	Sand-very fine sand
Station SA-1	-70.374167	43.463333	8.0	Very fine sand
Station SA-2	-70.375667	43.463333	5.5	Very fine sand
Station SA-3	-70.379933	43.467592	4.8	Very fine sand
Station SA-4	-70.375821	43.463463	9.0	Coarse sand
Station SA-5	-70.377505	43.470079	8.2	Coarse sand

4.4.4 SHELLFISH

Soft-shelled clams (*Mya arenaria*) are known to exist throughout the tidal areas of the Saco River estuary. However, the Camp Ellis/Ferry Beach is characteristic of a high energy area having high mobility of sediments resulting in high shellfish mortality and slow growth. Blue mussels (*Mytilus edulis*) occur in the river, mainly near the mouth. Atlantic surf clams (*Spisula solidissima*) and ocean quahogs (*Artica islandica*) are found near the mouth in offshore areas (U.S. Army Corps of Engineers, New England Division, 1992).

Atlantic surf clams are typically found to a depth of three feet below the water/sediment interface, from the eastern edge of Georges Bank and the Gulf of Maine throughout the Atlantic EEZ. They generally occur from the beach zone to a depth of about 200 feet, but beyond about 125 feet abundance is low. The Atlantic surf clam fishery is currently managed pursuant to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) of 1976, as amended by the Sustainable Fisheries Act (SFA) in October 1996.

An Atlantic surf clam survey was conducted within the project area in August 2005. This involved sampling at random locations along two transects parallel to Camp Ellis Beach. At each location, a one foot square area was excavated and examined for the presence of surf clams. Any individuals found were measured and then returned to their previous location.

Locations, number of individuals found, and measurements taken at each of the 25 sample locations are summarized in Table 4-4. Overall findings suggest a dispersed incidental surf clam population within the project area. See Figure 4-3.

Lobsters (*Homarus americanus*) are widely distributed over the continental shelf of the western North Atlantic Ocean and are most abundant from Maine to New Jersey in inshore waters out to a depth of 40 m. Post-larval lobsters have been observed settling into rock or gravel often covered with algae, salt-marsh peat, eelgrass, seaweed substrates, and firm mud. The preferred habitat for settlement of post-larval lobster appears to be any area with three-dimensional structure where they can build and maintain burrows for shelter from predators. Adult lobsters have been found in waters from the intertidal zone to as deep as 700 meters. Coastal populations concentrate in areas where shelter is readily available. When inactive, lobsters find shelter in burrows under rocks or, less frequently, in mud tunnels. In winter, especially when the water temperature is below 5°C, lobsters have been found close to the mouth of their burrow with sediment and debris, and remain in their burrow for weeks.

Although a lobster survey was not conducted by U.S. Army Corps of Engineers biologists for this proposed project, other surveys have noted lobster in the area (Reynolds and Casterlin, 1985; Sherman, et.al., 2003). Lobster would be expected to find some shelter in nearby rocky outcrops and possibly the jetties.

TABLE 4-4 Atlantic Surf Clam (*Spisula solidissima*) Survey - 2005				
Station ID	**Location (NAD 83)**		**# Individuals**	**Length (ft)**
Location 1	-70.380350	43.464760	1	0.45
Location 2	-70.379710	43.464780	-	-
Location 3	-70.379550	43.464820	-	-
Location 4	-70.379730	43.465180	-	-
Location 5	-70.379490	43.465210	-	-
Location 6	-70.379790	43.465170	-	-
Location 7	-70.380290	43.465110	-	-
Location 8	-70.380440	43.465080	-	-
Location 9	-70.380730	43.465540	2	-
Location 10	-70.380730	43.465610	1	.45
Location 11	-70.380680	43.465770	-	-
Location 12	-70.381460	43.466490	-	-
Location 13	-70.382040	43.467440	1	.125
Location 14	-70.381890	43.467490	-	-
Location 15	-70.381770	43.467560	-	-
Location 16	-70.381800	43.467820	-	-
Location 17	-70.381500	43.467940	-	-
Location 18	-70.381320	43.467720	1	.5
Location 19	-70.381190	43.467550	-	-
Location 20	-70.380950	43.467310	1	.55
Location 21	-70.380850	43.467110	-	-
Location 22	-70.380720	43.466950	-	-
Location 23	-70.380550	43.466680	-	-
Location 24	-70.380450	43.466410	1	.44
Location 25	-70.380310	43.466120	-	-

70°23'0"W
70°22'50"W
70°22'40"W
43°28'10"N
43°28'0"N
43°27'50"N
LEGEND
Station - Surf Clam Present
Station - Surf Clam Absent
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
US Army Corps
of Engineers
New England District
FIGURE 4-3
CAMP ELLIS BEACH, SACO, ME
2005 SURF CLAM SURVEY
0 50 100 150 200 250 Meters
0 250 500 750 1,000 Feet
2009 NAIP AERIAL IMAGERY
1:4,000
GCS NAD 1983
Saco
Old Orchard Beach
Biddeford
Arundel
Kennebunkport

4.4.5 FISHERIES RESOURCES

The Saco River and its three principal tributaries, the Swift River, the Ossipee River, and the Little Ossipee River, are important aquatic resources that support a variety of anadromous (lives in saltwater and enters fresh water to spawn), catadromous (lives in freshwater and enters saltwater to spawn), migratory and resident fish species, including the Atlantic salmon (*Salmo salar*), American shad (*Alosa sapidissima*), river herring (*Alosa* spp.), striped bass (*Morone saxatilis*), American eel (*Anguilla rostrata*), brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), smallmouth bass (*Micropterus dolomieui*), and yellow perch (*Perca flavescens*) (U.S. Fish and Wildlife Service, 2002).

Table 4-5 lists typical fisheries expected to occur in the project area (Reynolds and Casterlin, 1985; Sherman, et.al., 2003; McLaughlin, et.al., 1987, Furey and Sulikowski, in press). Fisheries resources may be considered significant for a variety of reasons, including State management practices, heavy recreational use, commercial fishing, or protected species habitat.

Several Federal, State, national and local organizations coordinate to protect, manage, study, and enhance fisheries resources in the Saco River and Saco Bay. Among them includes activities through the Saco River Coordinating Committee (SRCC). The SRCC consist of State and Federal resource agency staff and non-government conservation organizations, including the NOAA-Fisheries, U.S. Fish and Wildlife Service, Atlantic Salmon Commission, Maine Department of Marine Resources, Maine Department of Inland Fish and Wildlife, Saco River Salmon Club, Trout Unlimited, and American Rivers (National Marine Fisheries Service, 2004a). The U.S. Fish and Wildlife Service, in cooperation with other local and State agencies and organizations is working to restore Atlantic salmon, shad, and river herring to the Saco River system. The waters off the project area are part of the Northwest Atlantic Marine Alliance's (NAMA) Saco Bay Wild Scallop Enhancement Project, a collaborative research effort designed to assess the feasibility of returning wild scallops to the waters of Saco Bay (Northwest Atlantic Marine Alliance, 2004). The University of New England is conducting a striped bass research study with the purpose of finding out more about the habits and types of striped bass that visit or inhabit southern Maine's Saco River estuary and Saco Bay (University of New England, 2005).

TABLE 4-5 Fisheries Likely to be Found in the Saco River/Camp Ellis Project Area			
Common Name	**Genus species**	**Spawning**	**Characteristics**
Alewife a/	*Alosa pseudoharengus*	April to June	Marine to fresh water; common; resident
American eel b/	*Anguilla rostrata*	January, December	Fresh water to marine; common; resident
American sand lance	*Ammodytes Americana*	December, January	Marine; common; resident
American shad a/	*Alosa sapidissima*	May, June	Marine to fresh water; rare; summer migrant
Atlantic cod	*Gadus morhua*	Fall, winter, and early spring	Marine; common; resident
Atlantic herring	*Clupea harengus harengus*	Late summer to early fall	Marine and estuarine; common
Atlantic mackerel	*Scomber scombrus*	Spring, summer	Marine; common; summer migrant
Atlantic salmon a/	*Salmo salar*	October, November	Marine to fresh water; rare; resident
Atlantic sturgeon	*Acipenser oxyrynchus*	Mid to late spring	Fresh water to marine; resident
Atlantic silverside	*Menidia menidia*	April to July	Estuarine to marine; spring to fall migrant
Atlantic tomcod	*Microgadus tomcod*	November to February	Marine to fresh water; common; resident
Blueback herring a/	*Alosa aestivalis*	May to July	Marine and fresh water; common; summer migrant
Bluefish	*Pomatomus saltarix*	Spring, summer	Marine; common; summer migrant
Brook trout	*Salvelinus foninalis*	October, November	Fresh water-cold water fisheries; common; resident
Cunner	*Tautogolabrus adspersus*	Late spring to early summer	Marine; common; resident
Fourspine stickleback	*Apeltes quadracus*	May through July	Fresh water to marine;
Largemouth bass	*Micropterus salmoides*	Late spring	Fresh water
Little skate	*Raja erinacea*	Year-around	Marine; common; resident
Lumpfish	*Cyclopterus lumpus*	February to May	Marine; common; resident
Menhaden	*Brevoortia tyrannus*	March to May, September, October	Marine; common; summer migrant
Mummichog	*Fundulus heteroclitus*	April to September	Estuarine and fresh water; common; resident
Ninespine stickleback	*Pungitius pungitius*	Spring	Marine and fresh water; common; resident
Northern pipefish	*Syngnathus fuscus*	Summer	Estuarine and marine; resident
Ocean pout	*Macrozoarces americanus*	Late summer to early winter	Marine; common; resident
Pollock	*Pollachius virens*	November to January	Marine; common; resident
Rainbow smelt	*Osmerus mordax*	Spring	Marine to fresh water, summer migrant
Red hake	*Urophycis chuss*	May to November	Marine; common; summer migrant
Sand lance	*Ammodytes americanus*	November to March	Marine and estuarine; common
Sea raven	*Hemitripterus americanus*	Fall to early winter	Marine; common; resident
Silver hake	*Merluccius bilinearis*	Summer to early fall	Marine; common; summer migrant
Smallmouth bass	*Micropterus dolomieu*	June, July	Fresh water-warm water fisheries; common; resident
Striped bass a/	*Morone saxatilis*	April, May, early June	Marine to fresh water; common; summer migrant
Threespine stickleback	*Gasterosteus aculeatus*	March to August	Marine and fresh water; common; resident
White perch	*Morone Americana*	April to June	Fresh water-warm water fisheries; common; resident
Windowpane	*Scophthalmus aquosus*	Late winter, spring	Marine; common; resident
Winter flounder	*Pleuronectes americanus*	February to June	Marine; common; resident
Yellow Perch	*Perca flavescens*	April, May	Fresh water-warm water fisheries; common; resident
a/ anadromous (striped bass does not spawn in Maine); b/ catadromous			

The Saco River and Bay provide excellent recreational and commercial fishing opportunities for striped bass. The Saco River is one of the busiest sport fishing rivers in the State. American shad, blueback herring, alewives, and Atlantic salmon are known to reproduce in the Saco River. Anadromous fish run counts for Atlantic salmon, American shad, and blueback herring and alewife in 2007 were 24, 1,428, and 16,084 respectively (Saco River Salmon Club website). Twenty-one Atlantic salmon were counted at the Cataract Dam in 2010 (Maine Atlantic Salmon Commission website). Striped bass enter the river early to mid-May and remain through November. Fishing activity peaks during August and extends through October. Atlantic mackerel (*Scomber scombrus*) enter the Saco River during July and August. This species provides the second most important recreational fishery. Mackerel are generally concentrated in the lower two miles of the estuary with the majority of the fishing activity taking place at Camp Ellis and off the Saco River breakwaters

American eels are present throughout the estuary and provide an incidental fishery. Pollock (*Pollachius virens*) and winter flounder (*Pleuronectes americanus*) are also caught by sport fishermen in the lower to mid-estuarine reaches. White perch (*Morone americana*) are in the upper reaches of the estuary. The sport fishery for this species is concentrated in the vicinity of Cow Island.

The Saco River estuary is also important as a nursery for a number of fish species. Twenty-four fish species were caught between April and October in 2007 and 2008 at the mouth of the river; nearly all were juvenile (Furey and Sulikowski, in press). Atlantic herring, winter flounder, American eel, Atlantic tomcod, bluefish and rainbow smelt are either commercially or recreationally valuable. At least ten species of planktonic fish larvae were collected at the mouth of the Saco River and nearby estuarine areas in the summer of 2007, with radiated shanny and cunner comprising 96% of the total catch (Wargo, et. al., 2009).

Ferry Beach, adjacent to Camp Ellis offers excellent open beach fishing (Maine Department of Marine Resources, 2005a). The commercial fishery for finfish and shrimp is located offshore principally near Jeffereys Ledge.

4.4.6 ESSENTIAL FISH HABITAT

The National Marine Fisheries Service (NMFS) has designated specific areas as Essential Fish Habitat (EFH) in accordance with the Magnuson-Stevens Fishery Conservation Act, as amended by the Sustainable Fisheries Act of 1996. The Sustainable Fisheries Act includes requirements for evaluating fish habitat loss and protection of fisheries identified as essential fisheries. "Essential Fish Habitat" are those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (50 CFR Part 600).

The proposed project occurs in designated EFH habitat areas managed by the New England Fishery Management Council. Appendix C lists life history profiles for the 14 EFH designated fisheries. The fisheries in Saco Bay are: Atlantic salmon, Atlantic cod (*Gadus morhua*) pollock, red hake (*Urophycis chuss*), white hake (*Urophycis tenuis*), winter flounder, yellowtail flounder (*Limanda ferruginea*), windowpane flounder (*Scophthalmus aquosus*), American plaice (*Hippoglossoides platessoides*), ocean pout (*Macrozoarces americanus*), Atlantic halibut (*Hippoglossus hippoglossus*), Atlantic sea herring (*Clupea harengus harengus*), bluefish (*Pomatomus saltatrix*), and Atlantic mackerel.

4.4.7 WILDLIFE RESOURCES

4.4.7.1 GENERAL WILDLIFE SPECIES

The nearshore habitat supports a variety of wildlife species typical in southern Maine. While-tailed deer, gray squirrels, raccoons, red fox, cottontails, skunks, and small mammals (mice, chipmunks, voles, etc) are frequently observed in the Saco River-Camp Ellis area. The nearby Saco River watershed supports wildlife species, such as moose, black bear, ruffled grouse, snowshoe hare, woodcock, fisher, porcupine, muskrat, beaver, coyote, bobcat, and otter. These species may infrequently be observed in the Camp Ellis vicinity. The islands off the coast of Camp Ellis support harbor and gray seals (Fish and Wildlife Service-An Ecological Characterization of Coastal Maine, vol. 3, Atlantic Coast Ecological Inventory, 1980).

4.4.7.2 BIRDS

The sandy shores and salt marsh estuaries in this area offer breeding habitats for a number of species. The area supports concentrations of shore and sea birds, such as terns, plovers, gulls, turnstones, and American oystercatchers, and the Double-crested cormorant. The area supports several species of wading birds. Glossy ibis, snowy egrets, little blue herons, great blue herons, tri-colored herons, green herons, black-crowned night herons, blue-winged teals, mallards, black ducks, willets, snipes, savannah, and sharp-tailed sparrows reside in salt marsh estuaries nearby. The coastal shore also supports a variety of shore and sea birds, such as terns, plovers, gulls, turnstones, and American oystercatchers (Maine Audubon Society).

4.5 ENDANGERED AND THREATENED SPECIES

4.5.1 FEDERALLY LISTED OR PROPOSED ENDANGERED OR THREATENED SPECIES

The ESA-listed (threatened) piping plover occurs in the project area, with nesting pairs to the north at Goosefare Brook in Saco and to the south at Fortunes Rocks Beach in Biddeford, Maine (FWS, 2002).

TABLE 4-6
Birds Found in the Camp Ellis/Saco Harbor Region

Common Name	Genus and species
American oystercatchers	*Haematopus palliates*
Bald eagle	*Haliaeetus leucocephalus*
Black duck	*Anas rubripes*
Black-crowned night heron	*Nycticorax nycticorax*
Blue-winged teal	*Anas discors*
Double-crested cormorant	*Phalacrocorax auritus*
Glossy ibis	*Plegadis falcinellus*
Great blue heron	*Ardea herodias*
Green heron	*Butorides virescens*
Gulls	*Larus spp.*
Little blue heron	*Egretta caerulea*
Mallard	*Anas platyrhynchos*
Piping Plover a/	*Charadrius melodus*
Savannah	*Passerculus sandwichensis*
Sharp tailed sparrow	*Ammodramus cauducutus*
Snipes	*Gallinago gallinago*
Snowy egret	*Egretta thula*
Arctic tern a/	*Sterna paradisaea*
Least tern a/	*Sterna antillarum*
Roseate tern a/	*Sterna dougallii*
Tri-colored heron	*Hydranassa tricolor ruficollos*
Turnstones	*Arenaria interpres*
Willet	*Catoptrophorus semipalmatus*
a/ denotes threatened or endangered species	

One Federally endangered species of fish, the shortnose sturgeon (*Acipenser brevirostrom*), has been caught in the Saco River (Sulikowski, pers. comm.). Shortnose sturgeons have a range that extends from St John River in New Brunswick, Canada to St. Johns River in Florida. Shortnose sturgeons are anadromous, spending a portion of their lives in salt water, but returning to fresh water to spawn. However, in some northern populations (e.g., in the Kennebec

River), a portion of the population forages in the saline estuary while others forage in fresh water. The normal habit is to migrate to fresh water to spawn, usually from April to May. In the Saco River, the shortnose sturgeons have been observed leaving the Saco River in December and traveling to Massachusetts to overwinter. A gravid female was observed leaving the Merrimack River in Massachusetts and returning to the Saco River in April and May (Sulikowski, pers. comm.).

The shortnose sturgeon exhibits delayed sexual maturity, high reproductive capacity, and long life expectancy. Males and females mature at the same length (about 18 inches), but age at maturity varies with latitude. Sturgeons in the northern part of their range grow slower and mature later than those in the southern part of the range. Males reach sexual maturity in the north at 10-11 years and females at 12-18 years. Females usually breed every three years, and males may breed every year.

Spawning occurs in the spring at or above the head of tide. The female broadcasts her eggs in fresh water over a rubble bottom, and the male fertilizes them. Females lay 40,000-200,000 eggs, which hatch in about 13 days. After hatching, the larvae drift downstream and inhabit the deeper sections of river channels. Young of the year remain in fresh water. Juveniles (3-10 years old) move to the freshwater/saltwater interface. Adults are found in freshwater or tidal areas of rivers in summer and winter. They concentrate in small sections of the river, usually in areas of decreased river flow. These "concentration areas" may be associated with conditions suitable for the sturgeon's primary prey, freshwater mussels and crayfish. Adult shortnose sturgeon primarily eats mollusks and large crustaceans. Juveniles feed primarily on insects and small crustaceans. Both adults and juveniles feed on the river bottom day and night. Feeding and overwintering activities may occur in both fresh and saline habitats. Adult sturgeon in Merrymeeting Bay feed over submerged tidal flats and can tolerate rapid changes in salinity with the fluctuating tide. Other individuals feed in shallow and deep tidal channels. Female shortnose sturgeon may live to be 67 years old, while males seldom live beyond 30 years of age (ME Dept. of Inland Fisheries and Wildlife website).

On February 6, 2012, NMFS listed the Gulf of Maine distinct population segments (GOM DPS) of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) as a threatened species under Section 7 of the ESA. Atlantic sturgeon are found along the eastern seaboard from Cape Canaveral, FL to Labrador, Canada. Within the U.S. Gulf of Maine, Atlantic sturgeons have been documented from the following rivers: Penobscot, Kennebec, Androscoggin, Sheepscot, Saco, Piscataqua, Presumpscott, and Merrimack. Table 4-7 below provides a list of the historic and current spawning rivers in the Gulf of Maine as well as their current use by Atlantic sturgeon.

Atlantic sturgeon are omnivorous benthic feeders and filter quantities of mud along with their food. The diets of adult sturgeon include mollusks, gastropods, amphipods, isopods and fish. Juvenile sturgeon feed on aquatic insects and other invertebrates (ASSRT, 2007). Sand lance make-up a large portion of the diet for Atlantic sturgeon caught in the Saco Bay estuary (Sulikowski, pers. comm.).

TABLE 4-7.
Historic and Current Spawning Status of Atlantic Sturgeon in the U.S. GOM and its Current Uses in the Riverine Habitat (ASSRT, 2007 and FR 2012).

State	River	Historical Spawning Status	Current Spawning Status	Use of River by Atlantic Sturgeon
NB/ME	Saint Croix	Yes	Possibly	Nursery
ME	Penobscot	Yes	Possibly	Nursery
ME	Kennebec	Yes	Yes	Spawning, Nursery
ME	Androscoggin	Yes	Possibly	Nursery
ME	Sheepscot	Yes	Possibly	Nursery
ME	Saco[1]	Unknown	Unknown	Unknown
ME/NH	Piscataqua	Unknown	No	Unknown
NH/MA	Merrimack River	Yes	No	Nursery

Atlantic sturgeon spawn in freshwater, but spend most of their adult life in the marine environment. Generally, spawning adults migrate upriver in the spring/early summer; February-March in southern systems, April-May in mid-Atlantic systems, and May-July in Canadian systems (Murawski and Pacheco, 1977; Smith, 1985; Bain, 1997; Smith and Clugston, 1997; and Caron, *et al,.* 2002; *in* ASSRT, 2007). Atlantic sturgeons likely do not spawn every year, and multiple studies have indicated spawning intervals ranging from 1-5 years for males (Smith, 1985; Collins, *et al*., 2000; Caron *et al*., 2002) and 2-5 years for females (Vladykov and Greeley, 1963; Van Eenennaam *et al*., 1996; and Stevenson and Secor, 1999; *in* FR, 2010). Fecundity of female Atlantic sturgeon is correlated with age and body size and ranges from 400,000 to 8 million eggs.

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[1] Atlantic sturgeons are using the Saco River for significant portions of the year. Studies are underway to determine how the fish are using the river (e.g., just a foraging area or attempting to reestablish a spawning population). Email from NMFS dated May 1, 2012.

Spawning is believed to occur between the salt front of estuaries and the fall line of large rivers in flowing waters with optimal flows ranging from 46-76 cm/s and depths from 11-27 meters (Borodin, 1925; Leland, 1968; Scott and Crossman, 1973; Crance, 1987; and Bain *et al*., 2000; *in* FR, 2010). Their highly adhesive eggs are deposited on the bottom substrate usually on hard surfaces such as cobble (Gilbert, 1989 and Smith and Clugston, 1997, *in* FR, 2010). It is likely that cold, clean water is important for proper larval development.

Following spawning, males may remain in the river or lower estuary until the fall; females typically exit the rivers within four to six weeks (www.nmfs.noaa.gov/pr/species/fish/ atlanticsturgeon). Juveniles (subadults)[2] move downstream and inhabit brackish waters for a few months. When they reach a size of about 30 to 36 inches (76-92 cm) they move into nearshore coastal waters. Tagging data indicate that these immature Atlantic sturgeons travel widely once they emigrate from their natal (birth) rivers. Subadults and adults live in coastal waters and estuaries when not spawning, generally in shallow (10-50 meter depth) nearshore areas dominated by gravel and sand substrates (www.nmfs.noaa.gov/pr/species/fish/atlanticsturgeon). When at sea, the adults mix with populations from other rivers, but return to their natal rivers to spawn as indicated from tagging records (Collins, *et al*., 2000a, K. Hattala, NYSDEC, pers. comm. 1998; *in* ASSRT, 2007) and from population genetic studies showing relatively low rates of gene flow (King, *et al*., 2001 and Waldman, *et al*. 2002; *in* ASSRT, 2007).

Dunton, K.J., *et al.* (2010) discusses the results from five fish surveys of captured juvenile Atlantic sturgeon from Maine to North Carolina. Essential habitat for juvenile marine migrant Atlantic sturgeon can be broadly defined as coastal waters <20 meters in depth, and concentrated in areas adjacent to estuaries such as the Hudson River-NY Bight, Delaware Bay, Chesapeake Bay, Cape Hatteras, and the Kennebec River, Maine. This narrow band of shallow water appears to represent an important habitat corridor and potential migration path. Other authors reported by Dunton, K.J., *et al.* (2010) have reported concentrations of Atlantic sturgeon in Long Island Sound, North Carolina, and bycatch data indicated concentrations in Massachusetts Bay, Rhode Island, New Jersey, and Delaware.

In addition, catches reported by Dunton, K.J., *et. al.* (2010) were greatest during the fall and spring months. Winter appears to be the next highest season of captured juvenile Atlantic sturgeon, with the summer months showing very low capture rates. However, the bycatch mortality estimates by Stein, *et al.* (2004) and ASMFC

[2] Juveniles and subadults are used interchangeably in the ASSRT, 2007 report (and therefore in this report), and are defined as any sturgeon that is not considered a young-of-year (Age 0) or mature adult.

(2007) do not include the bycatch that occurs in estuaries and rivers, which are not covered by the observer programs. Many juveniles and adults stay in marine foraging areas from fall through spring and then migrate into the estuaries and rivers in the summer seeking thermal refuges (Stein, *et al,.* 2004). While bycatch decreases in the ocean during the summer relative to fall through spring due to the migration to estuaries and rivers, bycatch likely increases in estuaries and rivers during that time.

Tagging and tracking of the captured fish has shown that Atlantic sturgeon are making use of the lower four river kilometers of Saco River from the mouth up to Cataract Dam. They have been observed in the river between December and April with the highest concentrations in June and July (Sulikowski, pers. comm.). Atlantic sturgeons have been observed moving between Saco River and Scarborough River to the north within hours (Sulikowski, pers. comm.).

4.5.2 OTHER SPECIAL STATUS SPECIES

Due to the developed nature of the beach, no known State rare botanical features are expected to occur at Camp Ellis Beach.

Due to declines in the populations of alewife, blueback herring, and rainbow smelt, these species have been classified as "species of concern". Although the "species of concern" status does not carry any procedural or substantive protections under the Endangered Species Act, concerns regarding their status and threats warrant proactive attention and conservation action (NMFS letter dated November 23, 2010).

4.6 LAND USE, RECREATION, AND PUBLIC INTEREST AREAS

The project occurs in the marine coastal waters of Saco Bay at the confluence of the Saco River, Saco and Biddeford, Maine. The dominant land use in the adjacent mainland is coastal beach community with a moderate to high population density. Saco Bay is a marine environment which has commercial and recreational uses. Activities conducted in the bay area include boating, canoeing, surf casting, swimming, sunbathing, sailboarding, surfing, sailing, and fishing.

The Saco River is protected by the State of Maine as a designated special region through the Saco River Watershed and Saco River Corridor Commission because of its diverse natural resources, particularly the water quality. The Saco River Corridor Commission was created by the Maine Legislature in 1973. Its purpose is to regulate the use of land and water within the Saco River watershed. The Commission serves as a regulatory agency that provides coordinated, basin-wide land use regulation that is run by the affected communities themselves (Biddeford and Saco Water Company, 2005). The Saco River area hosts an abundance of recreational activity, such as sightseeing, wildlife observation, camping, hiking, photography, fishing, swimming, and boating (canoeing, kayaking, whitewater rafting, etc).

4.7 AIR QUALITY

U.S. Army Corps of Engineers guidance on air quality compliance is summarized in Appendix C of the USACE Planning Guidance Notebook (ER1105-2-100, Appendix C, Section C-7, pg. C-47). Section 176 (c) of the Clean Air Act (CAA) requires that Federal agencies assure that their activities are in conformance with Federally-approved CAA State Implementation Plans (SIP) for geographic areas designated as non-attainment and maintenance areas under the CAA. The EPA General Conformity Rule to implement Section 176 (c) is found at 40 CFR Part 93.

The U.S. Environmental Protection Agency (EPA) has developed National Ambient Air Quality Standards (NAAQS) for six principal pollutants. The NAAQS sets primary (public health) and secondary (decreased visibility, damage to animals, crops, ecosystems, etc.) concentration limits to determine the attainment status for each criteria pollutant. The six criteria air pollutants are carbon monoxide, lead, nitrogen dioxide, particulate matter (PM_{10} and $PM_{2.5}$), ozone, and sulfur dioxide.

As of April 30, 2012, all of Maine, including York County and the Town of Saco, was redesignated as an attainment area for the 2008 8-hour ozone standard (prior to 2012 portions of Maine were designeated as attainment areas). This signifies that the State of Maine is currently in attainment or maintenance status (meets the NAAQS) for all six criteria pollutants.

4.8 CULTURAL RESOURCES

4.8.1 PRE-CONTACT (NATIVE AMERICAN) ARCHAEOLOGY

From documentary evidence and preliminary archaeological work, it is clear that the lower Saco River was a center of Native American activity, both in prehistoric times and during the contact period (the time of initial encounters between Europeans and Indians in the late sixteenth and seventeenth centuries). From the writings of the French explorer, Samuel de Champlain, as well as other French and English observers, we know that there was a series of large native villages near the mouth of the Saco River in the first decade of the seventeenth century. A 1605 map drawn by Champlain shows a large Native American village near the present-day campus of the University of New England in Biddeford. The map also depicts Indian cornfields on both sides of the river. The name "Saco" itself is attributed to the

Abenaki people's word for "flowing out" or "outlet" and to the word "Sawacotuck" meaning "mouth of the tidal stream."

Native Americans did occupy Saco in both prehistoric and historic times. The York Institute Museum owns a collection of Indian artifacts which were discovered at various places throughout the City. Some of these artifacts may be as much as 4-5,000 years old. More recently, in the 1600's and 1700's, Indians lived in several areas of Saco. The most notable location was Factory Island, which was known in colonial times as Indian Island. Few contact period sites have been found in Maine, so these sites along the Saco River may provide important data for understanding early Indian- European interaction. *This article, prepared in 1987 for the Saco Comprehensive Plan by Dr. Emerson Baker, overviews the field [last accessed on September 24, 2010 from the City of Saco website: http://www.sacomaine.org/community/history/archaeology.shtml].*

4.8.2 HISTORY AND HISTORICAL ARCHAEOLOGY

The lower Saco region has a long and rich history. English occupation began as early as 1618, when Captain Richard Vines and his expedition spent the winter at Winter Harbor (Biddeford Pool). Starting in 1630, just ten years after the landing of the Pilgrims at Plymouth, the mouth of the Saco became a center of English settlement which included fishermen, traders, lumberjacks, and farmers. By 1636, at least 37 families had settled in the area. Thus Saco became one of the first English settlements in northern New England.

The little settlement grew gradually throughout the seventeenth century, until it was abandoned in 1690 at the outbreak of King William's War. It was not until the Treaty of Utrecht of 1713 that any significant effort at resettlement was made in Saco. After 1713, the Saco side of the river quickly returned to prosperity as a farming, fishing, and lumbering community. By 1762, the population on the east side of the river became so great, that the east side split off from Biddeford to form the town of Pepperrellborough. The name would later be changed to Saco.

While archaeological sites in coastal Maine from the colonial period are all important, the Maine Historic Preservation Commission has determined that those from the seventeenth century are the most significant. Very few documents are left to tell scholars the history of the very early settlement of Maine. In addition to those few documents, scholars rely on archaeology to learn about the seventeenth century in Maine. To date, very little archaeological work has been done in Saco. Only one site in Saco has been placed in the Maine Historic Preservation Commission's Maine Historic Sites Inventory. This site, designated as ME379-01, and named "Goosefare Brook #1," is a late eighteenth and early nineteenth century homestead site located on the bank of Goosefare Brook.

For centuries in pre-historic times, the dramatic falls of the Saco River near where it now crosses Main Street attracted summer visits from the Native people for seasonal fishing and hunting. By the early 17th century, the safe harbor and abundant natural resources attracted European visitors. In 1617 a company of adventurers led by Richard Vines weathered a winter at the mouth of the river in a place still known as Winter Harbor. After subsequent visits, permanent settlers arrived in 1631. Both sides of the river were considered as one town, known first as Saco, and after 1718 as Biddeford. For the next century the town remained sparsely settled because of the devastation of frequent wars with the Natives and the French.

The fortunes of the small settlement changed in 1716 when William Pepperrell, a young merchant from Kittery, purchased 5,000 acres and timber rights to an additional 4,500 acres on the east side of the Saco. Pepperrell sold off parts of his holdings to millwright Nathaniel Weare and mariner Humphrey Scamman to help expedite his lumbering operation. The eastern settlement's principal roads, Main Street and the Portland, Buxton, and Ferry Roads, were laid out in 1718.

The village grew steadily throughout the 18th century. In 1752 Sir William Pepperrell, then an English Baronet, donated four acres of land near the falls to the town for use as a village common, a burying ground, and a site for a new meetinghouse. The settlers on the eastern bank separated from Biddeford in 1762 and named the new village Pepperrellborough in honor of the town's benefactor. The town grew rapidly in size and wealth as farming, lumbering, and ship building bloomed and prospered. By the time of the Revolution, the growth of international commerce in the town required the government to establish a customs house near the wharves.

In 1805 the town dropped the weighty and difficult to spell name, Pepperrellborough, in favor of the simpler ancient name, Saco. The 19th century brought modern industrial capital development to Saco. The first corporation, a nail factory, was established in 1811. The factory was such a paying venture that it was followed in 1825 by the first of many cotton milling factories. In the next 25 years, Saco could boast of dozens of industries from cotton mills and machine shops, to iron foundries and cigar factories. With the development of massive cotton mills on the western falls of the river, the sister cities of Biddeford and Saco became leaders of manufacturing in the industrial age.

Civic life took on new ceremony with the building of a handsome Town Hall in 1855. The pressures of growth and increasing needs for services led the citizens of Saco to incorporate as a city in 1867. In the second half of the 19th century, an influx of immigrants from Europe and Quebec added cultural diversity to the city's other assets. Despite setbacks during the Civil War, the Panic of 1873, and the Crash of 1929, the city's people and industries prospered for most of the next hundred years.

Perhaps the greatest challenge in the city's history came from the closing of the York Mills in 1958. For a century the York Mills had been the city's largest employer and largest taxpayer. Thanks to diversification of the city's economy and the hard work of its citizens, Saco has withstood the changes of the 20th century and is thriving once again. The rich history of Saco has left a priceless legacy in the beauty and variety of the city's buildings. The architecture of Main Street reflects almost every period of change and development in the city's history, from the eighteenth century to the present. *[Taken from the City of Saco, Maine website: http://www.sacomaine.org/community/history/introduction.html and prepared by Thomas Hardiman, former curator, Saco Museum; last accessed on September 24, 2010.]*

4.9 SOCIOECONOMICS

The population of Saco, Maine is 18,185 and the median household income is $54,175. The average annual labor force was 10,250, of which 9,768 were employed, 482 were unemployed, and 4,555 were not in the labor force for the population 16 years and over. The unemployment rate was 4.7 percent. Average annual employment for Saco by occupation is shown in Table 4-8 (U.S. Census Bureau, 2005-2009 American Community Survey).

TABLE 4-8
Average Annual Employment for Saco by Occupation (U.S. Census Bureau, 2005-2009)

Occupation	Saco
Management, professional and related occupations	3,663
Service occupations	1,726
Sales and office occupations	2,439
Farming, fishing, and forestry occupations	150
Construction, extraction, maintenance, and repair occupations	724
Production, transportation, and material moving occupations	1,066
Total	**9,768**

The Saco River Federal Navigation Project makes important contributions to local economy, particularly in regards to the fishing and service occupations. The city pier and adjacent anchorages support a fishing fleet of nearly 40 vessels, and several charter and sport fishing boats operate out of the Camp Ellis area. Three marinas along the river provide berths or moorings for about 290 recreational boats, and three public boat ramps provide additional access to the river. A commercial boat yard, situated further upstream on the Biddeford side of the river, manufactures and services commercial and pleasure craft. Commercial paper products are also shipped from this boat yard. Visits to this picturesque area, primarily during the summer months, support two sizable restaurants that are situated near the pier. Marine programs at the University of New England in Biddeford, kayak rentals, and other related activities are also supported or enhanced by the project.

5.0 ENVIRONMENTAL CONSEQUENCES

5.1 GEOLOGY

Neither the alternatives discussed nor the proposed project would have a substantial affect on the geology of Saco Bay. However, the addition of sand to the littoral system and construction of the spur jetty will affect the erosion and accretion of sediment at Camp Ellis Beach and Saco Bay. This and other consequences are discussed in the sections below. Construction of the spur jetty will occur prior to the placement of beach nourishment material.

5.2 SOILS AND SEDIMENT

The purpose of the proposed project is to reduce the erosion caused by the construction of the Saco River jetties, and to prevent further shoreline loss at Camp Ellis Beach. The construction of a spur jetty for the Federally preferred alternative would reduce the energy from waves and currents currently moving sand off the beach. The effect of this on the soils in the upland area, and the addition of beach nourishment material would be the enlargement of the supratidal area (area above mean high water) by about 13 acres.

With the addition of beach nourishment material to the project area, both the high tide and low tide lines will be moved seaward as sand is added to the project area. Beach nourishment material will be selected to match the current grain size on the beach, and intertidal and subtidal areas. The material on the beach is composed of medium to coarse sand (GEI, 2006), while the material taken in the intertidal zone is slightly less coarse, ranging from fine to coarse sand. Borings taken just off the beach in the subtidal area indicate that the bottom is composed of even finer material; ranging from very fine to medium sand. Construction of the spur jetty will reduce wave energy in the area. The decrease in wave energy has the potential to attract smaller grain size material. For example, a shift from medium to fine-grained sand, or fine grained to very fine grained sand may occur.

Only the amount of the area, but not the type of sediment, would be expected to change with the other alternatives as two of the other alternatives also include beach nourishment. Initial placement of beach nourishment material would be less for Alternative 25A, but the formation of tombolos may be created behind the breakwaters. No new material would be added with the buy-out alternative, but the erosion of the soil from the upland area would be expected to move into the intertidal and subtidal areas.

5.3 WATER RESOURCES

5.3.1 WATER CIRCULATION AND LITTORAL PROCESS

The purpose of the proposed project is to minimize erosion of Camp Ellis Beach from wave action and subsequent transport of sediment away from the area. The preferred alternative would reduce wave energy in the nearshore zone, specifically the intersection of Camp Ellis Beach with the north jetty, by impeding the reflected wave energy off of the existing northern jetty. This would extend the life of the beach nourishment. The addition of a stone filled mattress and toe reinforcements for the spur jetty and the north jetty will reduce any scour and erosion on the seaward side of the structures.

The construction of the spur jetty prior to the placement of beach nourishment material would help reduce reflective wave energy and longshore transport, the erosive forces that are currently moving material off of Camp Ellis Beach. Therefore, the amount of sediment moved from Camp Ellis Beach after the construction of the spur jetty is expected to be reduced until the beach nourishment material is placed on the beach.

After beach nourishment material is placed on the beach, waves, littoral transport and cross-currents are expected to move some of the material into the subtidal area and some of the material is expected to move to the north. The beach is anticipated to reach 70-100% equilibrium within the first year. Although the addition of a spur jetty would be expected to reduce the transport of material away from the beach, the addition of beach nourishment material to the system means there is more sand to move. The rate of longshore transport should return to a rate more comparable to pre-north jetty.

Changes to reflected wave energy, reduction in sediment transport, the potential influence of salient formations, and the overall beach performance over a 50-year time horizon were assessed. Based on these assessments it was determined that the preferred alternative would provide substantial mitigation for impacts caused by the navigation project.

While total wave energy in the beach area would be reduced, the littoral process would continue. Sediment transport from the southern region of the Bay (from the jetties north to about 3,250 feet) would be between 10,000 and 20,000 cy per year depending on the future rate of sea level rise. With more sand in the southern area of the bay, areas to the north would not be starved for sand.

Although some improvement from flood damage in the form of reduced wave overtopping, inundation and wave velocity can be expected, it is not the objective of the proposed project. The proposed project is designed to mitigate the sediment erosive damage caused by construction of the Saco River jetties.

Depending on which other alternative is discussed, more or less sediment would be available for littoral transport. More sediment would be available for littoral transport per year under the beach nourishment only alternative, less sediment transport under Alternative 25A. The buyout alternative would also provide sediment to the littoral system as the soil erodes.

5.3.2 WATER QUALITY

No significant long-term changes in water quality are expected from the construction of the proposed project or the other proposed alternatives. Although the proposed project is intended to reduce erosion from wave energy, the area will remain exposed to currents, tides and waves which will continue to flush the area.

A short-term and insignificant impact to water quality may occur from construction of the proposed project. Stone and rock used to create the spur will be placed by a crane from a floating barge. The material placed in the water will be free from contaminants. Minimal, if any, turbidity will be generated from construction of the rock structures. A mattress and toe apron will be constructed for the spur jetty, a portion of the north jetty, and breakwaters to minimize scour of the existing bottom. The loose random stone construction of the spur jetty and breakwaters will further dissipate wave energy reducing any scour and resulting turbidity potential. Any scour that may occur would be expected to occur within the first few storms until the system equilibrates. As mentioned above, no erosion on the landward side of the spur jetty and/or breakwaters is expected to occur. The reduction in wave energy on the landward side of the structures would be expected to cause accretion of sand, not erosion.

Beach nourishment material will be initially placed by trucks on the beach above mean high water and moved by bulldozers into the intertidal area during low tide. Some turbidity may occur in the nearshore as beach nourishment material is moved to the intertidal and subtidal zones. Subsequent beach nourishment activities could include the placement of material by truck or the placement of material during maintenance dredging of the Saco River by a hydraulic dredge. The impacts from maintenance dredging of the Saco River would be analyzed under a separate Environmental Assessment. The movement of material during low tide will minimize the potential for turbidity.

Similar or nearly similar, potential temporary and long-term water quality impacts would be expected for the other proposed alternatives.

5.3.3 BEACH NOURISHMENT MATERIAL TRANSPORT

Beach nourishment material will be trucked from a nearby quarry to the project site. Between 80 and 100 trucks per day would be expected to transport the material between the fall and early spring timeframe. An increase in noise and exhaust will occur as trucks leave the highway and travel through residential neighborhoods. Damages to roads will be minimized by strict adherence to speed limits, and establishment of specific haul routes. Damage will also be minimal during the winter when the roads are frozen.

Slightly less time would be needed to truck the reduced cubic yards of nourishment material for Alternative 25A. Trucks would be needed to remove material (houses, debris, infrastructure, etc.) from the project area to a landfill or recycling area under the buyout alternative. Trucks would return when more beach nourishment material is needed. The frequency would be greatest with the beach only alternative and likely less frequent with the buyout alternative or Alternative 25A.

5.3.4 SEA LEVEL RISE

Updated sea level rise guidance was released by USACE in 2009 as EC 1165-2-211, which is very similar to the requirements of the Planning Guidance Notebook. The new EC requires a multiple scenario approach for three sea level rise scenarios (historic, intermediate and high), with each being considered equally plausible.

The coastal engineering appendix (Appendix B) found in the Feasibility Report provides more detail, but in summary, it was found that when the Bruun rule was used for the without project conditions, the historic rate of sea level rise will cause an additional 28 feet of beach erosion over 50 years or 0.6 ft/year. For the intermediate curve the increased sea level rise will cause 112 feet of additional beach erosion over 50 years or 2.8 ft/yr. For the high curve the increased sea level rise will cause 177 feet of additional beach erosion over 50 years or 4.1 ft/yr. Increased sea level rise rates will accelerate beach erosion. This is largely due to the cross shore adjustment of the beach profile to the higher water level conditions.

As sea level rise occurs, the beach profile will adjust with the berm elevation increasing to match the new water level. Beaches adjust to more dramatic changes in water level through the monthly tidal cycles and short term storm events. The real issue will be the potential impacts to beach fill renourishments as previously discussed. Obviously if the beach fill is not maintained to keep pace with increased sea level rise (if it does occur) there would be negative implications to the project performance under any of the alternatives selected.

5.4 PHYSICAL AND CHEMICAL SEDIMENT CHARACTERISITICS

The material used to build the beach at Camp Ellis would be composed of sand with a grain size similar to that which is presently on the beach. The sand that is chosen could ultimately be a finer grain sand, which would result in a shallower sloped beach, or coarser which would result in a steeper sloped beach. The use of equilibrium theory, and assuming a matching grain size distribution, means that as sand is placed on the beach the beach profile will grow seaward, and will match the existing shape of the beach. This simply translates the existing beach profile seaward. The healthy profile from the north was used as a template for the beach fill profile. The full profile, which included the same foreshore and sub-aerial beach profiles, was subjected to SBEACH modeling. Based on this modeling, a 12 ft-NAVD88 berm elevation was selected. This is approximately one foot higher than the natural berm elevation. The slight increase in elevation showed performance benefits during the storm modeling effort, specifically more beach material remained near shore and at higher elevations.

Sand is generally not a carrier of contaminants due to its grain structure. Also the source of sand, from an upland quarry or from Saco River is not a source of contamination. Therefore no significant contamination will occur at the project area.

5.5 BIOLOGICAL RESOURCES

5.5.1 GENERAL

The construction of two breakwaters, a spur and/or the placement of sand on the beach, as well as the buyout alternative, will have both positive and negative biological impacts. Temporary and permanent impacts to biological resources will occur from the propose project.

5.5.2 BENTHIC RESOURCES

Beach nourishment, construction of the spur jetty (with reinforcement of the north jetty), and the breakwaters will convert some subtidal habitat into intertidal and supratidal habitat. Table 5-1 provides a breakdown of the habitat lost and gained from each proposed alternative (except for buyout alternative). The total habitat for the structural alternatives will be slightly higher than the existing habitat because of the additional area created by the angle of the breakwaters/jetty. The habitat numbers for alternatives 6 and 25A include the beach fill component and the structural portions of the alternatives and display the total impact for each alternative.

TABLE 5-1 Acres of Habitat for Each Proposed Alternative			
BEACH NOURISHMENT ONLY	***Existing***	***Proposed***	***Change***
Supratidal	8.4	33.1	24.7
Intertidal	9.9	7.0	-2.9
Subtidal	24.0	2.2	-21.8
Total	**42.3**	**42.3**	
ALTERNATIVE 6	***Existing***	***Proposed***	***Change***
Beach Fill Component			
Supratidal	8.4	21.9	13.5
Intertidal	9.9	7.0	-2.9
Subtidal	24.0	13.4	-10.6
Subtotal	*42.3*	*42.3*	
Spur Jetty Component			
Supratidal	0.19	0.94	0.75
Intertidal	0.11	0.97	0.86
Subtidal	2.33	0.97	-1.36
Subtotal	*2.63*	*2.88*	
Total	**44.93**	**45.18**	
ALTERNATIVE 25A	***Existing***	***Proposed***	***Change***
Beach Fill Component			
Supratidal	8.4	20.8	12.4
Intertidal	9.9	7.0	-2.9
Subtidal	24.0	14.5	-9.5
Subtotal	*42.3*	*42.3*	
Spur Jetty and Breakwaters			
Supratidal	0.19	1.36	1.17
Intertidal	0.11	1.90	1.79
Subtidal	3.61	1.13	-2.48
Subtotal	*3.91*	*4.39*	
Total	**45.91**	**46.69**	

Under the beach nourishment only alternative, an increase in supratidal habitat is created from a decrease in subtidal habitat. In other words, approximately 22 acres of subtidal habitat will be lost initially to create supratidal habitat. There is a slight decrease in intertidal habitat as well, but this is expected to change as waves and currents redistribute the sand. If a coarser sand grain is used, then the intertidal area may be reduced, while more fine grained sand used for beach nourishment could increase the intertidal area. As the beach erodes the loss of subtidal habitat will gradually decrease until the beach is renouriushed.

However, the current benthic community is representative of a highly dynamic environment, which is characterized by a low-moderate number of species and a low-moderate number of individuals. With a reduction in wave energy at Camp Ellis Beach, the potential exists for a more diverse and productive benthic community to be present as finer-grained material settles out.

The beach fill component of Alternatives 6 and 25A will also increase supratidal habitat and decrease on subtidal habitat, but to a lesser degree due to reduced fill volumes. Under Alternative 6, about 11 acres of subtidal habitat will be lost initially to create supratidal habitat, and under Alternative 25A about 10 acres of subtidal habitat will be impacted. In addition, the spur jetty component of Alternative 6 will result in the permanent replacement of about 2.3 acres of sandy subtidal habitat with stones and rocks. Construction of the breakwaters and spur jetty for Alternative 25A will result in the permanent replacement of almost four acres of sandy subtidal habitat with a habitat of stones and rocks. The rocks used to construct the breakwaters and spur will serve as reef habitat for species to attach. In particular, rockweed (*Fucus* spp.), knotted wrack (*Ascophyllum nodosum*), Irish moss (*Chondrus crispus*), tufted red weed (*Gigarina stellata*), barnacles (*Balanus* spp.), and blue mussels (*Mytilus edulis)* may be found in the intertidal zone, and kelp (*Laminaria* sp.) and small red seaweeds sublittoral, especially on the protected side of the breakwaters and spur. These species will provide shelter for a number of invertebrates and fish. Where light is insufficient for plant growth, within the breakwater, the hard surfaces of the lower mid-littoral and sub-littoral are usually covered with sponges, encrusting hydroids, and bryozoans, or tube-making amphipods and small worms (Gosner, 1978).

Erosion of Camp Ellis would be expected under the buyout alternative, thereby moving the intertidal and subtidal habitat landward and increasing overall subtidal habitat. The eroded material would be expected to move cross-shore and longshore.

5.5.3 FISHERIES RESOURCES

The construction of the breakwaters and spur will replace sandy habitat with limited rock reef habitat in the project area. The rock reef will attract finfish and shellfish species that favor this habitat. Blue mussels that attach to these structures are a favored food item for both the adult tautog and cunner (Whitlatch, 1982). Other cryptic, and smaller finfish species that could use the rock habitat for feeding and shelter include the sea raven, cunner, ocean pout, rock gunnel, and wolf eel (Whitlatch, 1982). The rock structures will also provide shelter for another commercially important shellfish, the lobster.

The loss of shallow subtidal habitat and intertidal habitat to supratidal will reduce the available food source for fisheries by an incremental amount. The reduced subtidal habitat is expected to be minor impact considering the amount of habitat currently available in Saco Bay. Also, the loss of Camp Ellis Beach over the decades has increased available subtidal habitat. Nourishing the beach would restore the area to historic conditions. As noted above, subtidal habitat is expected to increase under the buyout alternative.

5.5.4 ESSENTIAL FISH HABITAT

Of the EFH managed species listed for Saco Bay, the following managed EFH species (and their life stages) may be expected to occur in the project area: Atlantic salmon (adults and smolts transiting the area), pollock (juveniles), white hake (juveniles, adults), winter flounder (all life stages), windowpane flounder (juveniles, adults, and spawning adults), American plaice (spawning adults), ocean pout (possibly all life stages), Atlantic halibut (larvae), bluefish (juveniles and adults), and Atlantic mackerel (juveniles and adults). The remaining species or life stages are not expected to occur in the project area due to unsuitable (shallow) water depths, or bottom substrate.

Although EFH species can be adversely impacted temporarily due to the formation of a turbidity plume, and sedimentation during placement, no significant impacts to EFH habitat or EFH species are expected based on the following reasons. Construction of the spur jetty, breakwaters, and/or beach nourishment will occur in shallow subtidal (less than 15 feet MLLW) or intertidal areas. Areas this shallow are utilized by a limited number of species and life stages. Construction of the spur jetty, breakwaters, and placement of sand on the beach would not impede the progress of fish (salmon) transiting Saco River. Impacts of sand placement have the potential to initially decrease the fish abundance, potential for gill clogging caused by increased turbidity, and direct burial of demersal fish. These fish are motile and would most likely leave the area while sand placement occurs, decreasing their abundance and diversity in the short-term. These impacts would be short-term and would not cause significant impact to populations of any finfish. It is assumed that impacts from turbidity will be very minor especially because of the open nature of the site. Turbidity should decrease quickly as the particles in the water column rapidly dissipated into the surrounding coastal ocean waters. Subtidal habitat would be expected to increase with the buyout alternative.

Adult salmon ascend the Saco River and enter freshwater primarily in June and July (Saco River Salmon Club website). The majority of the adult salmon overwinter and return to sea the following spring. Eggs hatch in late March or April. The smolts in New England rivers enter the sea during May and June to begin their ocean migration. Based on this data, it appears that impacts to salmon would be minimal due to the limited area of disturbance. It is expected that the fish would move away from the disturbance

Pollock juveniles may be in the project area during construction activities. They have been captured at depths of 0 to 250 meters, but are more commonly found at 25 to 75 meter depths. Although it is possible a few juveniles may occur at the construction site, it is not their preferred depth and no significant impacts to the pollock juvenile population are expected as they would be able to move away from the disturbance.

White hake juveniles and adults may be found in the project area, but the depths are at the lower limit of their range. The disturbance from construction would be expected to minimal, if any.

The peak spawning time for winter flounder in Massachusetts Bay is February and March. Spawning occurs somewhat later along the coast of Maine continuing into May (Pereira, et.al., 1999). After spawning, adults tend to leave inshore waters, although some remain inshore year-round. The eggs, larvae, and young-of-year are found in shallow inshore depths. Juveniles appear in deeper depths. Adults may be found in depths, up to 30 meters, but in shallower depths when spawning. The high energy area off Camp Ellis Beach is not expected to provide significant winter flounder spawning habitat. Adults would be expected to avoid the disruption.

Windowpane flounder inhabit nearshore waters north of Cape Cod, but their occurrence in estuaries is not well documented (Chang, et.al., 1999). They are most abundant in depths from 3-7 feet. Spawning begins in February or March in inner shelf waters, peaks in the Middle Atlantic Bight in May, and extends onto Georges Bank during the summer. Adults in the Gulf of Maine use nearshore waters in the spring and autumn, while juveniles have low densities in nearshore areas in spring and autumn. There is reasonable inference that the adults, spawning adults, eggs, larvae, and juveniles of windowpane flounder would be common (not abundant or highly abundant) in Saco Bay (Chang, et.al., 1999). Few juveniles, adults, or spawning adults would be expected in the project area during construction. Adult fish would be expected to avoid the construction activity. Juveniles prefer muddy substrate in the Gulf of Maine, which is not common in the project area.

American plaice spawning adults migrate from deeper depths into shoaled grounds before spawning in the Gulf of Maine (Johnson, 2004). Adults spawn and fertilize their eggs at or near the bottom. The eggs then drift into the upper water column after they are released. In the Gulf of Maine, the spawning season extends from March through the middle of June, with peak spawning activity in April and May. Temporary and local interference with spawning American plaice might occur from project activities but is probably not significant due to the high energy area off of Camp Ellis Beach. This is not expected to be a significant impact due to the limited project area in the Gulf of Maine.

All or some of the life stages of ocean pout may use the project area. Spawning adults use hard bottom, sheltered areas, and rock reefs for spawning (Steimle, et.al., 1999). It may be possible that the jetties and habitat around the islands, as well as some of the shallow subtidal areas could be used for this purpose. Spawning occurs in the late summer through early winter with the peak in September-October. Eggs and larvae stay near the nest shelter while juveniles occur in shallow coastal waters around rocks and attached algae. Bottom temperature and depth of the adults are similar to the juveniles. The project area may be of limited use by ocean pout. A temporary and local disturbance may occur if spawning adults use the north jetty or the substrate where beach fill would be placed. The limited area of disturbance should not cause a significant overall impact to ocean pout.

Atlantic halibut adults tend to spawn in deep waters (180 – 700 meters), much deeper than the water depths at the project site (5 meters). Larvae are pelagic and tend to rise toward the surface and drift inshore until metamorphism. The smallest bottom stages collected from waters are less than 50 meters (Cargnelli, et.al., 1999). As juveniles prefer depths between 20-60 meters, it is unlikely that this species would occur in any number, or at all, as larvae or any lifestage at the project site.

Bluefish juveniles and adults are highly migratory fish, appearing in Maine waters in early to mid-June and staying through late summer. Juveniles exhibit similar seasonal migration. While juveniles spend much of their time inshore in estuaries, adult bluefish usually spend only the late spring, summer, and fall months in close proximity to the shore and are only infrequent visitors to the enclosed inshore waters (McBride, 2004).

Adult and juvenile Atlantic mackerel are common (not highly abundant or abundant) in Saco Bay between June through September. Adults and juveniles are rarely abundant in October (Studholme, et.al., 1999). Most juveniles were observed at depths of 20 to 50 meters in the summer, and similar depths in the fall. Adults are commonly found at depths of 50-70 meters in the summer and in the fall at 60-80 meters. The minimum depth adult and juvenile mackerel are found is 10 meters; deeper than the project depth. Therefore the proposed project is not expected to have any impacts to this species.

The proposed project would be constructed in phases and take about a year to construct the spur jetty and between six to nine months to nourish the beach. Following completion of the jetty, beach nourishment material would be placed on the beach between fall and spring, when benthic activity is reduced.

5.5.5 WILDLIFE RESOURCES

5.5.5.1 GENERAL WILDLIFE SPECIES

The addition of sand and rock to the project area is not expected to significantly affect the wildlife population of Saco Bay/Camp Ellis Beach. Small mammals such as mice and voles found in the project area may relocate to unaffected habitat. However, available wildlife habitat could increase substantially if the buyout alternative was selected and the area left naturally.

5.5.5.2 BIRDS

The importance of tidal flats as feeding sites for birds can vary, with areas having dense populations of infaunal invertebrates being more attractive (Whitlatch, 1982). An increase in supratidal habitat from the proposed project will benefit species of shorebirds and herons that rely heavily on tidal flats for feeding and resting. Shorebirds feed primarily on invertebrates that are captured on beaches and flats. Foraging begins on the beach and as the tide recedes the birds will follow the tide onto the flats (Whitlatch, 1982). During high tide, the birds usually rest on adjacent beaches and upland areas (Whitlatch, 1982). Wading and diving birds, such as the loons and grebes, use the flats to catch fish at high tide on the flats, while black ducks feed on tidal invertebrates.

The rock structures can provide resting spots for gulls and other species of birds. The rock structures may also provide a food source for birds that prefer mollusks such as sandpipers, black ducks, and scoters.

Plovers and terns prefer to nest on sandy beaches. Beach nourishment could attract these nesting species, most of which are listed as threatened or endangered by the Federal and/or State government. Further discussion of the potential impacts to these species from the proposed project is discussed in more detail in the following section.

Additional bird habitat would be available for upland species if the buyout alternative was selected and left naturally.

5.6 ENDANGERED AND THREATENED SPECIES

5.6.1 FEDERALLY LISTED OR PROPOSED ENDANGERED OR THREATENED SPECIES

Both shortnose sturgeon and GOM DPS of Atlantic salmon are listed as Federally endangered species. The GOM DPS for Atlantic sturgeon is listed as a threatened species. No critical habitat is listed for any of these species within the project area.

However, based upon the information presented in Section 4.5above, it is possible that adult shortnose sturgeon and Atlantic sturgeon juveniles and adults could be present in Saco Bay to transit to other locations or to use the bay as a forage area. The proposed project could create minimal disturbance, if any, to either species. Sand will be placed on the beach as fill above the high water line and then graded to the lower levels during low tide. Rocks will be removed from a barge and placed on the seafloor with care. No direct impacts to the subject species from either disturbance are expected.

A permanent displacement of a soft bottom with rock will occur possibly resulting in a very minor reduction in food source. Sand placement will temporarily reduce a potential food source for these species as the sand moves out to the shallow subtidal habitat. As the beach erodes, it is expected that subtidal areas will become repopulated with benthic organisms and continue to serve as a potential forage area. However, the overall area of impact is relatively small when compared to the remaining Saco Bay. Consequently, no direct impacts to either sturgeon species are expected. Therefore, although it is possible that shortnose sturgeon and Atlantic sturgeon could be present in the vicinity of the Camp Ellis Beach Shoreline Damage Mitigation Project, it is concluded that these activities are not likely to adversely affect Atlantic sturgeon or its critical habitat. NMFS concurred with this determination in a letter dated March 12, 2013.

Piping plovers have been known to nest at Ferry Beach north of the project area; the last known nesting was in 2007 (U.S. Fish and Wildlife letter, dated December 16, 2010). Suitable piping plover nesting habitat is likely to be created with the addition of a 60 to 70-foot wide beach berm at Camp Ellis Beach. To mitigate for potential indirect impacts from disturbance of nesting plovers north of the project area, beach nourishment will begin at the north end of the project area near Ferry Park Avenue and move to the southern end of the project area at the north jetty. This activity will begin after piping plovers have fledged, after September 1 and a couple months before they may return (i.e. beach nourishment activities will begin as soon as possible after September 1. No beach nourishment activity will occur between April 1 and August 31, unless 1) a qualified monitor is in place by April 1 to determine the location, if any, of breeding plovers, 2) nourishment activities are located 100 meters or more from piping plover territories and/or nests, and 3) plovers are monitored continuously and, if it is determined that plovers are disturbed the activity all work will cease and the Service will be notified. Beach slopes will be no greater than 10:1 and planting of beach grass or other vegetation is not included as part of the project.

In addition, the City of Saco will prepare a beach management plan that is approved by the U.S. Fish and Wildlife Service. This beach management plan will incorporate current standard piping plover habitat conditions as outlined in the 1994 "Guidelines for Managing Recreational Activities in Piping Plover Breeding Habitat on the U.S. Atlantic Coast to Avoid Take under Section 9 of the Endangered Species

Act" and any other specific conditions unique to Camp Ellis Beach. Example conditions include providing beach monitors to conduct surveys and determine if suitable piping plover nesting habitat exists and post warning signs and "symbolic fencing" (see U.S. Fish and Wildlife Service letter dated December 16, 2010). Based on the above actions to protect piping plovers, it has been determined that the proposed Federal action to reduce damage from shoreline erosion on Camp Ellis Beach is not likely to significantly affect piping plovers.

The buyout alternative may provide additional habitat suitable for plovers, as there may be reduced human activities and impacts in the project area. If so, the beach management plan would cover any new habitat. Continual erosion of Camp Ellis Beach could ultimately undermine available habitat for nesting.

5.6.2 OTHER SPECIAL STATUS SPECIES

No rare botanical State listed species are known to exist in the project area (ME Department of Conservation letter dated October 1, 2010).

5.7 AIR QUALITY

Clean Air Act compliance, specifically with U.S. Environmental Protection Agency's (EPA) General Conformity Rule, requires that all Federal agencies, including the Department of the Army, review new actions and decide whether the actions would worsen an existing National Ambient Air Quality Standards (NAAQS) violation, cause a new NAAQS violation, delay the State Implementation Plan (SIP) attainment schedule of the NAAQS, or otherwise contradict the State's SIP.

The State of Maine is authorized by the EPA to administer its own air emissions permit program, which is shaped by its SIP. The SIP sets the basic strategies for implementation, maintenance, and enforcement of the NAAQS. The SIP is the Federally enforceable plan that indentifies how the State will attain and/or maintain the primary and secondary NAAQS established by the EPA (U.S. Environmental Protection Agency, 2004). In Maine, Federal actions must conform to the Maine SIP or Federal implementation plan. For non-exempt activities, the USACE must evaluate and determine if the proposed action (construction and operation) will generate air pollution emissions that aggravate a non-attainment problem or jeopardize the maintenance status of the area for ozone. When the total direct and indirect emissions caused by the operation of the Federal action/facility are less than threshold levels established in the rule (40 C.F.R. § 93.153), a Record of Non-applicability (RONA) is prepared and signed by the facility environmental coordinator.

Construction and Operation

Construction is expected to take about 1 ½ to two years. The spur jetty will be constructed first, which is predicted to be completed within a year. Upon completion of the spur jetty, sand will be brought to the site by trucks and graded to build the beach. Construction activity at the proposed project site would require a barge crane or excavator, dump trucks, front-end loaders, tugboats, dozer, and other construction equipment.

During construction, equipment operating in Saco will emit pollutants that contribute to increased levels of criteria pollutants such as carbon monoxide, nitrogen oxides, and ozone. The emissions for construction vehicles and related equipment will have an insignificant impact to local air quality.

In order to minimize air quality effects during construction, all construction operations would comply with applicable provisions of the State of Maine air quality control regulations pertaining to dust, odors, construction, noise, and motor vehicle emissions. No direct or indirect increases or other changes in local or regional air quality are likely to occur with the construction and operation of the proposed project.

The general conformity rule was designed to ensure that Federal actions do not impede local efforts to control air pollution. It is called a conformity rule because Federal agencies are required to demonstrate that their actions "conform with" (i.e., do not undermine) the approved SIP for their geographic area. Federal agencies make this demonstration by performing a conformity review. The conformity review is the process used to evaluate and document project-related air pollutant emissions, local air quality impacts and the potential need for emission mitigation. A conformity review must be performed when a Federal action generates air pollutants in a region that has been designated a non-attainment or maintenance area for one or more NAAQS. Non-attainment areas are geographic regions where the air quality fails to meet the NAAQS.

Volatile organic compounds (VOC) and nitrogen oxides (NOx) are important considerations in air quality because they are precursors to ozone. Ozone (O_3) is a gas composed of three oxygen atoms. It is not usually emitted directly into the air, but at ground-level is created by a chemical reaction between oxides of nitrogen (NO_x) and volatile organic compounds (VOC) in the presence of sunlight. Ozone has the same chemical structure whether it occurs miles above the earth or at ground-level and can be “good” or “bad”, depending on its location in the atmosphere.

In the earth’s lower atmosphere, ground-level ozone is considered “bad”. Motor vehicle exhaust and industrial emission, gasoline vapors, and chemical solvents as well as natural sources emit NOX and VOC that help form ozone. Ground-level ozone is the primary constituent of smog. Sunlight and hot weather cause ground-level ozone to form in harmful concentrations in the air. As a result, it is known as a summertime air pollutant. Many urban areas tend to have high levels of "bad" ozone, but even rural areas are also subject to increased ozone levels because wind carries ozone and pollutants that form it hundreds of miles away from their original sources. "Good ozone" occurs naturally in the stratosphere approximately 10 to 30 miles above the earth's surface and forms a layer that protects life on earth from sun's harmful rays.

The proposed project is located in York County, Maine. During the development of this study, a portion of York County (where Saco is located) was considered to be in a maintenance status for ozone for the 2008 8-hour ozone air quality classification, thus requiring a general conformity review. The General Conformity emission threshold trigger for ozone in a maintenance area is 50 tons per year of volatile organic compounds (VOC) within an ozone transport area and 100 tons/year of nitrogen oxides (NO_X). However, in 2012 the entire state of Maine was redesignated as attainment area for the 2008 8-hour ozone classification. Since the general conformity review was prepared, it is discussed below and the RONA included within this document as Attachment C.

A general conformity review and emission inventory for the proposed project was completed and is included in this document even though the project is now in an attainment area. For the conformity review, a list of construction equipment was identified. The New England District prepared calculations of the worst-case project specific emissions of NOx and VOCs to determine whether project emissions would be under the General Conformity Trigger Levels. Because of the small scale of the project, several simplifying assumptions were applied in performing the calculations to prepare a worst-case analysis. The actual emissions would most likely be much lower, but in no case above the calculated values. For instance, the load factor is the average percentage of rated horsepower used during a source's operational profile. To simplify the calculations, we used a worst-case estimate load factor of 0.8, or 80 percent, for all equipment; typical load factor is 0.4 to 0.6. We used 10 hours per day as worst-case hours of operation for beach nourishment, even though this number would probably be less in the winter months. We used the total construction duration minus non-work days (i.e. holidays, and weather days) to estimate days of operation, rather than the specific days of operation for each piece of equipment. Based on these calculations, the worst-case emissions for the beach nourishment portion of the project are 66.58 tons of NOx emissions and 12.62 tons for VOC emissions per year. Construction of the spur jetty would result in 79.70 tons of NOx emissions and 7.96 tons of VOC emissions per year. In the year when construction of the spur jetty is completed and beach nourishment occurs immediately after, the combined total emissions for both projects for the year are

91.16 tons of NOx and 12.5 tons of VOC. In both cases, the total construction emissions were below the General Conformity Trigger Levels.

This project's construction activity does not reach the threshold levels established by the EPA rule, and is not regionally significant, and therefore the conformity rule is not applicable. A RONA may be found in Attachment C.

5.8 CULTURAL RESOURCES

5.8.1 PRE-CONTACT (NATIVE AMERICAN) ARCHAEOLOGY

No previously documented Native American sites are recorded in the Camp Ellis Beach project survey area, or in the immediate adjacent onshore area. However, site files at the Maine Historic Preservation Commission (MHPC) indicated that six recorded archaeological sites, dating from the late Ceramic (3,000-450 Before Present (BP)) to Contact (circa 450 BP) periods, were located less than one mile from the project area. This was consistent with the location of the study area and its proximity to a major river, the river's mouth and confluence with the ocean.

A review of environmental data and sea level rise curves for coastal Maine indicates that the entire Camp Ellis Beach project area was likely exposed land available for human occupation from the beginning of the Paleoindian period (circa 11,500 BP) up until the start of the Late Archaic Period (circa 6,000 BP). Between about 6,000 and 3,000 BP (roughly the beginning of the Late Archaic period to the start of the Ceramic Period, the area was gradually inundated by what likely would have been a destructive marine transgressive process of shore-face retreat, as rising sea level caused the shoreline and surf zone to migrate landward across the project survey area. By the beginning of the Ceramic Period (3,000 BP), the Camp Ellis Beach area would have been entirely underwater.

However, due to the combined effects of the area's inundation through shore-face retreat processes, its exposure to high-energy impacts from wind-driven oceanic waves and tidal currents and the recent erosion that Camp Ellis Beach has been experiencing, any archaeologically sensitive paleosols and Native American sites that may have been present have most likely been eroded and destroyed. Therefore, there is a low potential for formerly terrestrial and/or maritime Native American archaeological sites within the project area.

5.8.2 HISTORY AND HISTORICAL ARCHAEOLOGY

A review of shipwreck databases and coordination with the SHPO reported a total of 24 vessel casualties along the Saco and Biddeford coasts; however, none of these shipwrecks are recorded within the Camp Ellis Beach project area and adjacent shore. Most of the reported shipwrecks occurred in close proximity to land and were witnessed by shoreline observers. Given the project area's close proximity to shore, it seems unlikely that if a shipwreck occurred, it would have gone unnoticed and not been documented in the historic record. However, earlier and smaller vessels may have been grounded on the beach without being documented. Therefore, the project area was assessed as having a moderate potential for historic archaeological deposits, namely shipwrecks.

A systematic remote sensing archaeological survey was performed in November 2009 at the location of the USACE proposed construction of nearshore breakwaters and a spur jetty at the Camp Ellis Beach site. The investigation involved archival background research, field survey to record marine geophysical and geotechnical data, and analysis and synthesis of the research and survey results to assess the project study area's archaeological sensitivity and to determine the presence/absence of pre-contact and historic period submerged archaeological deposits within it.

A total of 22 side scan sonar anomalies and nine separate magnetic anomalies were inventoried during the remote sensing survey. These anomalies were interpreted to be associated with a sunken modern core drilling barge and its associated steel boring tubes and debris, other pieces of isolated modern debris, or exposed and buried geological features. None of the targets or anomalies was interpreted to be archaeological deposits. Additionally, sub-bottom profile data produced no acoustic reflectors indicative of buried cultural or geological features.

A total of 20 geotechnical boring samples recovered in the Camp Ellis Beach project area under a separate contract were provided to Fathom for analysis and comparison with the sub-bottom profiler data for the presence of possible stratified paleosols. The stratigraphic sequence consisted primarily of sand mixed with silt and gravel overlying clay or, in some cases, compacted gravel or bedrock. None of the boring samples exhibited sediments that are characteristic of archaeologically sensitive paleosols.

Based on the results of this study, no remote sensing targets or anomalies or buried geological features indicative of archaeological deposits were identified. As a result, no further archaeological investigation of the proposed Camp Ellis Beach nearshore breakwaters and spur jetty project area is recommended. Additionally, the placement of sand on the beach in conjunction with the offshore structures is unlikely to impact significant historic properties due to the high energy impacts from waves and tidal currents and recent erosion discussed above.

Therefore, in summary, the USACE believes that the proposed shoreline protection measures at Camp Ellis Beach should have no effect upon any structure or site of historic, architectural or archaeological significance as defined by Section 106 of the National Historic Preservation Act of 1966, as amended, and implementing regulations 36 CFR 800. The Maine State Historic Preservation Officer, in a letter dated October 6, 2010, has concurred with this determination.

5.9 ENVIRONMENTAL JUSTICE AND PROTECTION OF CHILDREN

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" requires Federal agencies to identify and address disproportionately high and adverse human health or environmental effects of its program, policies, and activities on minority and low-income populations in the U.S., including Native Americans. Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks," requires Federal agencies to identify and assess environmental health risks and safety risks that may disproportionately affect children.

No significant adverse impacts to children, minority or low income populations are anticipated as a result of this project or the proposed alternatives. About four percent of the population is considered a minority, or non-white, and 22% of the population is under 18 years old within the city of Saco, Maine (U.S. Census, 2010). Only 7.1% of families or 8.2% of individuals, within the City of Saco is below the poverty level (U.S. Census Bureau, 2000). The proposed project is designed to protect property and people in the Camp Ellis section of Saco. Some type of temporary fencing is likely to be provided by the contractor to alert children and the general public of the construction site and to secure the area. Therefore, any potential environmental effects of this project on minorities, low-income people or children are small.

5.10 NOISE

Trucks will be traveling through residential areas to dispose of sand onto the project area. It is anticipated that trucks will be traveling at slower speeds to reduce road damage. Truck traffic would be subject to any local ordinances. Additional noise from trucks would be expected with alternatives that require more frequent beach nourishment.

5.11 FLOODPLAIN MANAGEMENT

Executive Order 11988 requires Federal agencies to take action to minimize occupancy and modification of the floodplain. Specifically EO 11988 prohibits Federal agencies from funding construction in the 100-year floodplain unless there are no practicable alternatives. However, Camp Ellis beach is already fully developed and the purpose of the project is to minimize the impacts from construction of the Saco River jetties. The only other alternative would be to move the homes and business from the area which would be very expensive and not practicable.

6.0 CUMULATIVE IMPACTS

Cumulative impact is defined by NEPA as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

Prior response by the community and individuals to the loss of property and infrastructure created by the effects of erosion from construction of the Saco River jetties has been to build seawalls and other temporary structures to reduce erosion. With construction of the spur jetty and the creation of a beach of sufficient width to prevent future shore losses, these efforts by the locals would be expected to cease. Beach nourishment activities are expected to occur approximately once every 12 years. A wider and more stable beach may mean more recreational activity during the warmer months. No change to public access should occur with the placement of beach material. Additional nesting activity from piping plovers may also occur and will need to be monitored by the City of Saco to protect this species.

To the extent that other actions are expected to be related to the project as proposed, these actions will provide little measurable cumulative impact.

Cumulative impacts from the other proposed alternatives would be more or less depending if additional structures are added, and less nourishment activity is needed. The buyout plan would reduce the socioeconomic activity of Camp Ellis Beach as homes, businesses, and infrastructure are removed. However, commercial and recreational activities at the City pier would not be eliminated under the buyout alternative as continuous access would be provided to this facility.

7.0 ACTIONS TO MINIMIZE ENVIRONMENTAL IMPACTS

The definition of mitigation under NEPA " includes:

(a) Avoiding the impact altogether by not taking a certain action or parts of an action.
(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
(e) Compensating for the impact by replacing or providing substitute resources or environments."

Actions to avoid potential impact to piping plovers during construction include no beach nourishment activity between April 1 and August 31, unless 1) a qualified monitor is in place by April 1 to determine the location, if any, of breeding plovers, 2) nourishment activities are located 100 meters or more from piping plover territories and/or nests, and 3) plovers are monitored continuously and, if it is determined that plovers are disturbed the activity all work will cease and the U.S. Fish and Wildlife Service will be notified. Beach nourishment activities will begin at the north end of the beach, beach slopes will be no greater than 10:1, and no vegetation will be planted.

In addition, the Town of Saco will prepare a beach management plan that is approved by the U.S. Fish and Wildlife Service. This beach management plan will incorporate current standard piping plover habitat conditions as outlined in the 1994 "Guidelines for Managing Recreational Activities in Piping Plover Breeding Habitat on the U.S. Atlantic Coast to Avoid Take under Section 9 of the Endangered Species Act" and any other specific conditions unique to Camp Ellis Beach.

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9.0 LIST OF PREPARERS

Bargerhuff, Kirk E. – Biologist

B.S. Wildlife Management, 1988 (Purdue University)

Paiva, Marcos A. - Archaeologist/Tribal Coordinator

B.A. History, 1989 (University of Massachusetts, Dartmouth)

M.A. History/Historical Archaeology, 1993 (University of Massachusetts, Boston)

Ph.D. Candidate Anthropology, present (Brandeis University)

Rogers, Catherine J. – Ecologist (Regional Expert)

B.S. Plant and Soil Science, 1980 (University of Massachusetts)

M.S. Ecological and Evolutionary Biology/Coastal Zone Study, 1986 (University of West Florida)

10.0 COMPLIANCE WITH FEDERAL ENVIRONMENTAL STATUTES, EXECUTIVE ORDERS AND EXECUTIVE MEMORANDA

FEDERAL STATUTES

1. Archaeological Resources Protection Act of 1979, as amended, 16 USC 470 et seq.

Compliance: Issuance of a permit from the Federal land manager to excavate or remove archaeological resources located on public or Indian lands signifies compliance.

2. Preservation of Historic and Archeological Data Act of 1974, as amended, 16 U.S.C. 469 et seq.

Compliance: The project has been coordinated with the Maine State Historic Preservation Officer.

3. American Indian Religious Freedom Act of 1978, 42 U.S.C. 1996.

Compliance: Must ensure access by native Americans to sacred sites, possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

4. Clean Air Act, as amended, 42 U.S.C. 7401 et seq.

Compliance: RONA and public notice of the availability of this report to the Environmental Protection Agency is required for compliance pursuant to Sections 176c and 309 of the Clean Air Act (see Attachment C – RONA).

5. Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972) 33 U.S.C. 1251 et seq.

Compliance: Clean Water Act Section 404(b)(1) Evaluation and Compliance Review has been incorporated into the project report. An application will be filed for State Water Quality Certification pursuant to Section 401 of the CWA.

6. Coastal Zone Management Act of 1982, as amended, 16 U.S.C. 1451 et seq.

Compliance: A Coastal Zone Consistency Determination will be submitted to the State to determine consistence to the maximum extent practicable with the approved State CZM program.

7. Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.

Compliance: Coordination with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) has determined formal consultation requirements pursuant to Section 7 of the Endangered Species Act have been met (USFWS letter dated December 16, 2010 with piping plover beach management conditions met, and NMFS letter dated March 12, 2013).

8. Estuarine Areas Act, 16 U.S.C. 1221 et seq.

Compliance: Not Applicable. This report is not being submitted to Congress.

9. Federal Water Project Recreation Act, as amended, 16 U.S.C. 4601-12 et seq.

Compliance: Public notice of availability to the project report to the National Park Service (NPS) and Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

10. Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661 et seq.

Compliance: Coordination and full consideration of comments from the FWS, NMFS, and Maine fish and wildlife agencies, signifies compliance with the Fish and Wildlife Coordination Act.

11. Land and Water Conservation Fund Act of 1965, as amended, 16 U.S.C. 4601-4 et seq.

Compliance: Public notice of the availability of this report to the National Park Service (NPS) and the Office of Statewide Planning relative to the Federal and State comprehensive outdoor recreation plans signifies compliance with this Act.

12. Marine Protection, Research, and Sanctuaries Act of 1971, as amended, 33 U.S.C. 1401 et seq.

Compliance: Not applicable, because fill material is for beach nourishment, not dredged material disposal, the Clean Water Act Section 404 Evaluation was conducted.

13. National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq.

Compliance: Coordination with the State Historic Preservation Office signifies compliance.

14. The American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3000-3013, 18 U.S.C. 1170

Compliance: Regulations implementing NAGPRA will be followed if discovery of human remains and/or funerary items occur during implementation of this project.

15. National Environmental Policy Act of 1969, as amended, 42 U.S.C 4321 et seq.

Compliance: Preparation of the Environmental Assessment signifies partial compliance with NEPA. Full compliance shall be noted at the time the Finding of No Significant Impact is signed by the District Engineer.

16. Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.

Compliance: No requirements for projects or programs authorized by Congress. The project is operated pursuant to the Congressionally approved continuing authority of the Rivers and Harbors Act.

17. Watershed Protection and Flood Prevention Act as amended, 16 U.S.C 1001 et seq.

Compliance: Floodplain impacts have been considered in project planning. The project will not result in the loss of floodplain.

18. Wild and Scenic Rivers Act, as amended, 16 U.S.C 1271 et seq.

Compliance: Not applicable.

19. Magnuson-Stevens Act, as amended, 16 U.S.C. 1801 et seq.

Compliance: An Essential Fish Habitat Assessment will be provided to the National Marine Fisheries Service for recommendations.

EXECUTIVE ORDERS

1. Executive Order 11593, Protection and Enhancement of the Cultural Environment, 13 May 1971

Compliance: Coordination with the Maine Historic Preservation Officer signifies compliance.

2. Executive Order 11988, Floodplain Management, 24 May 1977 amended by Executive Order 12148, 20 July 1979.

Compliance: Public notice of the availability of this report or public review fulfills the requirements of Executive Order 11988, Section 2(a) (2).

3. Executive Order 11990, Protection of Wetlands, 24 May 1977.

Compliance: Public notice of the availability if this report for public review fulfills the requirements of Executive Order 11990, Section 2 (b).

4. Executive Order 12114, Environmental Effects Abroad of Major Federal Actions, 4 January 1979.

Compliance: Not applicable to projects located in the United States geographical boundaries.

5. Executive Order 12898, Environmental Justice, 11 February 1994.

Compliance: The project will not have a significant impact on minority or low-income population, or any other population in the United States.

6. Executive 13007, Accommodation of Sacred Sites, 24 May 1996

Compliance: Not applicable. This project is not on Federal lands.

7. Executive Order 13045, Protection of Children from Environmental Health Risks and Safety Risks. 21 April, 1997.

Compliance: Not applicable. The project would not create a disproportionate environmental health or safety risk for children.

8. Executive Order 13061, and Amendments – Federal Support of Community Efforts Along American Heritage Rivers

Compliance: Not applicable.

9. Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, 6 November 2000.

Compliance: Consultation with Indian Tribal Governments, where applicable, and consistent with executive memoranda, DoD Indian policy, and USACE Tribal Policy Principles signifies compliance.

EXECUTIVE MEMORANDUM

1. Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.

Compliance: There are no impacts to prime agricultural lands on the project.

2. White House Memorandum, Government-to-Government Relations with Indian Tribes, 29 April 1994.

Compliance: Consultation with Federally Recognized Indian Tribes, where appropriate, signifies compliance.

ATTACHMENT A

Benthic Data

IDENTIFICATION AND ENUMERATION OF BENTHIC MACROFAUNA FROM SACO BAY AND CAMP ELLIS, MAINE

Contract No. DACW33-02-M-0194

SUBMITTED BY:

PETER FOSTER LARSEN & JOANNE LARDIE

COASTAL SCIENCES

91 KNICKERBOCKER ROAD

BOOTHBAY, MAINE 04537

This report represents analytical results of benthic samples transferred on May 1, 2002 to Coastal Sciences by representatives of the U.S. Army Corps of Engineers.

Peter F. Larsen, Ph.D.
Coastal Sciences

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CASE NARRATIVE

Thirteen benthic samples consisting of seven grabs and six cores from Saco Bay and the beach at Camp Ellis, Maine were transferred on May 1, 2002 to Coastal Sciences by representatives of the U.S. Army Corps of Engineers. The samples had been collected by USACE personnel on May 1, 2002 using a 0.04 m^2 modified Van Veen grab and a smaller hand held core. The samples were then sieved on a 0.5 mm screen and fixed in formalin with Rose Bengal.

In the laboratory, the samples were resieved on nested 1.0 and 0.5 mm sieves and preserved in 70% ethanol. The benthic macrofauna in each size fraction of each sample was separated for the organic and inorganic debris and sorted to major taxonomic categories. This tedious process was accomplished by trained personnel using binocular dissecting microscopes. A subsample of the residue of each sample was reexamined to insure complete removal of the fauna. No problems were detected. Each taxonomic group was examined by experienced marine taxonomists who identified each individual to the lowest practical taxonomic level, usually species, and enumerated the number of individuals in each taxon. The results were tabulated and are presented in the enclosed tables, which are submitted in both paper and digital formats.

The tabular results are presented as individuals per sample. A summary tabulation is presented on each station sheet indicating the number of species in the sample, density on a per square meter basis and species diversity on a natural log base.

An authoritative analysis of the data is not appropriate due to the lack of ancillary data such as salinity, depth, sediment characteristics, etc. Some preliminary impressions, however, are interesting. Samples appeared to be from clean sandy substrates. There was little organic detritus. Seventy-nine putative species were encountered (Table 1). This is a relatively high number considering the small number of samples. Naturally, the highest diversity occurred in the subtidal samples. These samples contained between 10 and 54 species with a mean of 29 (Table 2). Likewise, these stations exhibited a fairly high density on a per square meter basis with a mean of over sixteen thousand. By contrast the intertidal samples were sparsely populated by a very few species. Beach sediments are characteristically colonized by few species. Whereas abundances can reach high numbers in many cases, the low densities encountered here are not considered unusual.

There is one unusual occurrence to note. In the 0.5 size fractions of the jetty samples there were what we called red blobs. They were especially abundant in samples J1 through J5 where the densities varied between 5,750 and 13,675 individuals per square meter. They were probably not adequately sampled by the 0.5 mm sieve. We believe these individuals to be the just set larvae of a spionid polychaete. Microscopic examination indicated (suggested) that they were 2-3 segments long, had some indication of setae and often were surrounded by a clear membrane to which particles of sand were encrusted. Consultation with a larval polychaete expert would be required for a more authoritarian identification. These individuals were not included in the numerical tabulations so as not to skew the community structure tables.

Table 1. Complete List of Species Encountered in Saco Bay/Camp Ellis Samples. Samples Collected in May 2002.	
PHYLUM	**SPECIES**
Phylum Cnidaria	
	Athenaria anemone
	Hydroids
	Sagartidae anemone
Phylum Platyhelminthes	
	Platyhelminthes
Phylum Nemertea	
	Nemertean
Phylum Mollusca	
	Arctica islandica
	Cerastoderma pinnulatum
	Diaphana minuta
	Gemma gemma
	Lunatia heros
	Modiolus modiolus
	Mya arenaria
	Mytilus edulis
	Nassarius trivittatus
	Nucula delphinodonta
	Spisula solidissima
	Tellina agilis
	Thyasira gouldii
	Yoldia sapotilla
Phylum Annelida	
	?*Lepidonotus squamatus*
	Algaophamus neotenus
	Ampharetidae
	Aricidea jeffreysii
	Asabellides oculata
	Capitella capitata
	Chaetozona setosa
	Clymenella torquata
	Drilonereis magna
	Enipo gracilis
	Eteone flava
	Eteone lactea
	Eteone trilieata
	Euclymene zonalis
	Exogone hebes
	Harmothoe imbricata
	Lumbrineris fragilis
	Lumbrineris latreilli

	Nephtys bucera
	Nepthys incisa
	Nephtys picta
	Oligochaeta
	Paraonis fulgens
	Pholoe minuta
	Phyllodoce mucosa
	Prionospio steenstrupi
	Protodorvillea kefersteini
	Pygospio elegans
	Scoloplos acutus
	Spio sp.
	Spio setosa
	Spiophanes bombyx
	Tharyx acutus
Phylum Phoronida	
	Phoronid
Phylum Arthropoda	
	Barnacle juvenile
	Cancer irroratus
	Corophium bonelli
	Corophium crassicorne
	Diastylis polita
	Dulichia sp.
	Edotea triloba
	Eudorella sp.
	Gammarellus angulosus
	Gammarus oceanicus
	Leptocheirus pinguis
	Mite
	Munna fabricii
	Orchomenella pinguis
	Photis macrocoxa
	Phoxocephalus holbolli
	Pontogeneia inermis
	Protohaustorius deichmannae
	Pseudoleptocuma minor
	Tanais cavolina
	Trichophoxus epistomus
	Unciola irrorata
Phylum Echinodermata	
	Echinarachnius parma
	Holothurian juv.
	Ophiopholis aculeata
	Ophiura sp.

Table 2. Summary of Species Numbers and Densities (m2) in Jetty and Beach Samples. Collected May 2002.					
JETTY SAMPLES			**BEACH SAMPLES**		
Sample #	**# Species**	**Density**	**Sample #**	**# Species**	**Density**
J1	38	20,775	B1	6	275
J2	20	11,375	B2	7	325
J3	32	15,425	B3	4	200
J4	54	43,650	B4	5	150
J5	37	20,725	B5	4	125
J6	10	1,950	B6	2	100
J7	14	2,225			
Mean	**29**	**16,589**	**Mean**	**5**	**196**
Min	**10**	**1,950**	**Min**	**2**	**100**
Max	**54**	**43,650**	**Max**	**7**	**325**

Sample J1 Camp Ellis/Saco Beach. Collected May 2002.							
NUMBER of SPECIES:	**38**						
DENSITY (m2):	**20,775**						
DIVERSITY (H'):	**2.174**						
Species	**1.0**	**0.5**	**Total**	**Cum. Tot.**	**%**	**Cum. %**	**Higher Taxon**
Photis macrocoxa	156	113	269	269	32.37	32.37	Arthropoda
Aricidea jeffreysii	20	143	163	432	19.61	51.99	Annelida
Pygospio elegans	85	40	125	557	15.04	67.03	Annelida
Paraonis fulgens	66	14	80	637	9.63	76.65	Annelida
Exogone hebes	26	10	36	673	4.33	80.99	Annelida
Spiophanes bombyx	31	1	32	705	3.85	84.84	Annelida
Nassarius trivittatus	22		22	727	2.65	87.48	Mollusca
Tellina agilis	18	3	21	748	2.53	90.01	Mollusca
Diastylis polita	14	1	15	763	1.81	91.82	Arthropoda
Chaetozona setosa	6	6	12	775	1.44	93.26	Annelida
Nepthys incisa	5		5	780	0.60	93.86	Annelida
Capitella capitata	1	3	4	784	0.48	94.34	Annelida
Unciola irrorata	4		4	788	0.48	94.83	Arthropoda
Euclymene zonalis	3		3	791	0.36	95.19	Annelida
Lumbrineris latreilli	3		3	794	0.36	95.55	Annelida
Eteone flava	3		3	797	0.36	95.91	Annelida
Pholoe minuta	1	2	3	800	0.36	96.27	Annelida
?Lepidonotus squamatus	3		3	803	0.36	96.63	Annelida
Edotea triloba	3		3	806	0.36	96.99	Arthropoda
Yoldia sapotilla	3		3	809	0.36	97.35	Mollusca
Modiolus modiolus		3	3	812	0.36	97.71	Mollusca
Protodorvillea kefersteini		2	2	814	0.24	97.95	Annelida
Nemertean		2	2	816	0.24	98.19	Nemertea
Algaophamus neotenus	1		1	817	0.12	98.32	Annelida
Scoloplos acutus	1		1	818	0.12	98.44	Annelida
Clymenella torquata	1		1	819	0.12	98.56	Annelida
Lumbrineris fragilis	1		1	820	0.12	98.68	Annelida
Asabellides oculata		1	1	821	0.12	98.80	Annelida
Phoronid		1	1	822	0.12	98.92	Phoronida
Phoxocephalus holbolli	1		1	823	0.12	99.04	Arthropoda
Pontogeneia inermis	1		1	824	0.12	99.16	Arthropoda
Trichophoxus epistomus	1		1	825	0.12	99.28	Arthropoda
Pseudoleptocuma minor	1		1	826	0.12	99.40	Arthropoda
Cancer irroratus	1		1	827	0.12	99.52	Arthropoda
Holothurian juv.	1		1	828	0.12	99.64	Echinodermata
Mite		1	1	829	0.12	99.76	Arthropoda
Cerastoderma pinnulatum	1		1	830	0.12	99.88	Mollusca
Spisula solidissima		1	1	831	0.12	100.00	Mollusca

Sample J2 Camp Ellis/Saco Beach. Collected May 2002.							
NUMBER of SPECIES:	**20**						
DENSITY (m2):	**11,375**						
DIVERSITY (H'):	**2.287**						
Species	**1.0**	**0.5**	**Total**	**Cum. Tot.**	**%**	**Cum. %**	**Higher Taxon**
Photis macrocoxa	104	53	157	157	34.51	34.51	Arthropoda
Aricidea jeffreysii	21	102	123	280	27.03	61.54	Annelida
Pygospio elegans	32	31	63	343	13.85	75.38	Annelida
Tellina agilis	8	30	38	381	8.35	83.74	Mollusca
Spiophanes bombyx	34	2	36	417	7.91	91.65	Annelida
Nassarius trivittatus	23		23	404	5.05	88.79	Mollusca
Unciola irrorata	12	10	22	426	4.84	93.63	Arthropoda
Paraonis fulgens	1	11	12	416	2.64	91.43	Annelida
Modiolus modiolus	1	8	9	425	1.98	93.41	Mollusca
Chaetozona setosa	3	5	8	433	1.76	95.16	Annelida
Yoldia sapotilla	3	4	7	440	1.54	96.70	Mollusca
Diastylis polita	5	1	6	439	1.32	96.48	Arthropoda
Nepthys incisa	5		5	444	1.10	97.58	Annelida
Spisula solidissima	1	3	4	448	0.88	98.46	Mollusca
Edotea triloba	3		3	447	0.66	98.24	Arthropoda
Exogone hebes	3		3	450	0.66	98.90	Annelida
Capitella capitata	1	1	2	452	0.44	99.34	Annelida
Algaophamus neotenus		1	1	453	0.22	99.56	Annelida
Asabellides oculata	1		1	454	0.22	99.78	Annelida
Cerastoderma pinnulatum	1		1	455	0.22	100.00	Mollusca

Sample J3 Camp Ellis/Saco Beach. Collected May 2002.							
NUMBER of SPECIES:	**32**						
DENSITY (m2):	**15,425**						
DIVERSITY (H'):	**2.317**						
Species	**1.0**	**0.5**	**Total**	**Cum. Tot.**	**%**	**Cum. %**	**Higher Taxon**
Pygospio elegans	80	57	137	137	22.20	22.20	Annelida
Photis macrocoxa	66	53	119	256	19.29	41.49	Arthropoda
Aricidea jeffreysii	78	29	107	363	17.34	58.83	Annelida
Paraonis fulgens	2	81	83	446	13.45	72.29	Annelida
Tellina agilis	10	27	37	483	6.00	78.28	Mollusca
Spiophanes bombyx	30	1	31	514	5.02	83.31	Annelida
Unciola irrorata	6	17	23	537	3.73	87.03	Arthropoda
Modiolus modiolus		10	10	547	1.62	88.65	Mollusca
Exogone hebes	5	3	8	555	1.30	89.95	Annelida
Nassarius trivittatus	8		8	563	1.30	91.25	Mollusca
Harmothoe imbricata	5		5	568	0.81	92.06	Annelida
Prionospio steenstrupi	5		5	573	0.81	92.87	Annelida
Protodorvillea kefersteini	1	4	5	578	0.81	93.68	Annelida
Pholoe minuta	4		4	582	0.65	94.33	Annelida
Arctica islandica		3	3	585	0.49	94.81	Mollusca
Diastylis polita	2	1	3	588	0.49	95.30	Arthropoda
Drilonereis magna	3		3	591	0.49	95.79	Annelida
Edotea triloba	3		3	594	0.49	96.27	Arthropoda
Lunatia heros	2	1	3	597	0.49	96.76	Mollusca
Yoldia sapotilla	1	2	3	600	0.49	97.24	Mollusca
Capitella capitata	1	1	2	602	0.32	97.57	Annelida
Chaetozona setosa		2	2	604	0.32	97.89	Annelida
Gemma gemma		2	2	606	0.32	98.22	Mollusca
Orchomenella pinguis		2	2	608	0.32	98.54	Arthropoda
Phoxocephalus holbolli	2		2	610	0.32	98.87	Arthropoda
Asabellides oculata		1	1	611	0.16	99.03	Annelida
Corophium crassicorne	1		1	612	0.16	99.19	Arthropoda
Dulichia sp.	1		1	613	0.16	99.35	Arthropoda
Eteone trilieata	1		1	614	0.16	99.51	Annelida
Nepthys incisa		1	1	615	0.16	99.68	Annelida
Nucula delphinodonta	1		1	616	0.16	99.84	Mollusca
Scoloplos acutus		1	1	617	0.16	100.00	Annelida

Sample J4 Camp Ellis/Saco Beach. Collected May 2002.							
NUMBER of SPECIES:	**54**						
DENSITY (m2):	**43,650**						
DIVERSITY (H'):	**2.555**						
Species	**1.0**	**0.5**	**Total**	**Cum. Tot.**	**%**	**Cum. %**	**Higher Taxon**
Aricidea jeffreysii	166	203	369	369	21.13	21.13	Annelida
Prionospio steenstrupi	300	34	334	703	19.13	40.26	Annelida
Photis macrocoxa	268	47	315	1018	18.04	58.30	Arthropoda
Corophium crassicorne	82	32	114	1132	6.53	64.83	Arthropoda
Phoxocephalus holbolli	86	3	89	1221	5.10	69.93	Arthropoda
Modiolus modiolus		76	76	1297	4.35	74.28	Mollusca
Euclymene zonalis	55	6	61	1358	3.49	77.78	Annelida
Chaetozona setosa	33	25	58	1416	3.32	81.10	Annelida
Scoloplos acutus	36	16	52	1468	2.98	84.08	Annelida
Spiophanes bombyx	44		44	1512	2.52	86.60	Annelida
Drilonereis magna	28		28	1540	1.60	88.20	Annelida
Pholoe minuta	20	4	24	1564	1.37	89.58	Annelida
Diastylis polita	20	1	21	1585	1.20	90.78	Arthropoda
Nucula delphinodonta	3	16	19	1604	1.09	91.87	Mollusca
Clymenella torquata	14		14	1618	0.80	92.67	Annelida
Protodorvillea kefersteini		13	13	1631	0.74	93.41	Annelida
Pygospio elegans	5	7	12	1643	0.69	94.10	Annelida
Orchomenella pinguis	7		7	1650	0.40	94.50	Arthropoda
Nephtys picta	5	1	6	1656	0.34	94.85	Annelida
Tellina agilis	4	2	6	1662	0.34	95.19	Mollusca
Capitella capitata	2	3	5	1667	0.29	95.48	Annelida
Exogone hebes	5		5	1672	0.29	95.76	Annelida
Nemertean	2	3	5	1677	0.29	96.05	Nemertea
Unciola irrorata	4	1	5	1682	0.29	96.33	Arthropoda
Eteone lactea	4		4	1686	0.23	96.56	Annelida
Phoronid	3	1	4	1690	0.23	96.79	Phoronida
Tharyx acutus	4		4	1694	0.23	97.02	Annelida
Thyasira gouldii	1	3	4	1698	0.23	97.25	Mollusca
Edotea triloba	3		3	1701	0.17	97.42	Arthropoda
Leptocheirus pinguis	3		3	1704	0.17	97.59	Arthropoda
Paraonis fulgens	3		3	1707	0.17	97.77	Annelida
Spio setosa	3		3	1710	0.17	97.94	Annelida
Yoldia sapotilla	2	1	3	1713	0.17	98.11	Mollusca
Arctica islandica		2	2	1715	0.11	98.22	Mollusca
Athenaria anemone		2	2	1717	0.11	98.34	Cnidaria
Cerastoderma pinnulatum	2		2	1719	0.11	98.45	Mollusca
Diaphana minuta	1	1	2	1721	0.11	98.57	Mollusca
Dulichia sp.	2		2	1723	0.11	98.68	Arthropoda
Echinarachnius parma	2		2	1725	0.11	98.80	Echinodermata
Eudorella sp.	2		2	1727	0.11	98.91	Arthropoda

Gemma gemma	1	1	2	1729	0.11	99.03	Mollusca
Lumbrineris fragilis	2		2	1731	0.11	99.14	Annelida
Munna fabricii		2	2	1733	0.11	99.26	Arthropoda
Mytilus edulis		2	2	1735	0.11	99.37	Mollusca
Nassarius trivittatus	2		2	1737	0.11	99.48	Mollusca
Ampharetidae	1		1	1738	0.06	99.54	Annelida
Eteone trilieata	1		1	1739	0.06	99.60	Annelida
Mya arenaria		1	1	1740	0.06	99.66	Mollusca
Nephtys bucera	1		1	1741	0.06	99.71	Annelida
Ophiopholis aculeata	1		1	1742	0.06	99.77	Echinodermata
Ophiura sp.	1		1	1743	0.06	99.83	Echinodermata
Phyllodoce mucosa	1		1	1744	0.06	99.89	Annelida
Pseudoleptocuma minor	1		1	1745	0.06	99.94	Arthropoda
Sagartidae anemone	1		1	1746	0.06	100.00	Cnidaria

Sample J5 Camp Ellis/Saco Beach. Collected May 2002.							
NUMBER of SPECIES:	**37**						
DENSITY (m2):	**20,725**						
DIVERSITY (H'):	**1.937**						
Species	**1.0**	**0.5**	**Total**	**Cum. Tot.**	**%**	**Cum. %**	**Higher Taxon**
Aricidea jeffreysii	86	258	344	344	41.50	41.50	Annelida
Photis macrocoxa	182	69	251	595	30.28	71.77	Arthropoda
Spiophanes bombyx	41		41	636	4.95	76.72	Annelida
Paraonis fulgens	15	11	26	662	3.14	79.86	Annelida
Drilonereis magna	14	3	17	679	2.05	81.91	Annelida
Nucula delphinodonta	12	3	15	694	1.81	83.72	Mollusca
Tellina agilis	3	12	15	709	1.81	85.52	Mollusca
Diastylis polita	14		14	723	1.69	87.21	Arthropoda
Modiolus modiolus	1	9	10	733	1.21	88.42	Mollusca
Prionospio steenstrupi	10		10	743	1.21	89.63	Annelida
Pygospio elegans	4	5	9	752	1.09	90.71	Annelida
Nephtys picta	8		8	760	0.97	91.68	Annelida
Nassarius trivittatus	7		7	767	0.84	92.52	Mollusca
Phoronid	4	2	6	773	0.72	93.24	Phoronida
Chaetozona setosa	1	4	5	778	0.60	93.85	Annelida
Pholoe minuta	5		5	783	0.60	94.45	Annelida
Phoxocephalus holbolli	5		5	788	0.60	95.05	Arthropoda
Yoldia sapotilla	2	3	5	793	0.60	95.66	Mollusca
Munna fabricii	1	3	4	797	0.48	96.14	Arthropoda
Edotea triloba	3		3	800	0.36	96.50	Arthropoda
Harmothoe imbricata	3		3	803	0.36	96.86	Annelida
Mya arenaria	1	2	3	806	0.36	97.23	Mollusca
Unciola irrorata	1	2	3	809	0.36	97.59	Arthropoda
Capitella capitata		2	2	811	0.24	97.83	Annelida
Corophium crassicorne	2		2	813	0.24	98.07	Arthropoda
Dulichia sp.	1	1	2	815	0.24	98.31	Arthropoda
Lunatia heros	1	1	2	817	0.24	98.55	Mollusca
Orchomenella pinguis	1	1	2	819	0.24	98.79	Arthropoda
Spisula solidissima	2		2	821	0.24	99.03	Mollusca
Arctica islandica		1	1	822	0.12	99.16	Mollusca
Echinarachnius parma		1	1	823	0.12	99.28	Echinodermata
Eteone trilieata	1		1	824	0.12	99.40	Annelida
Gemma gemma	1		1	825	0.12	99.52	Mollusca
Leptocheirus pinguis	1		1	826	0.12	99.64	Arthropoda
Mite		1	1	827	0.12	99.76	Arthropoda
Nemertean	1		1	828	0.12	99.88	Nemertea
Scoloplos acutus		1	1	829	0.12	100.00	Annelida

Sample J6 Camp Ellis/Saco Beach. Collected May 2002.							
NUMBER of SPECIES:	**10**						
DENSITY (m2):	**1,950**						
DIVERSITY (H'):	**1.737**						
Species	**1.0**	**0.5**	**Total**	**Cum. Tot.**	**%**	**Cum. %**	**Higher Taxon**
Chaetozona setosa	7	22	29	29	37.18	37.18	Annelida
Tellina agilis	1	17	18	47	23.08	60.26	Mollusca
Paraonis fulgens	7	3	10	57	12.82	73.08	Annelida
Nassarius trivittatus	8		8	65	10.26	83.33	Mollusca
Yoldia sapotilla	5	2	7	72	8.97	92.31	Mollusca
Capitella capitata		2	2	74	2.56	94.87	Annelida
Eteone lactea		1	1	75	1.28	96.15	Annelida
Nephtys picta	1		1	76	1.28	97.44	Annelida
Photis macrocoxa	1		1	77	1.28	98.72	Arthropoda
Spisula solidissima	1		1	78	1.28	100.00	Mollusca

Sample J7 Camp Ellis/Saco Beach. Collected May 2002							
NUMBER of SPECIES:	**14**						
DENSITY (m2):	**2,225**						
DIVERSITY (H'):	**1.617**						
Species	**1.0**	**0.5**	**Total**	**Cum. Tot.**	**%**	**Cum. %**	**Higher Taxon**
Capitella capitata	19	16	35	35	39.33	39.33	Annelida
Nemertean	8	25	33	68	37.08	76.40	Nemertea
Exogone hebes	3	1	4	72	4.49	80.90	Annelida
Platyhelminthes	4		4	76	4.49	85.39	Platyhelminthes
Modiolus modiolus	1	2	3	79	3.37	88.76	Mollusca
Aricidea jeffreysii	1	1	2	81	2.25	91.01	Annelida
Arctica islandica		1	1	82	1.12	92.13	Mollusca
Barnacle juvenile	1		1	83	1.12	93.26	Arthropoda
Chaetozona setosa	1		1	84	1.12	94.38	Annelida
Eteone trilieata	1		1	85	1.12	95.51	Annelida
Paraonis fulgens		1	1	86	1.12	96.63	Annelida
Pholoe minuta		1	1	87	1.12	97.75	Annelida
Photis macrocoxa		1	1	88	1.12	98.88	Arthropoda
Tanais cavolina	1		1	89	1.12	100.00	Arthropoda

Sample B1 Camp Ellis/Saco Beach. Collected May 2002.							
NUMBER of SPECIES:	**6**						
DENSITY (m2):	**275**						
DIVERSITY (H'):	**1.421**						
Species	**1.0**	**0.5**	**Total**	**Cum. Tot.**	**%**	**Cum. %**	**Higher Taxon**
Pygospio elegans	3	3	6	6	54.55	54.55	Annelida
Aricidea jeffreysii	1		1	7	9.09	63.64	Annelida
Harmothoe imbricate	1		1	8	9.09	72.73	Annelida
Paraonis fulgens	1		1	9	9.09	81.82	Annelida
Protohaustorius deichmannae	1		1	10	9.09	90.91	Arthropoda
Scoloplos acutus	1		1	11	9.09	100.00	Annelida

Sample B2 Camp Ellis/Saco Beach. Collected May 2002.							
NUMBER of SPECIES:	**7**						
DENSITY (m2):	**325**						
DIVERSITY (H'):	**1.631**						
Species	**1.0**	**0.5**	**Total**	**Cum. Tot.**	**%**	**Cum. %**	**Higher Taxon**
Pseudoleptocuma minor	2	4	6	6	46.15	46.15	Arthropoda
Pygospio elegans	1	1	2	8	15.38	61.54	Annelida
Capitella capitata	1		1	9	7.69	69.23	Annelida
Gammarus oceanicus		1	1	10	7.69	76.92	Arthropoda
Nepthys incise	1		1	11	7.69	84.62	Annelida
Paraonis fulgens		1	1	12	7.69	92.31	Annelida
Protohaustorius deichmannae	1		1	13	7.69	100.00	Arthropoda

Sample B3 Camp Ellis/Saco Beach. Collected May 2002.							
NUMBER of SPECIES:	**4**						
DENSITY (m2):	**200**						
DIVERSITY (H'):	**1.213**						
Species	**1.0**	**0.5**	**Total**	**Cum. Tot.**	**%**	**Cum. %**	**Higher Taxon**
Paraonis fulgens	2	2	4	4	50.00	50.00	Annelida
Gammarus oceanicus	1	1	2	6	25.00	75.00	Arthropoda
Modiolus modiolus	1		1	7	12.50	87.50	Mollusca
Protohaustorius deichmannae	1		1	8	12.50	100.00	Arthropoda

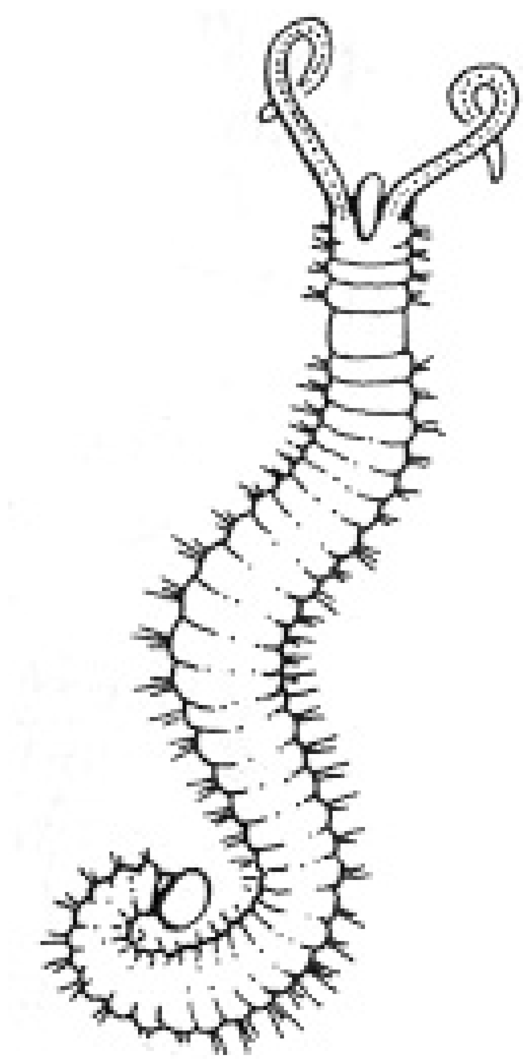
Sample B4 Camp Ellis/Saco Beach. Collected May 2002							
NUMBER of SPECIES:	**5**						
DENSITY (m2):	**150**						
DIVERSITY (H'):	**1.561**						
Species	**1.0**	**0.5**	**Total**	**Cum. Tot.**	**%**	**Cum. %**	**Higher Taxon**
Paraonis fulgens		2	2	2	33.33	33.33	Annelida
Oligochaeta		1	1	3	16.67	50.00	Annelida
Protohaustorius deichmannae	1		1	4	16.67	66.67	Arthropoda
Pseudoleptocuma minor	1		1	5	16.67	83.33	Arthropoda
Spio sp.	1		1	6	16.67	100.00	Annelida

Sample B5 Camp Ellis/Saco Beach. Collected May 2002.							
NUMBER of SPECIES:	**4**						
DENSITY (m2):	**125**						
DIVERSITY (H'):	**1.332**						
Species	**1.0**	**0.5**	**Total**	**Cum. Tot.**	**%**	**Cum. %**	**Higher Taxon**
Pygospio elegans		2	2	2	40.00	40.00	Annelida
Gammarellus angulosus	1		1	3	20.00	60.00	Arthropoda
Paraonis fulgens	1		1	4	20.00	80.00	Annelida
Pseudoleptocuma minor	1		1	5	20.00	100.00	Arthropoda

Sample B6 Camp Ellis/Saco Beach. Collected May 2002.							
NUMBER of SPECIES:	**2**						
DENSITY (m2):	**100**						
DIVERSITY (H'):	**0.562**						
Species	**1.0**	**0.5**	**Total**	**Cum. Tot.**	**%**	**Cum. %**	**Higher Taxon**
Spisula solidissima	3		3	3	75.00	75.00	Mollusca
Modiolus modiolus		1	1	4	25.00	100.00	Mollusca

MACROBENTHIC SURVEY OF CAMP ELLIS

SACO, MAINE



Prepared By:

Peter E. Pellegrino, Ph. D.
Coastal Resource Analysts
Waterford, CT 06385
2004

I. Introduction

Benthic infaunal communities are composed of a variety of small organisms including worms, clams, snails, and crustaceans. The major ecological functions of the benthos include the production of biomass as food resources for higher trophic levels and the bioturbating (mixing) of sand and mud.

Benthic organisms are very sensitive to habitat disturbances, including organic enrichment and contamination of sediments by toxic substances. Benthic communities can therefore provide a useful environmental monitoring tool to evaluate estuarine systems.

II. Objectives

The objective of this study was to document the fauna of the benthic cores and grab samples from Camp Ellis, Saco, Maine collected on August 4-5, 2004.

III. Methods

Benthic samples were provided by the U.S. Army Corps of Engineers, New England District for identification. All organisms were seived through a 0.5 mm screen and identified to the lowest possible taxonomic category and counted.

IV. Results

The benthic structure of the 14 beach cores is summarized in Table 1. Table 2 summarizes those organisms recovered in the 14 subtidal VanVeen grab samples. Based on the analysis of a single replicate from each station, it is apparent that the community is dominated by a typical assemblage of sandy nearshore and intertidal beach species.

The dominant species in the cores included the arthropod *Haustorius canadensis* and the polychaetes *Pygospio elegans* and *Paraonis fulgens*. Dominant species in the grabs included the polychaetes *Pygospio elegans* and *Paraonis fulgens*. Stations SA-4(A), SA-4(B), and SA-5 were dominated by oligochaetes and nematodes.

Table 1
Macrobenthic Analysis of Beach Core Samples from Camp Ellis, Saco, Maine. Collected August 4-5, 2004.
(Numbers are Reported per 0.003 m^2)

↓SPECIES/LOCATION→	T1-1	T1-2	T1-3	T2-1	T2-2	T2-3	T3-1	T3-2	T3-3	T3-4	T4-1	T4-2	T4-3	T4-4
ANNELIDA														
POLYCHAETEA														
Aricidea catherinae	5	-	-	-	-	4	-	-	2	-	-	3	-	2
Leitoscoloplos fragilis	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Pygospio elegans	-	8	23	9	-	3	-	-	-	-	-	4	-	-
Paraonis fulgens	-	12	10	7	8	5	5	-	14	4	-	-	-	-
Nephtys ciliata	-	-	1	-	-	-	-	1	1	-	-	-	-	1
Mediomastus ambiseta	-	-	2	-	2	-	-	1	1	9	7	-	3	-
Scolelepis squamata	-	-	-	-	-	1	-	3	-	-	3	1	-	-
Schistomeringus caecus	-	-	-	-	-	2	-	-	-	-	-	-	-	-
Orbinia sp.	-	-	-	-	-	-	-	-	-	1	-	-	-	-
OLIGOCHAETEA														
Oligochaete sp. A	-	-	-	-	-	13	18	-	-	-	-	-	-	-
NEMATODA														
Nematode sp. A	-	-	-	-	-	68	19	7	3	-	-	-	-	-
MOLLUSCA														
BIVALVIA														
Tellina agilis	-	2	-	-	-	-	-	-	-	-	-	-	-	1
Siliqua costata	-	-	-	-	1	-	-	-	-	-	-	-	-	-
NEMERTEA														
Nemertina sp A	-	-	-	-	-	1	-	-	-	-	-	-	-	-

Table 1 (continued)
Macrobenthic Analysis of Beach Core Samples from Camp Ellis, Saco, Maine. Collected August 4-5, 2004.
(Numbers are Reported per 0.003 m²)

Arthropoda														
Amphipoda														
Haustorius canadensis	4	11	1	5	-	-	-	9	7	1	-	5	11	-
Ischyrocerus anguipes	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Mysids														
Mysid sp. A	-	-	-	-	-	-	-	-	-	1	-	-	-	-
TOTALS														
Number of Species	**2**	**5**	**5**	**3**	**3**	**8**	**3**	**6**	**6**	**5**	**2**	**4**	**2**	**3**
Number of Individuals	**9**	**34**	**37**	**21**	**11**	**97**	**42**	**22**	**28**	**16**	**10**	**13**	**14**	**4**

TABLE 2 Macrobenthic Analysis of Van Veen grabs from Camp Ellis, Saco, Maine August 4-5, 2004. Numbers are Reported per $0.04m^2$												
↓SPECIES/LOCATION→	**BW-1**	**BW-2**	**BW-3(A)**	**BW-3(B)**	**BW-4**	**BW-5**	**SA-1**	**SA-2**	**SA-3**	**SA-4(A)**	**SA-4(B)**	**SA-5**
ANNELIDA												
POLYCHAETEA												
Leitoscoloplos fragilis	-	1	-	-	-	-	-	-	-	-	-	-
Nephtys picta	13	3	4	2	3	5	4	1	-	-	1	-
Pygospio elegans	63	29	3	1	10	20	3	4	12	-	-	-
Paraonis fulgens	16	8	6	3	19	17	5	3	26	-	-	16
Mediomastus ambiseta	8	11	-	-	45	18	5	-	-	-	-	-
Spiophanes bombyx	2	-	1	-	2	-	-	-	-	-	-	-
Nephtys ciliata	-	2	-	-	-	-	-	-	-	-	-	-
Clymenella torquata	-	-	-	-	4	-	-	-	-	-	-	-
Lumbrineris acuta	-	-	-	-	-	-	-	-	-	1	-	-
Exogene hebes	-	-	-	-	-	-	-	-	-	12	17	-
Driloneris sp.	-	-	-	-	-	-	-	-	-	1	-	-
Glycera sp.	-	-	-	-	-	-	-	-	-	1	-	-
Schistomeringus caecus	-	-	-	-	-	-	-	-	-	1	3	1
Proceara sp.	-	-	-	-	-	-	-	-	-	1	-	-
Neries pelagica	-	-	-	-	-	-	-	-	-	-	2	-
Tharyx acutus	-	-	-	-	-	-	-	-	-	-	-	2
OLIGOCHAETEA												
Oligochaeta sp A.	-	-	-	-	-	-	-	-	-	143	196	41
NEMATODA												
Nematode sp. A	-	-	-	-	-	-	-	-	5	494	650	421
MOLLUSCA												

BIVALVIA												
Lyonsia hyalina	-	-	-	-	-	-	-	-	1	-	3	-
Spisula sp.	-	-	-	-	-	-	-	1	2	-	-	-
Tellina agilis	5	3	2	-	10	1	3	1	-	-	-	1
Gemma gemma	7	5	4	-	4	1	8	-	-	-	-	-
Mulinia lateralis	1	-	-	-	-	-	-	-	-	-	-	-
Siliqua costata	1	-	-	-	-	1	-	-	1	-	-	-
GASTROPODA												
Nassarius trivitattus	-	-	-	-	1	-	-	1	-	-	-	1
Lunatia heros	-	-	-	-	-	-	-	1	-	-	-	-
NEMERTEA												
Nemertina sp. A	-	-	-	-	-	-	-	-	-	1	1	3
Arthropoda												
Amphipoda												
Microprotopus raneyi	-	-	-	-	2	-	-	-	-	-	-	1
Unciola irrortata	-	-	-	-	1	-	-	-	-	-	-	-
Psammonyx nobilis	-	-	-	-	-	-	1	-	-	-	-	-
Haustorius canadensis	-	-	-	-	-	-	-	1	-	-	-	-
ISOPODA												
Edotea triloba	-	-	-	-	1	-	-	-	-	-	-	-
Chiridotea caeca	-	-	-	-	-	-	-	-	-	-	3	-
CUMACEANS												
Diastylis quadrispinosa	-	-	-	-	-	2	-	-	-	-	-	-
Mysids												
Mysid sp A	-	-	-	-	-	1	-	1	-	-	1	1
TOTALS												
# of Species	**9**	**8**	**6**	**3**	**12**	**9**	**7**	**9**	**6**	**9**	**10**	**10**
# of Individuals	**125**	**62**	**20**	**6**	**102**	**66**	**29**	**14**	**47**	**655**	**877**	**88**

ATTACHMENT B

Essential Fish Habitat

Life History

ESSENTIAL FISH HABITAT EVALUATION
SACO BAY, MAINE

ESSENTIAL FISH HABITAT SETTING

The 1996 amendments to the Magnuson-Stevens Fishery Conservation Management Act strengthen the ability of the National Marine Fisheries Service and the New England Fishery Management Council to protect and conserve the habitat of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. This habitat is termed "essential fish habitat", and is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Managed species listed for the 10' x 10' squares of latitude and longitude which include Saco Bay are: Atlantic salmon, Atlantic cod, pollock, red hake, white hake, winter flounder, yellowtail flounder, windowpane flounder, American plaice, ocean pout, Atlantic halibut, Atlantic sea herring, bluefish, and Atlantic mackerel.

The following lists the managed species and their appropriate life stage history for the designated 10' x 10' squares which include Saco Bay.

ATLANTIC SALMON (*Salmo salar*)

Juveniles: Bottom habitats of shallow gravel/cobble riffles interspersed with deeper riffles and pools in rivers and estuaries. Generally, the following conditions exist where Atlantic salmon parr are found: clean, well-oxygenated fresh water, water temperatures below 25^0 C, water depths between 10 cm and 61 cm, and water velocities between 30 and 92 cm per second. As they grow, parr transform into smolts. Atlantic salmon smolts require access downstream to make their way to the ocean. Upon entering the sea, "post-smolts" become pelagic and range from Long Island Sound north to the Labrador Sea.

Adults: For adult Atlantic salmon returning to spawn, habitats with resting and holding pools in rivers and estuaries. Returning Atlantic salmon require access to their natal streams and access to the spawning grounds. Generally, the following conditions exist where returning Atlantic salmon adults are found migrating to the spawning grounds: water temperatures below 22.8^0 C, and dissolved oxygen above five ppm. Oceanic adult Atlantic salmon are primarily pelagic and range from the waters of the Continental Shelf off southern New England north throughout the Gulf of Maine.

ATLANTIC COD (*Gadus morhua*)

Eggs: Surface waters around the perimeter of the Gulf of Maine, George's Bank, and the eastern portion of the Continental Shelf off southern New England. Generally, the following conditions exist where cod eggs are found: sea surface temperatures below 12^0 C, water depths less than 110 meters, and a salinity range from 32-33‰. Cod eggs are most often observed beginning in the fall, with peaks in the winter and spring.

Larvae: Pelagic waters of the Gulf of Maine, Georges Bank, and the eastern portion of the Continental Shelf off of southern New England. Generally, the following conditions exist where cod larvae found: sea surface temperatures below 10^0 C, water depths from 30 to 70 meters, and a salinity range from 32-33‰. Cod larvae are most often observed in the spring.

Juveniles: Bottom habitats with a substrate of cobble or gravel in the Gulf of Maine, Georges Bank, and the eastern portion of the Continental Shelf off southern New England. Generally, the following conditions exist where cod juveniles found: water temperatures below 20^0 C, water depths from 25 to 75 meters, and a salinity range from 30-35‰.

Adults: Bottom habitats with a substrate of rocks, pebbles, or gravel in the Gulf of Maine, Georges Bank, southern New England, and the middle Atlantic south to Delaware Bay. Generally, the following conditions exist where cod adults are found: water temperatures below 10^0 C, water depths from 10 to 150 meters, and a wide range of oceanic salinities.

POLLOCK (*Pollachius virens*)

Juveniles: Bottom habitats with aquatic vegetation or a substrate of sand, mud or rocks in the Gulf of Maine and Georges Bank. Generally, the following conditions exist where pollock juveniles are found: water temperatures below 18^0 C, water depths from 0 to 250 meters, and salinities between 29-32‰.

RED HAKE (*Urophycis chuss*)

Juveniles: Bottom habitats with a substrate of shell fragments, including areas with an abundance of live scallops, in the Gulf of Maine, on Georges Bank, the Continental Shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where red hake juveniles are found: water temperatures below 16° C, depths less than 100 meters and a salinity range from 31 - 33‰.

Adults: Bottom habitats in depressions with a substrate of sand and mud in the Gulf of Maine, on Georges Bank, the Continental Shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where red hake adults are found: water temperatures below 12 ° C, depths from 10 to 130 meters, and a salinity range from 33 - 34‰.

WHITE HAKE (*Urophycis tenuis*)

Juveniles: *Pelagic stage* – Pelagic waters of the Gulf of Maine, the southern edge of Georges Bank, and southern New England to the middle Atlantic. White hake juveniles in the pelagic stage are most often observed from May through September. *Demersal stage* – Bottom habitats with seagrass beds or a substrate of mud or fine-grained sand in the Gulf of Maine, the southern edge of Georges Bank, and southern New England to the middle Atlantic. Generally, the following conditions exist where white hake juveniles are found: water temperatures below 19 ° C and depths from 5 - 225 meter.

Adults: Bottom habitats with a substrate of mud or fine-grained sand in the Gulf of Maine, the southern edge of Georges Bank, and southern New England to the middle Atlantic. Generally, the following conditions exist where white hake adults are found: water temperatures below 14 ° C and depths from 5 - 325 meter.

WINTER FLOUNDER (*Pleuronectes americanus*)

Eggs: Bottom habitats with a substrate of sand, muddy sand, mud, and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where winter flounder eggs are found: water temperatures below 10 ° C, salinities between 10 - 30‰ and water depths less than 5 meters. On Georges Bank, winter flounder eggs are generally found in water less than 8 ° C, and less than 90 meters deep. Winter flounder eggs are often observed from February to June with a peak in April on Georges Bank.

Larvae: Pelagic and bottom waters of Georges Bank, the inshore areas of the Gulf of Maine, southern New England, and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where winter flounder larvae are found: sea surface temperatures less than 15° C, salinities between 4 - 30‰, and water depths less than six meters. On Georges Bank, winter flounder larvae are generally found in water less than 8 ^{o} C, and less than 90 meters deep. Winter flounder larvae are often observed from March to July with peaks in April and May on Georges Bank.

Juveniles: *Young-of-the-Year*: Bottom habitats with a substrate of mud or fine-grained sand on Georges Bank, the inshore areas of the Gulf of Maine, southern New England and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where winter flounder young-of-the-year are found: water temperatures below 28^{o} C, and depths from 0.1 – 10 meters, and salinities between 5 - 33‰. *Age 1 + Juveniles*: Bottom habitats with a substrate of mud or fine-grained sand on Georges Bank, the inshore areas of the Gulf of Maine, southern New England and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where juvenile winter flounder are found: water temperatures below 25^{o} C, and depths from 1 – 50 meters, and salinities between 10 - 30‰.

Adults: Bottom habitats including estuaries with a substrate of mud, sand and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where adult winter flounder are found: water temperatures below 25^{o} C, and depths from 1 – 100 meters, and salinities between 15 - 33‰.

Spawning Adults: Bottom habitats including estuaries with a substrate of sand, muddy sand, mud, and gravel on Georges Bank, the inshore areas of the Gulf of Maine, southern New England and the middle Atlantic south to the Delaware Bay. Generally, the following conditions exist where spawning adult winter flounder are found: water temperatures below 15^{o} C, depths less than 6 meters, except on Georges Bank where they spawn as deep as 80 meters, and salinities 5.5 - 36‰. Winter flounder are most often observed spawning during the months of February to June.

<u>YELLOWTAIL FLOUNDER (*Pleuronectes ferruginea*)</u>

Eggs: Surface waters of Georges Bank, Massachusetts Bay, Cape Cod Bay, and the southern New England continental shelf south to Delaware Bay. Generally, the following conditions exist where yellowtail eggs are found: sea surface temperatures below 15^{0} C, water depths from 30-90 meters and a salinity range from 32.4-33.5‰. Yellowtail flounder eggs are most often observed during the months from mid-March to July, with peaks in April to June in southern New England.

Larvae: Surface waters of Georges Bank, Massachusetts Bay, Cape Cod Bay, the southern New England shelf and throughout the middle Atlantic south to the

Chesapeake Bay. Generally, the following conditions exist where yellowtail larvae are found: sea surface temperatures below 17^0 C, water depths from 10 – 90 meters, and a salinity range from 32.4 – 33.5‰. Yellowtail flounder larvae are most often observed from March through April in the New York bight and from May through July in southern New England and southeastern Georges Bank.

Juveniles: Bottom habitats with a substrate of sand or sand and mud on Georges Bank, the Gulf of Maine, and the southern New England shelf south to the Delaware Bay. Generally, the following conditions exist where yellowtail flounder juveniles are found: water temperatures below 15^o C, depths from 20 – 50 meters, and salinities from 32.4 – 33.5‰

Adults: Bottom habitats with a substrate of sand or sand and mud on Georges Bank, the Gulf of Maine, and the southern New England shelf south to the Delaware Bay. Generally, the following conditions exist where yellowtail flounder adults are found: water temperatures below 15^o C, depths from 20 – 50 meters, and salinities from 32.4 – 33.5‰

WINDOWPANE FLOUNDER (*Scopthalmus aquosus*)

Eggs: Surface waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where windowpane flounder eggs are found: sea surface temperatures less than 20^0 C, water depths less than 70 meters. Windowpane flounder eggs are often observed from February to November with peaks in May and October in the middle Atlantic and July through August on Georges Bank.

Larvae: Pelagic waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where windowpane flounder larvae are found: sea surface temperatures less than 20^0 C, water depths less than 70 meters. Windowpane flounder larvae are often observed from February to November with peaks in May and October in the middle Atlantic and July through August on Georges Bank.

Juveniles: Bottom habitats with a substrate of mud or fine-grained sand around the perimeter of the Gulf of Maine, on Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where windowpane flounder juveniles are found: water temperatures below 25^0 C, water depths from 1 – 100 meters, and a salinity range from 5.5 – 36‰.

Adults: Bottom habitats with a substrate of mud or fine-grained sand around the perimeter of the Gulf of Maine, on Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border. Generally, the following conditions exist where windowpane flounder adults are found: water temperatures below 26.8^0 C, water depths from 1 – 75 meters, and salinities between 5.5 – 36‰.

Spawning Adults: Bottom habitats with a substrate of mud or fine-grained sand in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border. Generally, the following conditions exist where spawning windowpane flounder adults are found: water temperatures below 21^0 C, water depths from 1 – 75 meters, and salinities between 5.5 – 36‰. Windowpane flounder are most often observed spawning during the months February – December with a peak in May in the middle Atlantic.

AMERICAN PLAICE (*Hippoglossoides platessoides*)

Eggs: Surface waters of the Gulf of Maine and Georges Bank. Generally, the following conditions exist where most American plaice eggs are found: sea surface temperatures below 12^0 C, water depths between 30 and 90 meters and a wide range of salinities. American plaice eggs are observed all year in the Gulf of Maine, but only from December through June on Georges Bank, with peaks in both areas in April and May.

Larvae: Surface waters of the Gulf of Maine, Georges Bank and southern New England. Generally, the following conditions exist where most American plaice larvae are found: sea surface temperatures below 14^0 C, water depths between 30 and 130 metes and a wide range of salinities. American plaice larvae are observed between January and August, with peaks in April and May.

Adults: Bottom habitats with fine-grained sediments or a substrate of sand or gravel in the Gulf of Maine and Georges Bank. Generally, the following conditions exist where most American plaice adults are found: water temperatures below 17^0 C, water depths between 45 and 175 meters, and a wide range of salinities.

Spawning Adults: Bottom habitats of all substrate types in the Gulf of Maine and Georges Bank. Generally, the following conditions exist where most spawning American plaice adults are found: water temperatures below 14^0 C, water depths less than 90 meters, and a wide range of salinities. Spawning begins in March and continues through June.

OCEAN POUT (*Macrozoarces americanus*)

Eggs: Bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay. Due to low fecundity, relatively few eggs (<4,200) are laid in gelatinous masses, generally in hard bottom sheltered nests, holes, or crevices where they are guarded by either female or both parents. Generally, the following conditions exist where ocean pout eggs are found: water temperatures below 10^0 C, depths less than 50 meters, and a salinity range from 32-34‰. Ocean pout egg development takes two to three months during late fall and winter.

Larvae: Bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay. Larvae are relatively advanced in development and are believed to remain in close proximity to hard bottom nesting areas. Generally, the following conditions exist where ocean pout larvae are found: sea surface temperatures below 10^0 C, depths less than 50 meters, and salinities greater than 25‰. Ocean pout larvae are most often observed from late fall through spring.

Juveniles: Bottom habitats, often smooth bottom near rocks or algae in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay. Generally, the following conditions exist where ocean pout juveniles are found: water temperatures below 14^0 C, depths less than 80 meters, and salinities greater than 25‰.

Adults: Bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay. Generally, the following conditions exist where ocean pout adults are found: water temperatures below 15^0 C, depths less than 110 meters, and a salinity range from 32-34‰.

Spawning Adults: Bottom habitats with a hard bottom substrate, including artificial reefs and shipwrecks, in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Delaware Bay. Generally, the following conditions exist where spawning ocean pout adults are found: water temperatures below 10^0 C, depths less than 50 meters, and a salinity range from 32-34‰. Ocean pout spawn from late summer through early winter, with peaks in September and October.

ATLANTIC HALIBUT (*Hippoglosus hippoglossus*)

Eggs: Pelagic waters to the sea floor of the Gulf of Maine and Georges Bank. Generally, the following conditions exist where Atlantic halibut eggs are found:

water temperatures between 4 and 7^0 C, water depths less than 700 meters, and salinities less than 35‰. Atlantic halibut eggs are observed between late fall and early spring, with peaks in November and December.

Larvae: Surface waters of the Gulf of Maine and Georges Bank. Generally, the following conditions exist where Atlantic halibut larvae are found: salinities between 30 and 35‰.

Juveniles: Bottom habitats with a substrate of sand, gravel, or clay in the Gulf of Maine and Georges Bank. Generally, the following conditions exist where Atlantic halibut juveniles are found: water temperatures above 2^0 C, water depths from 20 - 60 meters.

Adults: Bottom habitats with a substrate of sand, gravel, or clay in the Gulf of Maine and Georges Bank. Generally, the following conditions exist where Atlantic halibut adults are found: water temperatures below 13.6^0 C, water depths from 100 - 700 meters, and salinities between 30.4 – 35.3‰.

Spawning Adults: Bottom habitats with a substrate of soft mud, clay, sand, or gravel in the Gulf of Maine and Georges Bank, as well as rough or rocky bottom locations along the slopes of the outer banks. Generally, the following conditions exist where spawning Atlantic halibut adults are found: water temperatures below 7^0 C, water depths less than 700 meters, and salinities less than 35‰. Atlantic halibut are most often observed spawning between late fall and early spring, with peaks in November and December.

ATLANTIC SEA HERRING (*Clupea harengus*)

Eggs: Bottom habitats with a substrate of gravel, sand, cobble and shell fragments, but also on aquatic macrophytes, in the Gulf of Maine and Georges Bank. Eggs adhere to the bottom, forming extensive egg beds which may be many layers deep. Generally, the following conditions exist where Atlantic herring eggs are found: water temperatures below 15^0 C, water depths between 20-80 meters, and a salinity range from 32-33‰. Herring eggs are most often found in areas of well-mixed water, with tidal currents between 1.5 and 3.0 knots. Atlantic herring eggs are most often observed during the months July through November.

Larvae: Pelagic waters in the Gulf of Maine, Georges Bank, and southern New England that comprise 90% of the observed range of Atlantic herring larvae. Generally, the following conditions exist where Atlantic herring larvae are found: sea surface temperatures below 16^0 C, water depths from 50 - 90 meters, and salinities around 32‰. Atlantic herring larvae are observed between August and April, with peaks from September through November.

Juveniles: Pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where Atlantic herring juveniles are found: water temperatures below 10^0 C, water depths from 15 - 135 meters, and salinity range from 26 to 32‰.

Adults: Pelagic waters and bottom habitats in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to Cape Hatteras. Generally, the following conditions exist where Atlantic herring adults are found: water temperatures below 10^0 C, water depths from 20 - 130 meters, and salinities above 28‰.

BLUEFISH (*Pomatomus saltatrix*)

Juveniles: Pelagic waters over the Continental Shelf (from the coast out to the limits of the EEZ). Generally, juvenile bluefish occur in North Atlantic estuaries from June through October. Distribution of juveniles by temperature, salinity, and depth over the continental shelf is undescribed.

Adults: Pelagic waters over the Continental Shelf (from the coast out to the limits of the EEZ). Adult bluefish are found in North Atlantic estuaries from June through October in the "mixing" and "seawater" zones. Bluefish adults are highly migratory and distribution varies seasonally and according to the size of the individuals comprising the schools. Bluefish are generally found in normal shelf salinities (> 25 ppt).

ATLANTIC MACKEREL (*Scomber scombrus*)

Juveniles: EFH is the pelagic water found over the Continental Shelf (from the coast out to the limits of the EEZ). EFH is also the "mixing" and /or "seawater" portions of all the estuaries where Atlantic mackerel are "common", "abundant," or "highly abundant". Generally, juvenile Atlantic mackerel are collected from shore out to 1,050 feet and in water temperatures between 39^0 F and 72^0 F.

Adults: EFH is the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine through Cape Hatteras, North Carolina; in areas that encompass the highest 75% of the catch where adult Atlantic mackerel were collected in NEFSC trawl surveys. EFH is also the "mixing" and/or "seawater" portions of all the estuaries where Atlantic mackerel are "common", "abundant", or "highly abundant" on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, adult Atlantic mackerel are collected from shore out to 1,250 feet and in water temperatures between 39^0 F and 61^0 F.

ATTACHMENT C

Record of Non-Applicability (RONA)

and

Emissions Calculations

GENERAL CONFORMITY – RECORD OF NON-APPLICABILITY

Project Name: Camp Ellis Beach Shoreline Damage Mitigation, Saco, Maine

Project Point of Contact: Jay Mackay, Chief Environmental Resources Section

Phone: 978-318-8142

General Conformity under the Clean Air Act, Section 176 has been evaluated for the project described above according to the requirements of 40 CFR 93, Subpart B. The requirements of this rule are not applicable to this project because:

Total direct and indirect emission from this project are estimated at less than 100 tons for ozone, and are below the conformity threshold value established at 40 CFR 93.153(b) of 100 tons/year of ozone; AND

The project is not considered regionally significant under 40 CFR 93.153(i).

Supporting documentation and emissions estimates are:

(X) Attached

(X) Appear in the NEPA Documentation (Section 5.7)

( ) Other

____

Jay Mackay, Chief, Environmental Resources Section

General Conformity Review and Emission Inventory for Spur Jetty for Alternative 6 – Camp Ellis Beach, Saco, ME

	Project Emission Sources and Estimated Power						NOx Emission Estimates		VOC Emission Estimates	
Equipment/Engine Category	# of Engines	hp	LF	Hrs/day	Days of Operation	Hp-hr	NOx EF (g/hp-hr)	NOx Emissions (tons)	VOC EF (g/hp-hr)	VOC Emissions (tons)
¾ ton truck	1	250	0.80	10	16	32,000	6.86	0.24	1.3	0.05
Trucking for Mob and Demob	1	350	0.80	10	24	67,200	6.86	0.51	1.3	0.10
Loader (stone quarry)	1	350	0.80	10	192	537,600	6.86	4.07	1.3	0.77
Trucking Stone to Dock	1	400	0.80	10	256	819,200	6.86	6.19	1.3	1.17
Trucking Stone to Dock	1	400	0.80	10	256	819,200	6.86	6.19	1.3	1.17
Trucking Stone to Dock	1	400	0.80	10	256	819,200	6.86	6.19	1.3	1.17
Barge Crane or Excavator (place stone)	1	425	0.80	10	477	1,621,800	6.86	12.26	1.3	2.32
Tugboat – large towing*	1	3000	0.80	10	84	2,016,000	7.31	16.24	0.20	0.44
Tugboat – large towing*	1	3000	0.80	10	84	2,016,000	7.31	16.24	0.20	0.44
Tugboat – on site barge movement	1	1000	0.80	10	161	1,288,000	7.31	10.38	0.20	0.28
Survey/Work Boat	1	100	0.80	10	181	144,800	7.31	1.17	0.20	0.03
Total Emissions							**NOx Total**	**79.70**	**VOC Total**	**7.96**

Horsepower Hours

hp-hr = # of engines*hp*LF*hrs/day*days of operation

Load Factors (LF)

Load Factor represents the average percentage of rated horsepower used during a source's operational profile. For this worst case estimate, LF is held at 0.8 for all equipment. Typical is 0.4 to 0.6 (Reference: EPA 2000)

Emission Factors (EF)

NOx Emissions Factor for Off-Road Construction Equipment is 6.86 g/hp-hr (Tier 1 Emission Standard 40 CFR 89.112(1))
NOx Emissions Factor for Harbor Craft is 7.310 g/hp-hr (Reference: EPA 2009, Table3-8)
VOC Emissions Factor for Off-Road Construction Equipment is 1.30 g/hp-hr
VOC Emissions Factor for Harbor Craft is 0.20 g/hp-hr (Reference: EPA 2009, Table3-8)
Emissions (g) = Power Demand (hp-hr) * Emission Factor (g/hp-hr)
Emissions (tons) = Emissions (g) * (1 ton/907200 g)

Assumptions

*Includes time to tow stone materials barges to site and mobilize and demobilize crane/spud barge
Assume two hours for 40 mile round trip quarry to dock and back

EPA 2000. Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data. EPA 420-R-00-022.
EPA 2009. Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories, Final Report. April 2009.

General Conformity Review and Emission Inventory for Beach Nourishment for Alternative 6 – Camp Ellis Beach, Saco, ME

	Project Emission Sources and Estimated Power						NOx Emission Estimates		VOC Emission Estimates	
Equipment/Engine Category	# of Engines	hp	LF	Hrs/day	Days of Operation	Hp-hr	NOx EF (g/hp-hr)	NOx Emissions (tons)	VOC EF (g/hp-hr)	VOC Emissions (tons)
Loader (bank run sand)	1	350	0.80	10	350	980,000	6.86	7.41	1.3	1.40
Loader (bank run sand)	1	350	0.80	10	350	980,000	6.86	7.41	1.3	1.40
Trucking Sand to Beach	1	400	0.80	10	525	1,680,000	6.86	12.70	1.3	2.41
Trucking Sand to Beach	1	400	0.80	10	525	1,680,000	6.86	12.70	1.3	2.41
Trucking Sand to Beach	1	400	0.80	10	525	1,680,000	6.86	12.70	1.3	2.41
Trucking Sand to Beach	1	400	0.80	10	525	1,680,000	6.86	12.70	1.3	2.41
Dozer to Move Sand on Beach	1	75	0.80	10	104	62,400	6.86	0.47	1.3	0.09
3/4 ton Truck at Beach Site	1	75	0.80	10	104	62,400	6.86	0.47	1.3	0.09
Total Emissions							**NOx Total**	**66.58**	**VOC Total**	**12.62**

Horsepower Hours

hp-hr = # of engines*hp*LF*hrs/day*days of operation

Load Factors (LF)

Load Factor represents the average percentage of rated horsepower used during a source's operational profile. For this worst case estimate, LF is held at 0.8 for all equipment. Typical is 0.4 to 0.6 (Reference: EPA 2000)

Emission Factors (EF)

NOx Emissions Factor for Off-Road Construction Equipment is 6.86 g/hp-hr (Tier 1 Emission Standard 40 CFR 89.112(1))

VOC Emissions Factor for Off-Road Construction Equipment is 1.30 g/hp-hr

Emissions (g) = Power Demand (hp-hr) * Emission Factor (g/hp-hr)

Emissions (tons) = Emissions (g) * (1 ton/907200 g)

Assumptions

Assume 20 cubic yards per truck and one hour to make a 20 mile round trip

Assume 20 minutes to load each truck at the sand source

EPA 2000. Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data. EPA 420-R-00-022.

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FINDING OF NO SIGNIFICANT IMPACT

A 750-foot long spur jetty attached to the northern jetty at the mouth of the Saco River and 365,000 cy of beach fill with periodic nourishment is the optimal Federal plan to prevent and mitigate erosion damages to Camp Ellis Beach, Saco, Maine from the Saco River Federal Navigation Project.

I find that based on the evaluation of environmental effects discussed in this document, the decision on this application is not a major Federal action significantly affecting the quality of the human environment. Under the Council on Environmental Quality ("CEQ") NEPA regulations, "NEPA significance" is a concept dependent upon context and intensity (40 C.F.R. § 1508.27.) When considering a site-specific action like the proposed project, significance is measured by the impacts felt at a local scale, as opposed to a regional or nationwide context. The CEQ regulations identify a number of factors to measure the intensity of impact. These factors are discussed below, and none are implicated here to warrant a finding of NEPA significance. A review of these NEPA "intensity" factors reveals that the proposed action would not result in a significant impact—neither beneficial nor detrimental--to the human environment.

<u>Impacts on public health or safety</u>: The project is expected to have no negative effect on public health and safety and improve public safety by reducing erosion.

<u>Unique characteristics</u>: There are no unique characteristics associated with this project.

<u>Controversy</u>: The proposed project is not controversial. State and Federal resource agencies agree with the USACE impact assessment.

<u>Uncertain impacts</u>: The impacts of the proposed project are not uncertain, they are generally understood based on extensive investigations and wave modeling.

<u>Precedent for future actions</u>: The proposed project is a shoreline damage mitigation project, part of the Continuing Authority Program. Future projects will require their own independent analyses, reviews, and decision making that will not be subject to the decision made here.

<u>Cumulative significance</u>: As discussed in the EA, to the extent that other actions are expected to be related to the project as proposed, these actions will provide little measurable cumulative impact.

<u>Historic resources</u>: The project will have no known negative impacts on any pre-contact, contact, or post-contact archaeological sites recorded by the State of Maine. As a result of coordination with the State Historic Preservation Office, it has been

determined that no cultural resources will be impacted by the proposed beach fill and spur jetty construction.

Endangered species: The project will have no known negative impacts on any State or Federal threatened or endangered species. The proposed project may provide additional nesting habitat for the piping plover.

Potential violation of State or Federal law: This Federal action would not violate Federal or State law.

Measures to minimize adverse environmental effects of the proposed action are discussed in Section 7 of the EA. These include the following measures:

- The beach fill will be placed between October 1 through March 31 to avoid potential impacts to piping plovers and spawning benthic organisms.
- The City of Saco, ME will secure an approved U.S. Fish and Wildlife Service beach management plan prior to placement of beach fill.
- Beach fill placement will begin at the north end of the project area to minimize potential piping plover impacts and the beach will have a 1:10 slope. Construction of the jetty spur is not restricted.
- The beach fill will be composed of similar grained sand.

Based on my review and evaluation of the environmental effects as presented in the Environmental Assessment, I have determined that the Section 111 Shoreline Damage Mitigation Project at Camp Ellis Beach, Saco, Maine is not a major Federal action significantly affecting the quality of the human environment. Therefore, this action is exempt from requirements to prepare an Environmental Impact Statement.

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DATE

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Charles P. Samaris
Colonel, Corps of Engineers
District Engineer

CLEAN WATER ACT SECTION 404 (b)(1) EVALUATION
U.S. ARMY CORPS OF ENGINEERS, NEW ENGLAND DISTRICT
CONCORD, MA

PROJECT: Shoreline Damage Mitigation Project, Camp Ellis Beach, Saco, Maine

PROJECT MANAGER: Mr. Richard Heidebrecht Phone: (978) 318-8513

FORM COMPLETED BY: Ms. Catherine Rogers Phone: (978) 318-8231

PROJECT DESCRIPTION:

The Federally recommended plan, also referred to as Alternative 6, consists of a 750-foot long spur jetty and beach fill along Camp Ellis Beach. This alternative is intended to prevent further shoreline losses north of the existing northern jetty located at the mouth of the Saco River. These two project features are described in the following paragraphs:

The spur jetty would be attached, and placed perpendicular to the existing north jetty, at a point about 1,475 feet from the shoreline. The top of the structure would be about 15 feet wide and at an elevation of 14.5 feet MLLW. The seaward and landward side slopes of the jetty would be 1 vertical on 2 horizontal. The spur consists of an outer layer of armor stone which would be about 10 feet thick with average weight of 10 – 13 tons. This armor layer is underlain by smaller stones with an average weight of two tons that form the core of the structure. The seaward side and head section of the structure would include a layer of toe stone about six feet thick and 10 feet wide to prevent underscour. For overall stability, the stone structure would be placed on two layers of marine mattress. Marine mattresses are rock-filled containers constructed of high-strength geogrid. These mattresses would be laced together to form a stable foundation for the spur jetty. Cross sections of the spur jetty are shown below.

Due to increased turbulence at the spur and jetty junction, and the potential for damage to the existing north jetty, about 400 feet of the existing jetty seaward of the spur jetty would require reinforcement. Modifications to the first 200 feet of the north jetty include, raising the top elevation to prevent a large increase in overtopping, flattening the slope from the current 1 vertical to 1.5 horizontal to 1 vertical on 2 horizontal, adding armor stone, and reinforcing the toe to prevent scour. The toe of the existing structure would be reinforced an additional 200 feet for scour protection. North jetty reinforcement would also be placed on two layers of marine mattress for stability.

Alternative 6 also includes placing beach fill along Camp Ellis Beach. Beach fill would be placed from the existing north jetty to a point about 3,250 feet to the north. The proposed beach berm elevation is about 17.4 feet MLLW, the same approximate height as the natural beach berm to the north. The berm width would vary based on topography, but the minimum beach berm width required in the southern section is 60 feet and the minimum width required in the north section is 70 feet. Sand placed on the beach will have a 1:10 beach slope which, at low tide, would create a beach width of about 170 feet. Approximately 365,000 cubic yards of sand would be needed to create the beach on an approximately 13 acre footprint. Placement of beach fill would begin at the north end of the project and continue to the south to avoid potential impacts to nesting piping plovers at Ferry Beach. Beach fill placement would occur between September 1 and March 31. It is anticipated that sand fill would be transported to the site by trucks.

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
Evaluation of Clean Water Act Section 404(b) (1) Guidelines

PROJECT: Camp Ellis Beach, Saco, Maine – Shoreline Damage Mitigation Project

1. Review of Compliance (Section 230.10(a)-(d)).

   a. The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to, or be located in the aquatic ecosystem to fulfill its basic purpose. |X| YES |__| NO

   b. The activity does not appear to: 1) violate applicable state water quality standards or effluent standards prohibited under Section 307 of the CWA; 2) jeopardize the existence of Federally listed threatened and endangered species or their critical habitat; and 3) violate requirements of any Federally designated marine sanctuary |X| YES |__| NO

   c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values |X| YES |__| NO

   d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem |X| YES |__| NO

2. <u>Technical Evaluation Factors (Subparts C-F)</u>.

	N/A	Not Significant	Significant*
a. Potential Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C).			
1) Substrate.		X	
2) Suspended particulates/turbidity.		X	
3) Water.		X	
4) Current patterns and water circulation.		X	
5) Normal water fluctuations.		X	
6) Salinity gradients.	X		
b. Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D).			
1) Threatened and endangered species.		X	
2) Fish, crustaceans, mollusks and other aquatic organisms in the food web.		X	
3) Other wildlife.		X	
c. Potential Impacts on Special Aquatic Sites (Subpart E).			
1) Sanctuaries and refuges.	X		
2) Wetlands.	X		
3) Mud flats.	X		
4) Vegetated shallows.	X		
5) Coral reefs.	X		
6) Riffle and pool complexes.	X		
d. Potential Effects on Human Use Characteristics (Subpart F)			
1) Municipal and private water supplies.	X		
2) Recreational and commercial fisheries.		X	
3) Water related recreation.		X	
4) Aesthetics.		X	
5) Parks, national and historic monuments, national seashores, wilderness areas, research sites, and similar preserves.	X		

3. <u>Evaluation and Testing (Subpart G)</u>.

a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)

1) Physical characteristics......................... | X |
2) Hydrography in relation to known or anticipated sources of contaminants.............. | |
3) Results from previous testing of the material or similar material in the vicinity of the project .. | |
4) Known, significant sources of persistent pesticides from land runoff or percolation ..... | |
5) Spill records for petroleum products or designated hazardous substances (Section 311 of CWA) .... | |
6) Public records of significant introduction of contaminants from industries, municipalities, or other sources ..... | |
7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities .... | |
8) Other sources (specify) .... | |

List appropriate references.

Environmental Assessment for Camp Ellis Beach, Saco, Maine - 2013

b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredge or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and disposal sites and not likely to require constraints. The material meets the testing exclusion criteria.

| X | YES |__| NO

4. Disposal Site Delineation (Section 230.11(f)).

a. The following factors, as appropriate, have been considered in evaluating the disposal site.

1)	Depth of water at disposal site	| X |
2)	Current velocity, direction, and variability at the disposal site	| X |
3)	Degree of turbulence	| X |
4)	Water column stratification	| |
5)	Discharge vessel speed and direction	| |
6)	Rate of discharge	| X |
7)	Dredged material characteristics (constituents, amount, and type of material, settling velocities)	| X |
8)	Number of discharges per unit of time	| X |
9)	Other factors affecting rates and patterns of mixing (specify)	| X |

List appropriate references:

Environmental Assessment for Camp Ellis Beach, Saco, Maine - 2013

b. An evaluation of the appropriate factors in 4a above indicates that the fill site and/or size of mixing zone is acceptable

YES	NO
| X |	| |

5. Actions To Minimize Adverse Effects (Subpart H).

All appropriate and practicable steps have been taken, through application of recommendation of Section 230.70-230.77 to ensure minimal adverse effects of the proposed discharge.

YES	NO
| X |	| |

List actions taken:

The beach fill will be placed between October 1 through March 31 to avoid potential impacts to piping plovers and spawning benthic organisms. A U.S. Fish and Wildlife Service approved beach management plan for piping plovers will be in place prior to placement of beach fill. Construction of the jetty spur is not restricted.

6. Factual Determination (Section 230.11).

A review of appropriate information as identified in items 2 - 5 above indicates that there is minimal potential for short or long term environmental effects of the proposed discharge as related to:

a.	Physical substrate (review sections 2a, 3, 4, and 5 above).	YES | X | NO | |
b.	Water circulation, fluctuation and salinity (review sections 2a, 3, 4, and 5).	YES | X | NO | |
c.	Suspended particulates/turbidity (review sections 2a, 3, 4, and 5).	YES | X | NO | |
d.	Contaminant availability (review sections 2a, 3, and 4).	YES | X | NO | |
e.	Aquatic ecosystem structure, function and organisms(review sections 2b and c, 3, and 5)	YES | X | NO | |
f.	Proposed disposal site (review sections 2, 4, and 5).	YES | X | NO | |
g.	Cumulative effects on the aquatic ecosystem.	YES | X | NO | |
h.	Secondary effects on the aquatic ecosystem.	YES | X | NO | |

7. Findings of Compliance or Non-compliance.

The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines . YES | X | NO | |

DATE

Charles P. Samaris
Colonel, Corps of Engineers
District Engineer