DRAFT ENVIRONMENTAL IMPACT REPORT FOR THE ROSEATE TERN (*Sterna dougallii*) BREEDING HABITAT ENHANCEMENT AT BIRD ISLAND IN MARION, MASSACHUSETTS (NHESP-02-NBHTR)

SECTION ONE - INTRODUCTION

The Garrett Group, LTD (TGG) functioning as the agent for the Division of Fisheries and Wildlife *(MassWildlife)* and the inter-agency Project Management Team (PMT), has been contracted to guide the above-referenced project through a detailed MEPA review and a multi-jurisdictional permitting process. Under a previous contract, the effort was initiated with the preparation and submission of an Environmental Notification Form (ENF) for MEPA review (EOEA File No. 12490); and the holding of three (3) inter-agency pre-application meetings to determine the general environmental suitability and permittability of the proposed project.

The primary purpose of the proposed project, as defined by the federal inter-agency review and presented in USACOE (2001)[1] states:

> *"...to increase nesting habitat at Bird Island in order to support increased numbers of roseate terns and common terns, in support of the federal recovery plan for the roseate tern, and to stabilize the shoreline to protect the lighthouse of Bird Island."*

Bird Island is approximately 1.5 acres in area and is situated in Buzzards Bay, southwest of Butlers Point at the entrance of Outer Sippican Harbor. Please refer to Figure 1 - Site Locus. As reported (Bourne et al. 2001)[2], the location of the island based on the Massachusetts State Coordinate System is N2705706.0 and E8700007.0 (Lat. 41.669°N and Long. 70.718°W).

Existing features on the island include a deteriorating stone revetment and a stone and masonry lighthouse facility that is listed on the National Register of Historic Places and is maintained by the Bird Island Preservation Society. The base of the lighthouse structure is set at an approximate elevation 9.0-ft mean low water (MLW). Existing grades vary from elevation 4.0-ft to approximately elevation 10.0-ft. The island includes shoreline frontage of approximately 1,250 linear feet. The granite stone revetment extends along approximately 1,100 linear feet of the intertidal shoreline. The northern extent of the island is not armored and extends to an elongated gravelly/ sandy beach and intertidal/subtidal spit. Please refer to Figure 2 which graphically

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1 Correspondence from C. Godfrey (USACOE) to B. Blodgett *(MassWildlife)*, date 03-16-01.

2 Bourne Consulting Engineers. 2001. Bird Island Restoration Project. In association with ENSR and ACRE. October 2001. pgs 25 w/att.

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describes the existing conditions at Bird Island. The island provides critical nesting habitat for both Roseate Terns (*Sterna dougallii*) and Common Terns (*S. hirundo*) as well as other shore birds. In addition, Bird Island and the contiguous areas associated with Buzzards Bay are characterized by important coastal resources, including coastal beach, intertidal wetlands, shellfish habitat, and Eelgrass (*Zostera marina*) populations.

The Roseate Tern is a migratory seabird and restricts its habitat to the immediate coast. Roseates have a scattered breeding distribution primarily in the tropical and sub-tropical Atlantic, Indian, and Pacific Oceans. In North America, it breeds in two discrete populations: from Nova Scotia south to New York and in the Caribbean. The northeast population is among the northernmost nesting groups of this mostly tropical species. The Roseate's wintering range is poorly known, but increasing evidence indicates that northeastern birds winter along the north and east coasts of South America and southward along the coast of Brazil.

The northeastern population of the Roseate Tern is listed as endangered[3] at both the federal and state levels of jurisdiction, principally because of its range contraction and secondarily because of its declining numbers. By the 1880's, persecution of terns for the plume industry greatly reduced numbers in the northeast to perhaps 2,000 pairs. Following protection, numbers rose to the 8,500 pair level in 1930. From the 1930's through the 1970's, Roseates were displaced from nesting colonies by Herring Gulls *(Larus argentatus)* and Great Black-backed Gulls *(L. marinus)*, and had declined to 2,500 pairs by 1979. Currently, the northeast population averages about 4,300 pairs (1,697 in MA in 2001). Approximately 75% are concentrated at just 3 colonies: Great Gull Island, New York (1,500 pairs); Ram Island in Mattapoisett (626), and Bird Island in Marion (1,062) Desertion of approximately 30 major breeding sites over the past 80 years typically is the result of gull occupation, and secondarily, to predation in the colonies. The gradual loss of breeding sites in the northeast, coupled with the Roseate's reluctance to colonize new sites, is a serious obstacle to recovery of the northeast population.

In Massachusetts, the Roseate Tern generally nests on sandy, gravelly, or rocky islands. Roseate Terns have very specialized habitat requirements; however, are always found nesting in close association with the Common Tern. Roseate Terns, being less aggressive then their Common Tern brethren, seem to rely on the Common Tern's aggressive tendencies to protect their own nests. They usually place their nests in dense vegetation, such as Seaside Goldenrod *(Solidago sempervirens)* or Beach Pea *(Lathyrus maritima)*, or in structural elements (e.g., rubble or stone formations, or against rock or wooden debris), whereas Common Terns tend to nest in open sandy areas with limited vegetation. Roseate's appear to enjoy the security of crevices and structural backing to their nesting sites. Nest boxes are also used.

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3 Commonwealth of Massachusetts. 2000. Massachusetts Natural Heritage Atlas 2000-2001 Edition. NHESP - Boston, MA, Species List.

Roseates primarily feed on juvenile fish. They forage in highly specialized situations over shallow sandbars, shoals, inlets or schools of predatory fish, which drive smaller prey to the surface. Unlike the Common Tern, the Roseate rarely feeds very close to shore, and in Massachusetts, it is known to forage up to 30 km from the breeding colony.

The Common Tern is a migratory seabird that breeds in the northern hemisphere, principally in the temperate zones of Europe, Asia, and North America, and at scattered tropical and sub-tropical locations. In North America, it breeds along the Atlantic Coast from Labrador to South Carolina, and along lakes and rivers as far west as Montana and Alberta. Outside of the breeding season, the Common Tern is widely distributed throughout the temperate latitudes. Birds breeding on the Atlantic coast generally winter on the north and east coasts of South America as far south as northern Argentina.

The Common Tern is listed as a Species of Special Concern in Massachusetts[3] Populations are well below levels reported pre-1870, when hundreds of thousands are reported to have bred. Egging probably limited populations throughout the 1700's and 1800's. More seriously, hundreds of thousands were killed along the Atlantic coast by plume-hunters in the 1870's and 1880's, reducing the population to a few thousand at fewer than ten known sites by the 1890's. In Massachusetts, only 5,000 to 10,000 pairs survived, almost exclusively at Penikese and Muskeget Islands. The state's population grew to 30,000 pairs by 1920, following protection of the birds in the early part of the century. Populations subsequently declined through the 1970's, reaching a low of perhaps 7,000 pairs, largely as a result of displacement of terns from nesting colonies by Herring and Great Black-backed Gulls. Since then, numbers have crept upwards. In 2001, 14,378 pairs nested in the state. Over 80% of these birds were concentrated at just three sites: South Monomoy Island, Chatham (7,807 pairs); Bird Island, Marion (2,136 pairs); and Ram Island, Mattapoisett (1,890 pairs). Populations in Massachusetts continue to be threatened by predators and displacement by gulls. Also, should established nesting colonies be disrupted, lack of suitable (i.e., predator-free) alternative nesting sites is a serious concern in the state. Gull control at South Monomoy and Ram Islands has resulted in thriving Common Tern colonies at these restored sites. Two other tern restoration projects (at Penikese and Muskeget Islands) are currently underway; both involve clearing gulls from small portions of the islands.

In Massachusetts (Nisbet 2002)[4], the Common Tern generally nests on sandy or gravelly islands and barrier beaches, but also occurs on rocky or cobbly beaches and salt marshes. As compared to the endangered Roseate Tern, with which it often breeds, it prefers much more open nesting habitat (20-30% vegetative cover). This scattered vegetation is used for cover by chicks. Although Common Terns sometimes (e.g., in parts of Bird and Ram Islands) attempt to nest in areas with continuous cover of vegetation, these areas are unsuitable for them and they are usually unsuccessful in raising young. When they nest in such areas, they compete for space with Roseate

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[4] Nisbet, I. C. T. (2002). Common Tern (*Sterna hirundo*). *In* The Birds of North America, No. 618 (A. Poole and F. Gill, eds.). Birds of North America, Inc., Philadelphia, PA.

erns, which prefer vegetated habitats and can nest successfully there, and may be adversely ffecting Roseate Terns at these sites. The Common Tern feeds mainly on a wide variety of ıvenile fish; frequently it includes crustaceans and insects in its diet. Along the Atlantic coast in ıe breeding area, it usually feeds within 1 km of shore, often in bays, tidal inlets, or between slands; it may forage as far as 20 km from the breeding colony.

The long-term goal of the management program for Buzzards Bay is to restore Penikese Island as major breeding site, and to maintain three large and productive colonies of both Common and Roseate Terns at Bird, Ram and Penikese Islands. In the short- and medium-term, Bird Island is he most important of the three sites, because it currently supports 25-30% of the North American population of the federally endangered Roseate Tern, and because terns of both species have displayed a strong tendency to remain there despite deteriorating conditions. The objective of this project is to reverse this deterioration and to increase the stability and productivity of both species of tern at Bird Island; this is considered essential to meet the long-term goals of the project and to permit a steady increase in total numbers. In the long-term, Penikese Island has the potential to become the largest colony-site for Common Terns (based on historical observation), but all three sites are of roughly equal importance for Roseate Terns. Achievement of the long-term goal of he management program for Buzzards Bay would be an important step in meeting the goals of the Recovery Plan for the Northeastern Population of the Roseate Tern.

Bird Island is exposed to the long southwest fetch of Buzzards Bay where large wave forces originate causing a continued erosion of island materials. These materials have historically been distributed to the subtidal environment to the north and northeast of the island, in the lee of this fetch (Figure 2). Bird Island is subject to intense coastal storms, most notably hurricanes and nor'easters which yield extreme water surface elevations and severe wind generated waves. The wind and wave climate which characterize the site were detailed in Bourne et al. (2001). That report, based upon empirical wind and wave records, notes that the predominant wind direction at the site is from the southwest. The coastal processes analyzed considered the effects of winds originating between 90 and 225 degrees due to the effective restriction of the fetch lengths from other directions. The analysis demonstrated that the mean wave conditions at the site, based upon typical wind conditions over the fetch to the south of Bird Island, generated offshore significant wave heights (H_s), of approximately 1.3-ft with a wave period of about 2.5 seconds.

A historic armoring effort took place in the mid-1800's to protect the island and its lighthouse. This armoring consists of granite stone revetment which nearly surrounds the entire island and is in various stages of disrepair. The stone revetment was placed in attempt to protect island features and retain the materials which comprised the island. The effort has retarded island erosion, but has not eliminated it. An expanding and widening ring inside the armoring has been eroded of soils, sand and gravel, and is now intermittently flooded by extreme high tides and supports salt marsh and salt panne resources. These areas formerly supported Common Tern nesting habitat, and are now unsuitable for nesting habitat for either the Roseate or Common

Terns. The creation of these resources are the result of historic anthropogenic activity(ies) and natural processes, that now meet the definitions of protected and jurisdictional wetland resources (Figure 2).

The lighthouse has recently undergone extensive restoration. It also appears that the presence of the lighthouse and its foundation structure has assisted in stabilizing the center portion of the island at elevations 9.0 to 10.0-ft.

During recent site visits on March 15, April 11 and 29, 2002 which included flooding and ebbing tidal conditions, observations indicated that the jurisdictional areas inside the stone revetment only have hydrologic/hydraulic communication with the surrounding Buzzards Bay during storm events, when the island is overtopped by storm waves and tides, or during extreme astronomic high tides. Nearshore areas outside of the stone revetment, include cobbly sandy intertidal and subtidal shoals which support extensive Rockweed (*Fucus* spp.), Knotted Wrack (*Ascophyllum* spp.), Eelgrass *(Zostera marina)* and Green Fleece *(Codium fragile)* stands. Eelgrass and Green Fleece stands being reported by the Massachusetts Division of Marine Fisheries (MADMF 1999)[5]

The ENF filing provided a basic project description and required technical attachments. The Certificate (the Certificate) from the Secretary of Environmental Affairs (the Secretary), on the ENF and as presented in the Preface of this Draft Environmental Impact Report (DEIR), stated,

> *"[p]ursuant to the Massachusetts Environmental Policy Act (MEPA) - MGL c. 30, ss. 61-62H and Sections 11.05 and 11.06 of the MEPA regulations (301 CMR 11.00), I hereby determine that this project requires the preparation of an Environmental Impact Report (EIR)...because it involves an alteration requiring a variance in accordance with the Wetlands Protection Act...It will also require a Chapter 91 License and 401 Water Quality Certification from DEP...The project will also require a Conservation Permit from [NHESP]..."*

Not included in that finding is that the proposed project will also require a Section 401 and 404 permits under the Federal Clean Water Act and a Federal Consistency Review finding under the Commonwealth's Coastal Zone Management Program.

The Certificate presents the following scope which the DEIR must respond:

- *General* - The DEIR should follow the general guidelines for the preparation and circulation of the DEIR as required by MEPA, as modified by the Certificate; reprint and respond to all comments presented during the ENF's public comment period and which are germane to MEPA jurisdiction; and make copies of the DEIR available to Marion Public Library and those who request individual copies.

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5 Correspondence from G. Sawyer (MADMF) to C. Bradley (Town of Marion-Marine Department).

- *Alternatives* - Expand on the alternatives analysis presented in the ENF to address the MEPA's mandate of avoidance or minimizing all damage to the environment. This will require a comprehensive analysis of the no-build alternative which will detail and document an existing conditions database. Also, a detailed analysis of all alternatives is required to justify the variance required for preferred alternative to be permitted.

- *Project Permitting* - The DEIR should include a description of each state permit or agency action required by the proposed project, and discuss how the project will meet all jurisdictional requirements and performance standards for each state permit, particularly regarding the Conservation Permit and the variance from the Wetland Protection Act.

- *Wetlands* - The DEIR should fully describe all wetland resource areas and buffer zones present on-site, and include these resources on a reasonably scaled plan; should detail the specific significance of the identified resources (e.g. storm damage prevention and wildlife habitat); analyze both direct and indirect impacts on the wetlands resulting from the proposed project; quantify direct wetland impacts; and establish that said impacts have been minimized to the maximum feasible extent.

- *Rare Species* - The DEIR should address all conditions required by the Conservation Permit.

- *Historical and Archeological Resources* - Massachusetts Historical Commission (MHC) has determined that the project will have "no adverse effect" on the historic, architectural, archeological or cultural characteristics of the Bird Island Lighthouse.

- *Construction Impacts* - Evaluate the impacts related to project construction, including erosion and sedimentation impacts, losses of vegetation, and wildlife resources, including rare species habitat.

- *Proposed Section 61 Findings* -The DEIR should summarized both on- and offsite mitigation commitments (if necessary), including timetables, and responsible parties.

The purpose of this DEIR is to coordinate and present all findings from all previous technical studies, and any new analyses required to fully comply with the scope of services presented in the Certificate. The report will form the contents of the DEIR; and will be incorporated within, or accompany under separate cover, all regulatory submittals required by the proposed project.

The DEIR presents a comprehensive description of the project need, project implementation methods and operations, the existing environmental conditions in the project area, various project alternatives considered, and rationale for specific project recommendations, project impact assessment, compensatory project mitigation needs to offset said impacts, response to all public comments presented on the ENF, and the recommendation of the Least Environmentally Damaging Practicable Alternative (LEDPA). The DEIR has been organized as follows:

Preface:	The ENF Certificate
Section One:	Introduction,
Section Two:	Proposed Project,
Section Three:	Existing Conditions,
Section Four:	Project Alternatives Analysis,
Section Five:	Development of Compensatory Mitigation Strategies (On- and Offsite),
Section Six:	Response to ENF Comments, and
Section Seven:	Recommended LEDPA.
	Technical Appendices
	Plans and Figures

Technical Appendices are included and provide technical information in support of findings and recommendations presented within the body of the DEIR. Preliminary design details are provided on the enclosed Plans and Figures.

A comprehensive *Wetland Assessment Report* has been prepared by TGG and submitted to the USACOE - Regulatory Branch and MADEP SERO[6] - Wetland Section for review and approval. This DEIR identifies and characterizes each salt marsh and salt panne resource on Bird Island (federal and state). It also presents a Functions and Values Assessment (F&V) and a "Protectable Interests" Assessment that evaluates the environmental significance of each identified and delineated resources under the existing and proposed conditions for each alternative, and under the proposed compensatory mitigation proposal; and an Essential Fish Habitat Assessment (EFH) that evaluates all existing intertidal and subtidal conditions at Bird Island. Findings made in the *Wetland Assessment Report* are summarized within this DEIR. Copies of the *Wetland Assessment Report* can be made available upon request.

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6 Massachusetts Department of Environmental Protection - Southeast Regional Office

ldlife proposes a habitat restoration project to increase the area suitable for Common sting so they will occupy these new areas and relieve the current pressure and ment of Roseate Terns, from their preferred nesting habitat. Filling all or part of the low-eas which currently support salt marsh and salt panne resources will increase the area of bstrate and vegetation suitable for Common Tern nesting by a factor of two or more. The d activity will not effect the existing densely vegetated areas which currently are preferred support Roseate Terns. The proposed filling and rehabilitation of the stone revetment will nance island stabilization and provide further protection to the existing and restored al lighthouse structure.

alternatives were presented in the ENF and based on that preliminary alternatives analysis. tive 3 proposes to fill portions of Bird Island to create greater nesting habitat area for e and Common Terns and installation of nest boxes within the island's retaining wall, and termined to be the "preferred project alternative" Section Four of this DEIR presents a etailed and comprehensive analyzes of all alternatives considered for this project. ative 3 requires the filling of all existing salt marsh and salt panne areas within the stone ent, and is depicted on Figure 3. The jurisdictional wetland areas will be converted into ted uplands to restore lost Common Tern nesting habitat, to stabilize island sediments and nd provide additional protection to the historically significant lighthouse. Current thinking s consistent with the ENF presentation, however *MassWildlife* is looking at various fill s within the Alternative 3 concept, that attempt to limit proposed effects on the salt es, while still attempting to meet the project objectives. These include not filling Salt Marsh ernative 3a) and not filling a portion of Salt Marsh 1 (Alternative 3b).

never alternative is selected as the LEDPA, it will require authorization at the federal and levels (various permits) and a variance from the Massachusetts Wetlands Protection Act and menting Regulations (MGL c. 131, s. 40 and 310 CMR 10.00 et seq), hereafter referred to WPA.

fore-mentioned *Wetland Assessment Report*, which is presented under separate cover, ifies and characterizes each salt marsh and salt panne resource on Bird Island. It also nts a Functions and Values Assessment (F&V) and a "Protectable Interests" Assessment that evaluate the environmental significance of each identified and delineated resources under the ing conditions, and an Essential Fish Habitat Assessment (EFH) that evaluates all existing tidal and subtidal conditions at Bird Island. These existing conditions evaluations also ent the environmental conditions proposed under the Alternative 1 - No Action Alternative as ribed in the ENF. These findings provide the basis for the project impact presented in Section of this DEIR.

The salt marsh and salt panne resources which reside in the low scoured portions of the island, are the result of the on-going and dynamic erosion of the island. Observations indicate that these are isolated resources and have limited hydrologic/hydraulic communication with the surrounding Buzzards Bay during storm events, when the island is overtopped by storm waves and tides, or during wind driven or extreme high tides.

CONSTRUCTION OPERATIONS

Whichever alternative is finally determined to be the LEDPA, several fundamental design and construction elements are common to all, including the total rehabilitation of the existing stone revetment which extends around the western, southern, and eastern shoreline of the island. In addition, each alternative will require the importation and placement of fill material (e.g sand and stone) to achieve a recommended finish grade. It is anticipated that some re-vegetation of portions of the island will be required.

Sediment Sources for Required Fill Material

When the project was originally conceived, it was thought that all, or a portion of the fill material would be generated from a local dredging project(s) located in portions of Sippican Harbor near Ram Island, and/or from the shoal or "Borrow Area" which exists north and northeast of Bird Island (Figure 2). The latter represents materials that have eroded from Bird Island under various storm conditions from the southwest, and were deposited in the lee of these forces.

Several independent evaluations have indicated that dredging of the "Borrow Area" may cause adverse effects to very sensitive subtidal resources, may not be acceptable to several of the regulatory agencies, may not be reliable in providing the appropriate grain size distribution required for preferred Common Tern nesting habitat, and may not yield enough volume of material to complete the project. The latter would require the identification of additional sources, and require an additional construction procedures.

Section Three of this DEIR discusses this issue in more detail and recommends that the required sand and stone be provided from upland quarry(s) and sand pits located in the eastern Massachusetts region. These construction materials will be loaded onto barges and delivered to Bird Island at scheduled intervals. An upland stone source may be available from a local site in Marion, MA.

Work Components

The Project will require the delivery of up to 8558 cy (proposed Alternative 4 of the ENF) of graded and processed sand, approximately 2,000 tons of surge and armor stone, as well as the

equipment and personnel to perform the work, to Bird Island. Construction operations will require six fundamental work components, including:

- Mobilization/Demobilization of equipment to Bird Island;
- Transport and delivery of construction materials to Bird Island;
- Stockpiling and hauling of materials on Bird Island;
- Placement of stone for restored stone revetment;
- Placement and grading of fill; and
- Vegetation restoration.

In addition, daily ferry service for construction personnel will be required during morning and afternoon shift deployment and for emergency situations in the case of injury or health issues, as well as site visitations by project engineering, regulatory, and oversight personnel.

Mobilization / Demobilization

Prior to initiation of construction activities on Bird Island, limited basic support infrastructure will have to be established. Figure 4 provides a graphical description of these support facilities. These facilities will include:

- Temporary floating pier;
- Temporary haul road;
- Temporary field office facility to be located in the existing lighthouse;
- Fencing to restrict access to habitat areas;
- Erosion and sedimentation controls;
- Temporary fuel transfer facility at the pier; and
- Material stockpile area.

Temporary Pier: A temporary floating pier, comprised of steel interlocking modules and fixed in-place by driven timber anchor piles, will be installed in the northeast section of the island, north of the existing stone revetment. This floating pier will extend to the approximate seaward limit of the 5-ft contour and will impact the sand bottom over most of its length during low tide cycles. The pier will be approximately 32-ft wide and 120-ft long (3840 sf). This pier will be used to offload the material barges and to transfer the construction materials into haul trucks for delivery to the work site(s) and stockpile facility.

Haul Road: A temporary haul road, approximately 24-ft wide by 200-ft long will extend from the pier site to the work areas, and will include a turn-around section at its southern terminus. The haul road will be constructed of temporary interlocking composite panels placed directly on the sand surface. Some minor grading will be required to provide a continuous sand foundation for the road panels.

Temporary Field Office: A temporary field office will be established on the ground floor of the existing lighthouse structure. The lighthouse affords a secure, weather-tight facility for storage of project documents, maintaining safety and first-aid materials, maintaining a communications center, limited storage for hand tools and small equipment, and protection from the elements in the case of extreme climatic events. It is anticipated that temporary power will be provided to the facility by a propane powered generator and heat will be offered from a small propane heating unit. *MassWildlife* is aware that a limited electric battery power source, that powers the lighthouse beacon, currently exists on the island. These batteries are charged by an on-site solar panel. *MassWildlife* does not advocate co-mingling that limited and dedicated power source (navigation and safety) to also power construction equipment. Therefore, an additional clean power source (propane generators) is proposed.

Habitat Protection Fencing: Three (3) distinct areas have been identified which currently support Common and Roseate Tern nesting areas. These areas, as depicted on Figure 3 above elevation 6-ft, will not be filled or modified as a part of the proposed work. These areas will be physically and visually segregated and isolated by the installation of 4-ft high orange construction barricade fencing around each perimeter. The barricade fencing will be supported on driven steel posts, placed at 5-ft intervals. A gate will be maintained in the barricade surrounding the lighthouse nesting area to provide personnel access to the temporary office facility.

Erosion and Sedimentation Controls: Erosion and sedimentation controls, consisting of temporary silt fence and hay bale containment, will be established around the stockpile area and each wetland resource to be maintained. Specifically, Wetland SM 4, SM 5, SM 7 and maybe portions of Wetland SM 1 will be isolated with the silt fence and hay bales. The silt fence will be 3-ft high and the fence toe will be anchored in a 6-in deep backfilled trench along its entire length. Wood support posts will be fixed to the fencing at 5-ft intervals. Hay bales, placed along the downgradient face of the fencing will be staked into the ground with two (2) stakes. The erosion and sedimentation controls will be maintained on a daily basis. Prior to the initiation of each day's work activities, a complete visual survey of the control infrastructure will be made by the site supervisor or his designate. Any deficiencies in the fencing or hay bale elements will be corrected prior to the initiation of any site work.

Temporary Fuel Transfer Facility at Pier: The construction equipment will require periodic fueling. It is estimated that the equipment will consume an average of approximately 40 gallons of fuel by each piece of equipment or approximately 160 gallons of fuel each day. It is anticipated that approximately 480 gallons of diesel fuel will have to be delivered to the island every three (3) days that the site is active. Appendix A presents a computation sheet detailing anticipated fuel usage. A tug boat will be used to deliver the fuel to the temporary pier site. The fuel will be pumped from the tug directly into each

piece of construction equipment. The equipment will be driven to the pier and placed within a diked containment pan during the fuel transfer operation. The containment pan will be a permanent component of the pier facility. The pier facility will maintain a containment boom on-site for use should an inadvertent fuel spill occur during any transfer operation. In addition, the site operator will enter into an agreement with an authorized spill control contractor to maintain a 24-hour emergency on-call service in the case of any spill, to assure rapid response and immediate containment and clean-up of any fuel spill.

Material Stockpile Area: A temporary stockpile area will be established in the area of the existing salt pannes. This facility will incorporate an area approximately 60-ft x 100-ft and will be enclosed by a temporary silt fence and hay bale containment structure. The area will serve as a temporary storage area for the approximate 1,000 tons of stone to be incorporated with the existing stone for the reconstruction of the stone revetment. The facility will also be used as a surge pile area, storing up to approximately 1,000 cy of sand during the filling and grading of the upland areas.

Transport and Delivery of Construction Materials

All construction materials will be transported to Bird Island via barge and tug service. It is anticipated that the bulk products (e.g. stone and sand) will be loaded onto the material barges at existing shoreside facilities within the Buzzards Bay or eastern Massachusetts region. It is likely that these barges will range in size between 600 cy and 1,100 cy capacity. The specific barge specifications will vary depending upon the availability and the site requirements. The loaded draft of the barges will likely range between 3-ft and 8-ft, thus requiring manipulation of delivery with tidal conditions. All of the materials will be offloaded over the temporary pier by front-end loader and transferred into haul trucks. The haul trucks will deliver the bulk materials to the stockpile area for temporary storage.

Stockpiling and Hauling of Materials

The stockpiling requirements will be dependent upon the rate of progress of the construction activities. It is anticipated that the total construction activities will require approximately six months. It is likely that this term will span the September - March period. The stockpile area will be sufficient to temporarily store the anticipated 2,000 tons of additional stone required for the rehabilitation of the stone revetment. Delivery will best be accomplished with the careful coordination of those activities with favorable weather conditions. Reconstruction of the revetment and seawall will be completed before the importation of any sand fill. Therefore, the stone work, using the stockpiled stone, will be completed before any sand is required. It is anticipated that the stone work will require approximately five months to complete, while the sand placement and finish grading will be completed in approximately one month. Following the completion of all heavy stone and sand placement and grading, it is anticipated that some limited re-vegetation of areas impacted by construction activities will be required. In addition, vegetation

compatible with Common Tern nesting habitat will be established in those upland areas filled as a part of the project activities. All required vegetation will be delivered to the island and immediately planted, thus requiring only minimal handling and storage.

Placement of Stone for Restored Stone Revetment

Storm related waves can be significantly larger than those reported by Bourne et al. (2001). The predominant direction of approach for severe storm waves ranges from the southwest to southeast. The height and periods for storm related waves originating over these southerly fetches are generally dependent upon wind speed and duration, water depth, and fetch distance. Water surface elevation conditions at the site are summarized on Table 2-1.

Table 2-1: Stillwater Elevations in the Vicinity of Bird Island[1]

Water Surface Event	Elevation (ft), MLW
100-Yr Flood	+15.7
50-Yr Flood	+13.6
10-Yr Flood	+9.4
1-Yr Flood (High Tide Line)	+5.5
Mean High Water (MHW)	+4.4
NGVD	1.4
Mean Low Water (MLW)	0.0

Storm waves were characterized using the empirical Sverdrup-Munk-Bretschneider Method (USACOE 1984)[2], hereafter referred to as the SMB Method. A computational model, using the SMB Method corrected for shallow water effects, was developed for TGG by John C. Roberge, P.E., LLC, and was used to estimate storm wave conditions for the various water surface and wind states which characterize the site. The results of these analyses are summarized in Table 2-2. Computation sheets are presented in Appendix B.

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1 USACOE. 1988. New England Coastline Tidal Flood Survey. New England District, Waltham, MA.

2 USACOE. 1984. *Shore Protection Manual*, 4th ed., 2 vols., US Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, Vicksburg, MS, US Government printing Office, Washington, D.C., Chap. 3.