

*Lighthouse Inn Groin Improvements
West Dennis, Massachusetts
MEPA Environmental
Impact Report*

*Prepared For:
Lighthouse Inn Inc.
April 2017*

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GROUP

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April 14, 2017

Secretary Matthew A. Beaton
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114

RE: Environmental Impact Report
Lighthouse Inn Groin Improvements
West Dennis, Massachusetts

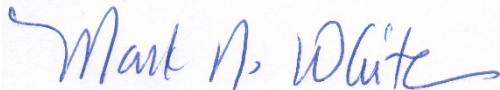
Dear Secretary Beaton:

On behalf of the LHI, Incorporated (LHI), Environmental Partners Group, Inc. is submitting this Draft Environmental Impact Report (DEIR) for the Lighthouse Inn Groin Improvements project in accordance with the Massachusetts Environmental Protection Agency (MEPA) Statute (M.G.L. Chapter 30 Section 61-62I) and MEPA Regulations (301 CMR 11.00).

LHI filed an Environmental Notification Form (ENF) for the project that was noticed in the Environmental Monitor on December 7, 2016. The Secretary's Certificate on the ENF, issued on January 6, 2017, determined that a DEIR is required for this project. This DEIR therefore provides a complete and detailed description and analysis of the project and its alternatives, an assessment of its potential environmental impacts, proposed Section 61 mitigation measures sufficient for the appropriate State agencies to fulfill their obligations in accordance with MGL c. 30, Section 61, and responses to all comments received on the ENF. Agencies and persons receiving copies of this EIR are listed in Appendix H.

Once again, we appreciate the guidance that your staff has provided to LHI as this DEIR was being prepared. Please feel free to contact me if you have any questions or need clarification with any of the information contained herein.

Very Truly Yours,
Environmental Partners Group, Inc.



Mark N. White
Sr. Project Manager

Enclosure: MEPA EIR for Lighthouse Inn Groin Improvements

CC: Refer to Appendix H for Distribution List
Greg Stone, LHI Inc.
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File



Lighthouse Inn Groin Improvements

MEPA Environmental Impact Report

*Project Municipality: Dennis, MA
Project Watershed: Cape Cod
EEA Number: 15623*

April 14, 2017

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OF THE LIGHTHOUSE INN MEPA EIR

MEPA ENVIRONMENTAL IMPACT REPORT FOR LIGHTHOUSE INN GROIN IMPROVEMENTS

This Environmental Impact Report (EIR) describes the proposed Lighthouse Inn Groin Improvements project. This EIR has been prepared pursuant to the Massachusetts Environmental Policy Act and Section 11.06 of the MEPA regulations (310 CMR 11.00). The project does not exceed a Mandatory EIR threshold, however, a discretionary EIR was required by the Secretary of Energy and Environmental Affairs Office.

Lighthouse Inn, Inc. (LHI Inc.) filed an Environmental Notification Form (ENF) for the project, which was noticed in the Environmental Monitor on December 7, 2016. The ENF was subject to an extended comment period and included a detailed description of the project, alternatives, baseline environmental conditions, and identified project mitigation measures.

The Secretary's Certificate on the Expanded ENF was issued on January 6, 2017 (provided in Appendix A) and states that "...comments from State and regional agencies request further analysis of alternatives and disclosure of potential environmental impacts in an EIR. Based on the review of the ENF and consultation with State Agencies, I hereby require the Proponent to prepare a Draft EIR..." This EIR includes a detailed description of the project and any changes to the project since the filing of the ENF, an analysis of the project and its alternatives, an assessment of its potential environmental impacts, proposed Section 61 mitigation measures sufficient for the appropriate State agencies to fulfill their obligations in accordance with MGL c. 30, Section 61, and responses to all comments received on the ENF.

A description of the project as it is currently proposed is provided in Section 1.0. Modifications to the project from what was described in the ENF is provided in Section 2.2.

1.0 Summary

1.1 Overview

LHI, Inc. is located in West Dennis, Massachusetts and owns the Lighthouse Inn. The proposed project area comprises approximately 550 feet of ocean shorefront along the Lighthouse Inn shoreline. The shorefront includes three rock groins which are the westernmost of a broader field of ten groins. The groins extend between 130 and 240-feet in length from the upland. A shore parallel breakwater spans between the two center groins with a gap opening of about 25-feet. The small size of this gap does not allow sufficient wave energy into the embayment, behind the breakwater, to maintain a natural sand beach and it acts to trap detritus within the embayment.

The proposed shorefront improvements, shown in the attached proposed improvement design plans (Appendix B), would reconfigure the existing groins to a design that is more conducive to maintaining shore protection for the historic lighthouse and a sand beach while improving natural tidal flow and flushing between the two western groins. These improvements would remove 54 feet, approximately 1/3rd, of the breakwater and shorten the length of the central-eastern groins. It would reconfigure the rock to a geometry that is more effective in stabilizing the beach, reducing detrital accumulation, and restoring more natural sand beach conditions along the shorefront. The proposed plan entails removal of approximately 3,250 square feet of existing rock structure, and it will construct approximately 2,900 square feet of new rock structure, by total footprint as shown on the plans. The proposed plan likewise requires placement of beach compatible sand fill after reconfiguration of the rock structures to renourish the sand beaches.

Specifically, the plan would reconfigure the removed rock to construct a T-head groin between the 1st and 2nd groins and construct heads at the ends of each of the existing groins (with the exception of the eastern most groin), to create three crenulated embayments, commonly referred to as pocket beaches. The plan would create two gaps of approximately 54 feet to stabilize the two embayment beaches and replace the non-flushing pool behind the existing long breakwater. The central T-head groin will be added by constructing a shore-perpendicular stem of approximately 77-feet long behind the central breakwater. Additionally, approximately 7,100 cubic yards (CY) of beach-compatible sand will be imported and placed to fill the beach cells.

An important purpose of the proposed project is that it seeks to beneficially reconfigure the shoreline's existing structures. The existing groin structures have acted to promote and partly maintain shore protection and a sand beach since the adjacent inlets and shoreline were modified. The proposed plan improves and

optimizes these structures through incorporation of contemporary advances and experience in the use of coastal structures with respect to their ability to maintain a stable sand beach of predictable geometry, particularly where subject to the erosion stress from adjacent coastal inlets.

1.2 Need for the Project

The proposed project will reconfigure the a rock groin system along the Lighthouse Inn shorefront such that the groins are more conducive to maintaining shore protection and a sand beach, while improving natural tidal flow and flushing between the two western groins. These shoreline improvements will provide better protection to the adjacent Inn at the property, and will also preserve and protect a light house on the property that was constructed in 1855 and continues to this day to be permitted by the Coast Guard as a private aid to navigation.

As further described in Section 4.2, the No-Action Alternative would retain the status quo condition of a minimal sand beach, poor water circulation and excessive accumulation of detrital seagrass that has been consistently present for many years and exhibits no sign, nor practical expectation of, improvement without intervention. There is neither indication nor physical reason to expect that these adverse conditions will change or improve without prudent corrective action.

2.0 Project Description

2.1 Description of the Project

The proposed project area comprises approximately 550 feet of ocean shorefront along the Lighthouse Inn shoreline. The shorefront, shown in the design plans included in Appendix B, includes three rock groins which are the westernmost of a broader field of ten groins. The groins extend between 130 and 240 feet in length from the upland. A shore parallel breakwater spans between the two center groins with a gap opening of about 25 feet. The small width of this gap does not allow sufficient wave energy into the embayment behind the breakwater to maintain a natural sand beach, and it acts to trap detritus within the embayment.

The proposed shorefront improvements, shown in the attached proposed conditions plan in Appendix B, would reconfigure the existing groins to a design that is more conducive to maintaining shore protection and a sand beach while improving natural tidal flow and flushing between the two western groins. Specifically, the project would construct the following:

- Remove 27' length of the breakwater east of the existing gap and a 54' length of the breakwater along its remainder. This will create two gaps of about 54 feet wide each and two beach embayments behind the existing breakwater.
- Construct a shore-perpendicular stem of about 77-ft length behind the central remaining breakwater head (shown as S3 on the design plans, Appendix B). The stem and remnant breakwater head creates the central T-head groin that defines and stabilizes the two embayment beaches, replacing the non-flushing pool behind the existing long breakwater. The stem crest elevation would be about +2.4' NAVD (about 2' lower than the breakwater crest) and the landward end would be buried into, or intersect, the beach slope just above the higher high waterline.
- Remove an approximately 52' length of excess boulders from the end of the existing central groin (S4/S5), seaward of the breakwater and spur groins.
- Construct a short, 28-ft long spur-groin at the seaward ends of the existing west groin (S1) and existing central groin (S5). The spur-groins will break up the seaward-directed return flow that otherwise runs along the existing straight groins and, in turn, decreases beach stability. The western spur-groin S1 creates a small anchor to the downdrift end of the Town beach to improve & stabilize the sand berm elevation along the western seawall. The eastern spur-groin S5 creates a small anchor to the updrift end of the eastern beach cell to improve & stabilize the sand berm elevation along the eastern seawall, specifically where it joins the existing central groin and where the beach is otherwise lowest in elevation.

- Renourish the beach area by importing and placing approximately 7,100 cubic yards (cy; 9,585 tons) of beach-compatible sand to fill the beach cells to, and initially beyond, their predicted design capacity – where the latter is indicated by the contour lines, elevations and slopes in the drawing (Appendix B). The beach fill would be approximately distributed as 550 cy to the western cell, 5750 cy to the middle two cells, and 800 cy to the eastern cell. The sand fill would be imported from upland quarries and/or from permitted excavation or dredge activities elsewhere (not on this site).
- The boulders removed from the breakwater and the seaward end of existing groin S4/S5 would be relocated/re-used to construct the stem and spur groins. To the extent that there is not an exact balance, additional boulders may be imported and placed if required and/or surplus (excess) boulders would be removed from the site.

2.2 Design Basis for the Project

Embayment beaches provide a reliably predictable beach geometry and stability that is described in the literature and understood through experience with many projects constructed during the past 30 years, including projects of scale and setting similar to the proposed project (Silvester & Hsu, 1993; Berenguer & Enriquez, 1988; Bodge, 1998; Hardaway & Gunn, 1999; Hanson & Kraus, 2001; among others). The incorporation of T-head (or ‘fishtail’) style groins is central to most of these projects. The specific coastal engineering design principles of the project are described in Appendix E, and summarized below.

The project design employs the observed principle that the ‘design shoreline’ is located between 0.35 to 0.65 times the gap-width behind the gap opening, where the latter value is germane to the central portion of the cell, particularly in higher energy and tide range regimes. The design shoreline is between the mid-tide and low-water shoreline elevations; or, about -1.0 ft NAVD’88 at this site. The proposed project beach behind the breakwater reflects a design shoreline set-back of (i) about 0.65 times the gap distance in the middle of the beach cell, and (ii) about 0.38 times the gap distance at the corners of each cell.

The slope of the project beach above and below the design shoreline reflect the ambient beach slopes measured along the adjacent natural beach profiles; i.e., about 1 vertical 9 horizontal (1:9) from the dry berm (+6.2’) to mean high water (MHW; +1.6’); 1:14 from MHW to NAVD (0.0’); and, 1:20 below 0.0’ to the intersection of the existing seabed at about -3.5’ to -4.0’. The elevations of the bulkhead and the rock revetment (rip-rap) crest along the property are about +7.8’ and +6.5’, respectively (the elevations vary).

The project design, with the beach slopes described above, seeks to create a stable beach berm of +6.2' to +7.0' along the central bulkhead between the two western groins to mostly bury the rock revetment with a dry sand berm, improve direct access between the sand beach and the upland, and create an additional sand reservoir along the back beach for storm protection. The observed dry beach berm elevation along the ambient, adjacent shorelines is about +6.2' at most higher high tides, more or less.

The proposed project beach west of the western groin, and east of the middle groin, reflects a semi-embayment (headland) design. Here, the design beach elevations are determined by the short spurs (S1 and S5 – see Appendix E) at the ends of the groins. At beaches with limited sediment supply, such as this site, empirical data indicate that the beach elevation at the base of the bounding groin, or headland, is about ½ the mean tide range below mean low water (MLW) (Bodge, 1998); or, about -3.8' NAVD at this site. The elevation may be slightly shallower at the downdrift end of a beach cell (e.g., -3.5') such as at structure S1 on the western end of the site; and, it may be slightly deeper at the updrift, anchor end of a beach cell (e.g., -4.0') such as at structure S5 near the eastern end of the site. The design beach elevation at the seaward ends of the spur groins is thus established at -3.5' and -4.0' at these two locations (S1, S5) respectively. From that elevation, the design beach grade immediately behind the spur groins is thence established by the same beach slopes described above (Figure 9 of Appendix E). The design profile is mostly limited to the reach immediately leeward of the spur groin, beyond which the profile transitions to the adjacent, ambient beach profile.

In this way, there is a modest increase in beach elevation and stability along the bulkhead immediately west of the western groin (behind spur S1), and immediately east of the central groin (behind spur S5). At the western end (S1), the berm elevation is increased to +6.2' (from about +4') to marginally cover the rock revetment along the bulkhead and improve lateral beach access from West Dennis Beach. At the eastern end (S5), the berm elevation is increased to +4.5' (from about +3.1'), which will improve -- but not complete -- the sand cover over the rocks along the bulkhead and improve lateral beach access from the east. No substantial change in the resultant beach profile is predicted at the far east end of the project site (immediately west of the existing eastern groin S6); however, placement of advance sand fill is included at this location in the project design, as a conservative contingency to provide additional sand supply to the eastern section of the property.

The project beach contours described above and shown in the design drawings (Appendix B) represent the target beach geometry expected from the project and as computed from dozens of similar prototype projects constructed of similar scale. The ultimately achieved beach geometry may be lesser (lower or narrower),

but not likely greater. Project construction will fill the beach to the contours indicated in the design drawings (Appendix B) plus an advance fill contingency. Based upon the September 2016 beach geometry, the volume required to fill the design beach contours is about 5,900 cubic yards. Initial project construction will place at least 7,100 cubic yards of beach-compatible sand fill, which includes the 5,900 cy design volume plus 1,200 cy advance fill (20%). The advanced fill is intended to overfill the design template as pre-emptive mitigation against potential erosion impacts to the adjacent shorelines from project construction. Sand fill placement to the adjacent shorelines (viz., east of Lighthouse Inn) is not included in the project plan because this is not the property of Lighthouse Inn. Instead, as a mitigative measure, additional sand overfill – described above – will be placed within the eastern project cell. Beach conditions will be surveyed prior to construction and adjustments made to the sand fill and advanced fill volume to account for erosion since the September 2016 survey.

The height, width, and length of the proposed structures and beach grade are the minimum and optimal dimensions necessary to achieve the required stable beach geometry through consideration of all those engineering principles described above, particularly within the configuration of the existing site and its structures, so as to minimize and avoid adverse environmental/littoral impacts in keeping with the State's guidance for Coastal Zone Management.

Periodic beach renourishment may be required to maintain the beach at its design contours. The ultimate requirement will depend upon storm impacts and project performance. Typical prudent guidance for similar projects includes renourishment at 2- to 5-year intervals at about 10% of the initial design volume per year. However, that said, no project renourishment has been required to-date for the majority of the dozens of similar T-head and embayment projects constructed by this project's concept designer (Olsen Associates, Inc.) over the last 25 years (Bodge, 1998 & personal communication).

2.3 Project Changes since ENF Filing

The proposed project plan, presented herein, differs from the project plan described in the ENF as follows.

- The currently proposed plan results in a net reduction of rock structures compared to existing conditions, whereas the previous proposal would have resulted in a net increase. The current plan will remove approximately 3,250 square feet of existing rock structure, and it will construct approximately 2,900 square feet of new rock structure, by total footprint, resulting in an overall net decrease in rock structure footprint of approximately 350 square feet relative to existing conditions. The plan proposed in the ENF proposed to remove approximately 4,179

sf of rock structures and add approximately 4,225 sf of rock structures, resulting in a net increase of 46 sf of rock within the groin field.

- The proposed plan will decrease the length of the existing central groin (S4/S5) from about 207 feet to about 155 feet by removing 52-ft length of excess rocks from the seaward end, seaward of the breakwater (unchanged from the ENF except that the dimensions are more accurately stated per the site survey).
- The proposed plan will not remove the excess rocks from the western groin (S1/S2) seaward of the breakwater, in contrast to the plan presented in the ENF. As described in the Alternatives Analysis, it was determined that construction actions to remove these submerged, scattered rocks would likely present the potential for net adverse impacts to the existing seabed, eelgrass and benthic habitats.
- The proposed plan will remove an approximately 81 foot length of the existing breakwater (versus 77 feet described in the ENF) to develop two gaps of about 54 feet wide each and two embayments behind the breakwater.
- The proposed plan will not construct a rock spur groin at the end of the easternmost existing groin (S6) and it will not undertake any modifications to that easternmost existing groin, as was proposed in the ENF. The length of the remaining spur groin at this cell (S5), on the east end of the central groin, is increased from 23 feet to 28 feet.
- The proposed plan decreases the length of the rock spur groin at the end of the westernmost existing groin (S1) from 34 feet to 28 feet.
- The proposed plan does not include notching or lowering the existing groins.
- The proposed plan will place approximately 7,100 cubic yards of imported beach-quality sand fill to nourish and overfill the beach cells after the rock structures are modified – as described in the ENF but not otherwise specifically quantified.

These modifications of the proposed plan, relative to the similar plan described in the ENF, were adopted to further minimize and avoid potential adverse environmental impacts and to likewise result in a net reduction in the overall rock structure area and footprint relative to existing conditions.

2.4 Timetable

LHI hopes to complete permitting activities during the spring and early summer of 2017 such that the construction activities for the project can commence during the fall of 2017. The project will be completed in one phase of construction. Construction will include partial removal of existing groin structures,

addition/extension of existing groin structures, and beach nourishment including sand fill, and is expected to be completed within approximately two months of them being initiated.

2.5 Construction Protocol and Methodology

The construction protocol and methodology for the proposed groin reconfiguration and beach nourishment program consists of the following:

- A preconstruction meeting will be held, to include the owner, contractor, engineer and appropriate local authorities and regulators to discuss the construction methodology, sequencing and schedule, and the pertinent permit conditions to be followed,
- Prior to construction the contractor limit of work area will be located and a pre-construction survey will be performed to establish reference benchmark elevations.
- In accordance with the proposed beach monitoring plan, the beach profile at each transect location will be surveyed immediately prior to the construction activities commencing.
- The construction access is anticipated to be from the west end of LHI's parking lot. This parking lot will also be used for materials staging, therefore temporary sand fill and matting will be placed for pavement protection.
- Temporary sand fill will be placed to create ramps to be used for equipment access over the seawall to the beach area.
- The construction equipment consists of a track excavator and loader for transporting stone and sand fill material to the work zone from the staging area. Spill kits will be available onsite at all times.
- With the exception of a limited area on the southeast area of the work zone, all access shall be within the existing rectangular stone area. A small access extension at the southeast corner of the work zone will be necessary to retrieve the excess stone from the southeast groin extension.
- The access route to the construction area will consist of two confining walls that are 2' x 2' 4' blocks laid dry and set in place, 14' apart and sand filled to an elevation sufficient to allow the excavator to operate during a 3-hour period on both sides of low tide. The sand fill will be consistent with the sand material specified for the beach nourishment.
- Once the stone work is completed at each groin the block-constructed access corridor shall be disassembled block-by-block, allowing the sand fill to remain in place. Subsequent block-constructed access ways to the remaining groins where work is to be performed will be installed and removed as necessary, following the same methodology.

- The work activities will generally occur from the east to the west area of the work zone. Existing stone temporarily removed will be stockpiled for re-use in accessible locations within the existing groin enclosure. The stone core material will be stored in a non-buoyant still bin within this enclosed zone.
- Each proposed new groin segment shall be constructed to match the foundation extent, side slope, width and elevation of the existing segment that it is joining. The joint shall be effected by disassembly and inspection of the segment to be joined. Replacement stones shall be integrated into the existing groin segment such as to create a continuous groin of similar uniformity.
- To preserve aquatic growth such as rockweed on the salvaged stone, effort shall be made to utilize existing stones originating from the older subtidal groin segments for use in the proposed subtidal portions of the proposed new segments.

2.6 Estimated Project Cost

The estimated cost of the proposed project is \$400,000. A summary of the items comprising the cost estimate are shown in Table 1.

TABLE 1. COST ESTIMATE.

Item	Total
Engineering, Permitting and Design	\$106,339.00
Relocation of Rock	\$184,600.00
Beach Compatible Sand	\$96,000.00
Placement of Beach Compatible Sand	\$12,000.00
TOTAL	\$398,393.00

3.0 Consistency with Planning

3.1 Dennis Comprehensive Plan

Dennis last updated their Local Comprehensive Plan in 2002. The Plan identifies a number of goals that are a priority to the community, one of which is the protection of the Town beaches/shoreline. The Dennis Comprehensive Plan indicates that the protection of Dennis beaches are an asset to the Dennis economy as they attract summer residents. The proposed project will protect and improve the southern shoreline in front of the Lighthouse Inn and improve the aesthetics of the area.

The Comprehensive Plan aims to preserve and maintain a healthy and natural environment, encourage outdoor recreation and retain community character. The proposed project is consistent with these goals, as it proposes to improve the tidal flow between the groins, reduce the accumulation of detritus between the groins, and improve the aesthetics of the area.

3.2 Cape Cod Commission Regional Policy Plan

The Cape Cod Commission's Regional Policy Plan (RPP) was originally adopted in 1991 and has been updated and amended several times, the most recent of which is dated August 17, 2012. The RPP was reviewed with respect to the following goals and performance standards that are applicable to the proposed project:

Economic Development Goal – Low-impact and Compatible Development (ED1): promote the design and location of development and redevelopment to preserve the Cape's environment and cultural heritage, use infrastructure efficiently, minimize adverse impacts, and enhance the quality of life for Cape Codders.

The project will also provide better protection to the Lighthouse Inn property and the lighthouse constructed in 1855, which is consistent with the Cape Cod economic development goal for the preservation the Cape's environment and cultural heritage. Additionally, protecting the Lighthouse Inn will provide economic benefit to the Inn and surrounding community as it enters its seventy ninth season in business. The Inn provides public access to the shores of Nantucket Sound, through offering the restaurant to the local community and accommodations to the traveling public. Economic job opportunities to the community are provided by the Inn (13 year-round jobs and an additional 75 seasonal jobs) and the Inn also provides significant tax revenues to the State and the Dennis community (most recently, State tax revenue of \$217,017 and local tax revenue of \$115,805).

Open Space and Recreation Goal – Open Space and Natural Resources (OSI): preserve and enhance the availability of open space that provides wildlife habitat and recreational opportunities, and protects the region’s natural resources and character.

The proposed project will have little if any impact to open space and aims to improve shore protection and provide beach nourishment. The project is consistent with the Cape Cod Regional Plan coastal resource goals which are to preserve and protect coastal areas. The project aims to revitalize the beach area between the existing groin structures.

Wildlife and Plant Habitat Goal – Prevent Loss, Minimize Adverse Impact, and Maintain Diversity (WPHI): Prevent the loss or degradation of critical wildlife and plant habitat, to minimize the adverse impact of new development on wildlife and plant habitat, and to maintain existing populations and species diversity.

LHI Inc. has designed the proposed improvements to minimize impacts to wildlife and plant habitat including avoiding construction in existing eelgrass beds that are adjacent to the project.

This review of performance goals associated with the Regional Policy Plan and the LHI proposed groin improvements is intended to convey the consistency of the project with these goals, and that LHI objectives for the project support these goals.

3.3 Massachusetts Coastal Erosion Commission

In addition to the project’s consistency with the Dennis Municipal Comprehensive Plan and the Cape Cod Commission’s Regional Policy Plan, the project is in accordance with the recommendations of the Massachusetts Coastal Erosion Commission (Report of the Massachusetts Coastal Erosion Commission, December 2015), whose purpose was to develop strategies for reducing, minimizing or eliminating the magnitude and frequency of coastal erosion and its adverse impacts on property, beaches and dunes. The January 2015 Report states on page IV “the Commission identified a few key, high level themes including... (2) support for the sensible use of pilot projects to advance new and creative solutions and encourage innovation in shoreline management approaches...”

4.0 Alternatives to the Project

The proposed groin improvements are described in Section 2. The objectives of the project are to (1) restore more natural, stable sand beach conditions along the 550-ft property shorefront of the Lighthouse Inn, (2) improve water circulation and decrease the accumulation of silt and detrital seagrass along the shoreline, (3) maintain and/or improve shore protection of the upland from storm tides and seas, and (4) minimize/avoid adverse environmental impacts from the work. The following Project Alternatives were considered with regard to the fulfillment of these objectives. Figures representing the different alternatives are provided in Appendix C.

4.1 Background on the Preferred Alternative

The preferred alternative, as shown on Figure 5 of Appendix C, seeks to minimize and avoid impacts to sensitive habitats while reconfiguring the groins by removing portions of the breakwater to create two gaps that are 50- to 55-feet in width, with beach fill placement in the lee. No modifications or spur groins are proposed for the eastern-most existing groin so as to minimize or avoid the potential for adverse impacts to the shoreline east of the project site. This will reduce the degree to which beach improvements may be realized along the eastern seawall (relative to alternatives discussed below), but some improvements will still be made by the spur groin (S5) that will serve to anchor the beach at its updrift end, where it is otherwise narrowest. The preferred alternative is feasible, constructible, meets project objectives, minimizes and avoids adverse impacts, and results in a net decrease in overall structure footprint.

No removal of the “excess” rocks at the end of the existing eastern groin (S1/S2) is proposed, in order to avoid the potential of collateral environmental damage caused by construction activities to remove these rocks. While it is acknowledged that removal of these boulders would increase the potential available area for eelgrass colonization along the seabed, it is also evident that there is no practical means to reach and remove these scattered, mostly submerged rock boulders without damage to the existing eelgrass resources near the boulders. Leaving these excess boulders in place would avoid the potential for adverse damage to the adjacent seabed and it would preserve the existing biotic community that exists among the submerged rocks.

The preferred alternative results in a slight net decrease in the project’s overall structural footprint. By simple length measure, it will remove 81 feet of existing breakwater, plus 52 feet of excess boulders from the end of groin S4/S5; or a decrease of 133 feet in total. It will add 56 feet of spur groins (S1 and S5) and 77 feet of low-elevation stem behind breakwater head S3; or an increase of 133 feet in total. Thus, the preferred alternative presents zero (0) net increase in overall structure length. Up to about 10 feet of the

landward portion of the stem (S3) will be mostly buried in sand. Hence, the change in overall structure footprint is zero (0) net increase, or a net effective decrease of up to about -10 feet, by length measure.

By area measure, the preferred alternative will remove approximately 3,250 square feet of existing rock structure, and it will construct approximately 2,900 square feet of new rock structure, by total footprint (Figure 5 in Appendix C). Thus, this alternative presents an overall decrease in rock structure footprint of approximately 350 square feet relative to existing conditions, more or less, and irrespective of burial by the project's sand fill.

Lastly, the preferred alternative will import and place approximately 7,100 cubic yards (9,585 tons) of beach-compatible sand to fill the beach cells to, and initially beyond, their predicted design capacity – where the latter is indicated by the contour lines, elevations and slopes in the design drawing provided in Appendix B. The beach fill would be approximately distributed as 550 cy to the western cell, 5750 cy to the middle two cells, and 800 cy to the eastern cell. The sand fill would be imported from upland quarries and/or from permitted excavation or dredge activities elsewhere (not on this site).

4.2 Alternative Design Considerations

The No-Action Alternative (additionally described in Section 4.3 below), retains the status quo, in which (1) the central 280-foot (approximate) shorefront between the site's existing two western groins exhibit poor water circulation, limited or no natural sand beach conditions, and excessive accumulation of mud and seagrass detritus, and (2) the western 130-ft and eastern 140-ft of shorefront exhibit limited or marginal dry sand beach. See Figure 1 in Appendix C. The No-Action (status quo) condition has been consistently presented for many years and exhibits no sign, nor practical expectation of, improvement without project intervention; and it does not meet, and cannot meet, the project objectives.

4.2.1 Alternative 1 - Remove Breakwater

This alternative would remove all or a substantial part of the existing shore-parallel breakwater between the two western groins. Complete removal of the breakwater would leave in place only the three existing shore-perpendicular rock groins. This condition existed previously and resulted in chronic or frequent severe wave attack, over-wash, flooding and damage of the upland property – for which reason the breakwater was originally constructed between the two groins. Accordingly, the alternative of complete removal of the breakwater is not considered further because it reflects a historical condition that previously did not, and would not, provide upland shore protection, with or without beach nourishment.

4.2.2 Alternative 2 - Partial Removal of Breakwater

Partial and substantial removal of the breakwater – to increase the size of the existing gap in the structure – would result in wave and flooding damage of the upland property, even with beach fill placement in the lee. Figure 2 in Appendix C illustrates an example of this alternative, in which almost half (45%) of the breakwater length is removed. This would increase the existing breakwater gap from about 30 feet to 130 feet, creating a narrow beach embayment (relative to its length) with 80-foot long spur groins on either side. The beach width is insufficient to allow for a stable berm and slope to be maintained along the central half of the shorefront. That is, the center half of the shorefront would feature little or no dry beach and would be subject to wave impact and overwash from storm tides and seas. Further, the 80-foot lengths of the bounding spur groins (the remnant breakwater) are too long to be conducive to flushing and circulation in their lee. Instead, spur groin lengths of 30 to 65 foot lengths are preferable, though not absolute, dimensions of bounding spur groins for low- to high- tide range and energy wave regimes, per empirical experience.

Removal of greater lengths of the breakwater – relative to that shown in Figure 2 – would further increase the upland’s exposure to wave damage and further reduce the width of the stable sand beach. In the limit, the breakwater gap cannot be more than about 55 to 60 feet in width (versus the example of 130 feet shown in Figure 2 of Appendix C) to ensure that there is a dry, stable beach berm along the entire upland seawall, leeward of the gap, given the site’s wave energy, tide range, typical beach slopes, and limited distance between the breakwater and the seawall – even with beach fill placement. That is, an alternative that removes significant portions of the breakwater and results in a gap-opening of greater than about 55 to 60 feet does not provide for an adequate dry beach and reliable shore protection along the property. In addition, an alternative that results in bounding spur groin lengths (remnant breakwater sections) that are excessively long does not promote adequate circulation and flushing behind the structures. Accordingly, Alternative 2 with its single gap and lengthy spur groins (remnant breakwater sections) does not meet the project objectives.

4.2.3 Alternative 3 - Segmented Breakwater

This alternative would remove portions of the breakwater to create two gaps of 50 to 55 feet in width, with beach fill placement in the lee. See Figure 3 in Appendix C. The net result would be one beach embayment with bounding groins of about 60-ft length and a segmented center breakwater of about 60 feet in length. The geometry (width) in the lee of the two gaps would be marginally capable of supporting a stable beach berm and slope along most of the upland wall, assuming that the beach geometry behind the two gaps could be maintained. If a shore-perpendicular structure (“stem”) is not present to segregate the two gaps, waves and currents between the two gaps will chronically erode the beach. Specifically, in the presence of oblique

wave attack – common to this site – waves enter the gaps and wash between them. The updrift waves flood the embayment and flow out of the downdrift gap, carrying sand with the flow. This ultimately erodes the beach. Addition of a low stem behind the segmented center breakwater “breaks up” the flow between the two gaps, and this has been demonstrated in many similar projects to stabilize a beach with similar geometries. The center stem is necessary to define the two beach embayments, creating two “pocket” beaches.

This alternative is not recommended because prototype experience indicates that it is not capable of reliably maintaining a beach in the lee of the two gaps, given the absence of a “stem” that segregates the flow between the gaps and which better defines two embayments. Additionally, this alternative does not provide improved beach stability and shore protection along the east or west thirds of the property shoreline.

4.2.4 Alternative 4 - T-Head Embayment and Beach Nourishment

This alternative is similar to the preferred alternative in that it creates a T-head and embayment beach design along the entire shoreline. See Figure 4 in Appendix C. It is identical to the segmented breakwater alternative discussed above but adds a low stem behind the central segmented breakwater to create two beach embayment cells in the lee of the existing breakwater. It also adds a spur groin to the end of the western groin, and adds interior-facing spurs to the ends of the 2nd and 3rd eastern groins. Imported beach fill nourishment is placed from off-site sources.

Spur groin S1 breaks up the rip current along the existing western groin and anchors the beach along the western third of the property and at the terminus of the Town of Dennis beach, allowing a stable dry beach berm along most of the Lighthouse Inn’s western seawall. The low stem behind the segmented (remnant) breakwater section S3 prevents the wash of waves and currents between the two breakwater gaps, creating two pocket beaches behind the breakwater gaps and a dry beach berm along the center of the Lighthouse Inn seawall. The spur groins S5 and S6, at the ends of the two eastern groins create a minor beach embayment and better allow for a dry beach berm along the eastern third of the Lighthouse Inn seawall. In sum, these structural modifications, with concurrent beach fill placement, potentially allow for a stable dry beach berm and slope along the entire property and seawall. The additional beach, and particularly the displacement of the non-flushing areas behind the breakwater by a stable sloping sand beach, reduce the accumulation of detrital seagrass while also providing protection to the shore. The structural dimensions of this conceptual alternative are approximately described as follows:

- The lengths of the breakwater gaps and remnant sections (spurs) are as described above in Alternative 3, with gap openings of about 54 feet – adequate to develop a dry beach berm of

+6.2' to +7.0' elevation that mostly buries the rock revetment in sand along the existing seawall, leeward of the existing breakwater.

- The location and nominal 36 foot length of the spur groin S1 reflects the approximate groin length needed to develop a dry beach berm of +4.5 to +6.2 foot elevation along the western seawall, mostly but not completely burying the rocks along the seawall, at a berm elevation consistent with the adjacent beach elevation to the west, thereby allowing lateral dry beach access from the west. The 36 foot length reflects the width between the predicted seabed elevation at the toe of the groin (-3.8' NAVD, or ½ the mean tide range below MLW) and the MLW line (-2.0' NAVD), for which the ambient slope is 1:20 x 1.8' vertical height = 36 feet.
- The approximate 87 foot long stem behind segmented breakwater S3 reflects the necessary length to span between the breakwater and nominal wave uprush upon the beach face (+3.8' NAVD). The stem would be mostly buried within the sand between the two gaps, with the landward end of 10 to 15 feet segment of the stem typically buried within sand beach berm.
- The approximate 26 foot and 30 foot lengths of the spur groins S5 and S6 that define the eastern embayment are those necessary to create a gap that is approximately 80 feet wide that would develop a dry beach berm of +6.2 ft elevation along most of the leeward seawall and rocks. This would bury most of the rock revetment along the eastern third of the seawall in sand between the eastern two groins, allowing lateral dry beach access from the east.

4.2.5 Alternative 5 - Beach Nourishment Alternative

This alternative (not illustrated) would add beach fill along all or the entire project shoreline in order to improve beach conditions, with no structure modifications. This alternative would not meet the project objectives. Consistent prior experience demonstrates that the existing breakwater structure and its gap do not allow for a normal, well-flushed beach to develop along the center of the site, despite prior addition of sand. And, the beaches along the eastern and western thirds of the site exhibit the more or less expected beach capacity in existing conditions. Sand fill added to the existing site would likely be eroded within one season, the central breakwater area would still not flush, and the project site would promptly return to its existing condition. This alternative is not recommended.

4.3 The Proposed Project versus the No Action Alternative

The 'no-action' alternative is presented as Figure 1 in Appendix C. The 'no action' alternative retains the status quo, in which the central approximately 280 foot shoreline between the site's existing two western groins continue to exhibit poor water circulation, limited or no natural sand beach conditions, and excessive accumulation of mud and seagrass detritus. The western 130 foot and eastern 140 foot of shoreline exhibit

limited or marginal dry sand beach. This status quo condition has been consistently observed for many years and exhibits no sign, nor practical expectation of, improvement without intervention. There is neither indication nor physical reason to expect that these adverse conditions will change or improve without corrective action. The No-Action Alternative cannot meet the project objectives.

5.0 Existing Environment

5.1 Physical Setting

The Site is located in West Dennis, Massachusetts along the Lighthouse Inn shorefront. The Town of Dennis is at the base of Cape Cod and is characterized by its coastline to the south (Nantucket Sound). The proposed project area comprises approximately 600 feet of ocean shorefront along the Lighthouse Inn shoreline. The shorefront includes three rock groins which are the westernmost of a broader field of ten groins.

The groins extend between 130 and 240 feet in length from the upland. A shore parallel breakwater spans between the two center groins with a gap opening of about 25 feet. The limited width of this gap does not allow sufficient wave energy into the embayment behind the breakwater to maintain a natural sand beach and it acts to trap detritus within the embayment. An existing rock revetment and vertical concrete bulkhead separate the beach area landward of the parallel breakwater from the upland grassy lawn in front of the Inn's primary building.

5.2 Geology and Soils

The glacial sediments of Cape Cod were deposited both by glaciers, glacial lakes and glacial melt-water processes that left a variety of deposits ranging from layers of low permeability clay to coarse sand and gravel materials. Much of the aquifer deposits in the Cape are stratified younger outwash deposits, some of which extend to bedrock in many areas or are underlain by glacial lake deposits in other areas. The younger outwash deposits of the Dennis quadrangle are of the Sandwich moraine.

Beach sediments along this shoreline are composed of medium- to fine-grained sand with median grain size of about 0.3 to 0.33 mm (WHG 2010). Sediments dredged from the adjacent Bass River and Swan Pond River inlets are typically as coarse or coarser than the native beach sediments (WHG 2010).

5.3 Sediment Quality

Three offshore sediment samples were collected in the vicinity of the Lighthouse Inn beach for grain size analysis. In summary, all three samples had a measure of shell fragments but otherwise clean uniformly graded medium sand. Sand observed on the higher beach area is finer due to it being primarily windblown. A sample location plan with the results of this sediment sampling are included in Appendix D.

5.4 Wetland Resource Areas

The project area is located within a coastal wetland zone. The proposed project will amend the existing groin structures along the shoreline of the site to a design more conducive to shoreline protection and tidal

flow will enhance beach re-nourishment. The project will re-configure the existing groin system by removing approximately 3,250 square feet of rock groin structures and adding approximately 2,900 square feet of new rock groin structures within 'Land Under the Ocean.' This will result in an overall decrease of rock structure footprint of approximately 350 square feet, relative to existing conditions. Additionally, approximately 60,600 square feet of Coastal Beach will receive sand for beach re-nourishment purposes. The beach re-nourishment will return the beach to the conditions that existed prior to when the groin system was constructed as shown in the aerial photos in Figures 2A-2D.

5.5 Plant and Animal Species and Habitat

Mapping of Priority Habitat of Rare Species and Estimated Habitat of Rare Wildlife provided by the Massachusetts Division of Fish & Wildlife, Natural Heritage and Endangered Species program (NHESP) is shown in Figure 3. LHI submitted a Project Review Request to the NHESP on November 2, 2016. The Division of Fish & Wildlife requested that supplemental information about the project be provided (an assessment of coastal processes, an alternatives analysis, engineered site plans and a description of disturbance areas) so that they can make a determination as to whether a 'take' of state-listed species will result from the proposed project. This additional information is included in this EIR.

A benthic habitat/eel grass assessment of the area where the groin reconfiguration and beach nourishment is proposed was prepared by Cape Cod Engineering (Appendix F). The focus of this assessment is on the eelgrass present in the project area. In summary, submerged aquatic vegetation observed at the site included red macro-algae, green macro-algae, and eel grass within discreet patches. Additionally, the stone groins below the low tide level were populated with common brown algae (rock weed). With regard to the presence of shellfish, no oysters or quahog sets have been observed within the groin system. Finfish are transient in nature and are likely not affected by the short-duration of the proposed construction.

5.6 Areas of Critical Environmental Concern and Outstanding Resource Waters

There are no Areas of Critical Environmental Concern (ACECs) within the project area.

5.7 Roadways and Traffic

The proposed project is located at the end of Lighthouse Inn Road. The project does not exceed any MEPA review thresholds for traffic generation nor does it require any state permits related to state-controlled roadways.

5.8 Scenic Qualities, Open Space and Recreational Resources

The project is located along the West Dennis shorefront. In accordance with the Dennis Comprehensive Plan, the proposed project aims to improve the tidal flow between the groins, reduce the accumulation of detritus between the groins and improve the aesthetics of the area. Additionally, the proposed project will provide better protection to the shoreline from future storm events and preserve the open space and recreational area.

5.9 Historic Districts, Structures and Archeological Sites

Consultation with the Massachusetts Historic Commission (MHC) was requested through a Project Notification Form that describes the proposed project. The MHC determined that the project is unlikely to affect significant archaeological or historic resources. A copy of this request to MHC and their response, dated November 4, 2016, is provided in Appendix G.

5.10 Zoning

The Town of Dennis' zoning districts are shown on Figure 4. The project site is zoned "Hotel Resorts District." According to the Town of Dennis By-Laws, the Hotel Resort District aims to:

- To create and protect attractive areas in pleasing and harmonious surroundings to accommodate the needs and desires primarily of visitors, tourists and transient guests;
- To control density, to assure that undue congestion of streets and facilities will not occur and to ensure that public safety is not compromised;
- To control the organization and design of use and structures to assure that the development will not detract from the natural features and attributes of the surrounding area; and,
- To insure that physical and visual public access to recreational, historic and scenic areas is maintained and improved.

The project goals are consistent with the zoning by-laws for the site.

5.11 Existing Coastal Conditions and Littoral Processes

A detailed description of the existing coastal processes, prepared by Olsen Associates, is included in Appendix E and is summarized here.

- The site constitutes an 'open coastline', but the nearshore waters are generally shallow and Nantucket Sound is likewise a generally shallow semi-embayment with irregular bathymetry sheltered by the offshore barrier islands of Martha's Vineyard, Nantucket, and Monomoy
- The littoral drift along the project shoreline is both eastward and westward, but more dominantly to the east. In terms of order-of-magnitude transport rates, littoral drift modeling

of the shoreline well east of the project area, along Chatham, indicates gross transport rates of between 2500- to 5000-cubic yards/year (cy/yr) easterly and 500- to 1500-cy/yr westerly, for a net total drift rate of about 2000 to 3500 cy/yr (easterly).

- The rate and direction of littoral transport along the Nantucket Sound shoreline is determined as much by local wind-generated seas within the Sound as by external Atlantic Ocean waves, given the complex shelter of the bounding barrier islands, morphology and shallow seabed of the Sound. Directional wave data measurements from buoys in Nantucket Sound indicate that there is a greater tendency for westerly-directed drift west of Lighthouse Inn, and for easterly-directed drift east of Lighthouse Inn, with an overall indication of net easterly-directed transport.
- Historical aerial photographs of the Lighthouse Inn area from April 1995 through May 2016 indicate the variability in littoral transport direction and do not indicate any seasonal trends of littoral transport.
- The rock groin field along the Dennis shoreline has been in place for approximately 100 years, and those at the Lighthouse Inn were rebuilt to their current condition in the early- to mid-1970's. The local shoreline has responded to the long-term presence and effects of the jetties at Bass River and at Swan River; the groin field was a result of the jetties' and inlet effects, with the existing project shoreline being mildly erosional. The Town of Dennis adds sand to the east end of its beach, adjacent to Lighthouse Inn, at the beginning of most summer seasons. However, there is not otherwise evident a critical erosion issue (excepting the lack of beach at Lighthouse Inn) or chronic erosional signature adjacent to any of the groins or the groin field.
- The existing breakwater system at Lighthouse Inn provides protection against wave damage and flooding to the main Inn building and lighthouse, but the gap in the breakwater is too small to allow adequate flushing in the breakwater lee. Lack of tidal flushing has led to the accumulation of seaweed, detritus, silt and clay that enters the gap and is deposited within the sheltered area and on the beach behind the breakwater. There is little or no accessible sand beach behind the breakwater, and the seabed therein is mostly silt and mud. The accumulated seaweed results in a noxious odor and inability to use the limited beach resources that exist. A stable sloping beach cannot develop within this area because there is insufficient wave energy and uprush to maintain the proper slopes and embayment geometry behind the narrow gap. Overly narrow gaps in breakwaters often result in siphoning of sand from the leeward side.

Numerical modeling to characterize the shoreline in the vicinity of the Lighthouse Inn project was not employed for purposes of this analysis. The complex physical processes associated with the small-scale

embayment (pocket) and semi-embayment beaches of this project are not readily modeled at a scale that can accurately describe the effects of the breakwater modifications and pocket beach response amidst the response of the large-scale adjacent shorelines. The beach embayments behind the gapped breakwater are both small and shallow in depth. If modeled with readily available wave transformation software, the computed difference in the overall wave regime between the existing and post-project conditions would be almost immeasurable. The dynamics of wave diffraction and current flow within a small pocket beach embayment are too fine and three-dimensional in nature to be readily translated to a larger-scale shoreline assessment, particularly over long time periods. Moreover, for any reliable accuracy, the numerical modeling results of pocket beach response must be calibrated to some rational measure; and that measure would be the empirical prototype beach response described above and in Appendix E. Accordingly, at best the numerical model would seek to replicate the empirical prototype predictions already described herein -- at least in terms of modeling the small-scale pocket beach improvements. And these predictions cannot be accurately modelled except at a very fine grid scale that is not suitable for extrapolation to potential larger far-field effects.

In sum, given the small-scale nature of the proposed modifications, and the inability of numerical models to accurately assess the effect of such small modifications amongst a broader littoral field, particularly with the project's minor changes in the nearshore seabed depth and morphology -- along with inherent uncertainties associated with the nearshore wind and wave field -- there is no net apparent benefit or value in numerically modelling the existing conditions or for the proposed project improvements for the purposes of assessing overall littoral impacts. Given the practical abilities, limitations, accuracies and data requirements of contemporary numerical modelling -- relative to the small-scale nature of the proposed project modifications -- a numerical-modelling assessment is unlikely to provide any more accurate assessment of the project performance and impacts than competent coastal engineering assessment based upon experience and observation of similar prototype projects. For this reason, modeling was not considered to be warranted or of net beneficial value for this specific project.

6.0 Assessment of Impacts

As described in Section 1, the proposed groin improvements will have a positive benefit to the community through improved shoreline protection and increased tidal flow and flushing between groin structures. These improvements will provide enhanced protection of the shoreline from future storm damage.

6.1 Wetlands

There will be no permanent impact to the coastal bank beach due to the proposed project. The coastal bank at this site is a very low bank and is entirely altered as a form of seawall with a fronting revetment formation. The proposed project will have temporary impacts to the coastal resources in the project area as the groin geometry is reconfigured. Effort will be made to minimize impacts to the coastal resource during construction. All equipment and materials that come into contact with the water will be thoroughly inspected prior to construction to ensure that no foreign substances enter the water. Stormwater controls will be placed along the shoreline of the project area to ensure stormwater runoff up-gradient of the site does not impact the project area during construction.

6.2 Rare Species

Massachusetts Natural Heritage and Endangered Species program (NHESP) mapping of Priority Habitat of Rare Species and Estimated Habitat of Rare Wildlife is shown in Figure 3. LHI submitted a Project Review Request to NHESP on November 2, 2016. The NHESP requested additional information in order to determine whether a 'take' of state-listed species will result from the proposed project. The additional information requested is included in this EIR. LHI will continue to coordinate with NHESP to ensure that these requirements are met prior to the start of any construction activities.

The proposed groin reconfiguration and beach nourishment program has been designed so as to minimize and avoid encroachment upon or near the submerged aquatic vegetation and is unlikely to adversely affect the eel grass found in this area.

6.3 Coastal Processes

A detailed description of coastal processes in relation to the proposed project was prepared by Olsen Associates and is included in Appendix E.

Erosion impacts to the adjacent shorelines from the proposed project are not anticipated because of the following factors:

- The project's structural footprint is not changed, and there is a slight reduction in overall structural area. The project is built within the area of the existing rock structures; the length of the existing shore-perpendicular groins is not increased; and, the length of the existing central groin is decreased by the removal of rocks from its seaward end.
- The physical performance of the embayment beaches created by the reconfigured T-head design and embayment beaches, and the predicted beach geometries, have been established through extensive prior, successful project experience in similar conditions.
- The rock spur groins to be added to the ends of the western and central groins are of minimum practical dimension (28-feet) and will influence the beach geometry only in their immediate vicinity to anchor the leeward beach toe, with the purpose of reducing offshore-directed currents and sand losses.
- The project will be overfilled with sand nourishment to its predicted design beach capacity plus approximately 20% volume, with the latter intended as overfill for purposes of precautionary mitigation.
- No modification to the downdrift, easternmost groin is proposed, in order to further minimize & avoid potential impacts to the eastern properties.
- The overall project shoreline exhibits a more or less stable configuration that has equilibrated to, and apparently benefitted from, the long-term presence of the existing groin field; and no substantial changes are proposed to the overall magnitude of that groin field.
- The overall littoral drift regime at the site is net easterly, but otherwise appears to exhibit a subtle slight neutrality by which transport is directed both westerly and easterly across the project site. This suggests that potential littoral impacts to the east, from modifying the project structures, may be lesser than that which would be otherwise anticipated. Post-project monitoring of the adjacent shorelines, proposed per the project, will inform this observation.

The only probable physical means by which the proposed project may affect adjacent shorelines would be if the embayments impound (trap) additional sand beyond their predicted design beach capacity or impound sand after storm erosion. In regard to the first point, it is possible, though unlikely, that the stable beach geometry will be greater than the design geometry; and for that purpose, the project's initial sand fill includes an overfill volume. In regard to the second point, the existing cells along the groin field are currently refilled after storms by sand transport from onshore sand transport and/or in a sequential updrift to downdrift direction. To-date, this does not appear to have resulted in adverse, sequential erosion along the beach (i.e., progressive increase in erosion from west to east). And, prototype experience indicates that the embayment (pocket) beaches developed by the proposed project exhibit less storm erosion than open

beach cells between straight groins; and in that case, they would require less sand recovery (impoundment) after a storm than the adjacent beach cells.

An additional possible project impact may result if the seaweed (detrital seagrass) that is currently deposited along Lighthouse Inn is subsequently deposited elsewhere along the adjacent shores. This is clearly a possibility, since a principal objective of the project is to reduce the anomalous accumulation of detritus along Lighthouse Inn. In that instance, it is presumed that the seaweed would be deposited equivalently along the shoreline, or it would drift further alongshore, and be thence swept or cleared from the beach by those means that currently exist. It is otherwise unreasonable to expect that Lighthouse Inn would be the ultimate repository for an unequal or excess abundance of detrital deposition along this shoreline.

As noted above, the project's design and anticipated performance is based upon the prototype, empirical engineering experience of numerous similar projects constructed since the early 1990's. Several relevant examples are included in Appendix E.

6.4 ACECs and Outstanding Resource Waters

There are no ACECs within the project area.

6.5 Historic and Archeological Impacts

There are no historic or archeological areas of concern in the vicinity of the project.

6.6 Traffic

There will be no long-term traffic impacts due to the project.

6.7 Other Construction (Short-Term) Impacts

The proposed project will have temporary impacts to the costal resources in the project area as the groin geometry is reconfigured. Effort will be made to minimize impacts to the costal resource during construction. Because of the granular character of the bottom sediment, turbidity conditions resulting from the construction activities are anticipated to be limited in character and duration.

To prevent air impacts from the construction equipment, the Contractor will be required to submit a plan for anti-idling and emissions limiting measures to be employed. Equipment idling will be limited to five minutes or less. A description of the mitigation measures for addressing these potential short-term impacts is provided in Section 9.3.

7.0 Greenhouse Gas Emissions Analysis and Energy Efficiency

The proposed groin reconfiguration and beach nourishment program at the Lighthouse Inn will not result in any Greenhouse Gas (GHG) emissions. During the construction activities, which are anticipated to have an approximately four to eight week duration, there will be limited GHG emissions from the construction equipment. As described in Section 6.7, the Contractor will be required to submit a plan for anti-idling and emissions limiting measures that are to be followed.

For these reasons, in consultation with the MEPA office as this EIR was being prepared, LHI is requesting an exemption under the GHG policy.

8.0 Statutory and Regulatory Standards and Requirements

8.1 Agency Coordination and Permitting

LHI has had extensive involvement with federal, state, regional and local regulatory bodies regarding the groin improvements project. Specifically:

- The Town has actively engaged the Massachusetts Division of Fish and Wildlife as part of the NHESP Project Review to discuss the proposed project. Consultation is ongoing to ensure no adverse impacts to rare species occur.
- Consultation with Massachusetts Office of Coastal Zone Management (CZM) is ongoing.
- Consultation with the US Army Corps of Engineers is ongoing in preparation of an application for a general permit.
- Pre-application meetings were held with the MEPA staff of the Executive Office of Energy and Environmental Affairs to guide the preparation of this DEIR.

8.2 Applicable Statutory and Regulatory Standards and Requirements

Implementation of the project will require various approvals from following state agencies: Massachusetts Department of Environmental Protection, the Executive Office of Environmental Affairs MEPA Unit, and Massachusetts Department of Fisheries and Wildlife Natural Heritage and Endangered Species Program. Federal level permitting will be required from the Environmental Protection Agency through the NPDES program and the United States Army Corps of Engineers. Regional permitting will be required through the Cape Cod Commission. A listing of the specific permitting needs for the project and their status is provided in Table 2.

8.3 Requests for Funding Assistance

LHI is not seeking funding assistance from State or federal government agencies.

8.4 Other Coordination Related to the Project

Implementation of the project will also require coordination with the Town of Dennis and the Coastal Zone Management (CZM) office. LHI has been coordinating with the Town of Dennis and CZM as well as the agencies listed in Table 1 above since July 2016. LHI will continue to coordinate with these agencies to ensure all permit requirements and special needs are met.

TABLE 2. PROJECT PERMIT REQUIREMENTS FOR GROIN IMPROVEMENTS.

Permit		Status
1. State Permits		
Department of Environmental Protection		
	Chapter 91 License	To be submitted Spring 2017
Executive Office of Environmental Affairs – MEPA		
	Environmental Notification Form	Noticed December 7, 2017. Secretary’s Certificate received January 6, 2017 requesting and EIR.
	Draft Environmental Impact Report	Submitted March 31, 2017.
Massachusetts Department of Fisheries & Wildlife, NHESP		
	MESA Project Review	Project Review Request submitted November 2016. NHESP issued response letters on November 29, 2016. MESA coordination is ongoing for proposed activities .
2. Federal Permits and Notices		
US Army Corps of Engineers		
	General Permit	To be submitted Early Spring 2017
Environmental Protection Agency		
	NPDES	To be filed by Construction contractors
3. Regional Permits		
Dennis Conservation Commission		
	Notice of Intent	NOIs to be submitted Summer 2017.

9.0 Mitigation Measures

This Section provides a description of proposed management techniques that will either result in positive, long-term benefits as a result of the project, or that are planned to avoid, minimize or mitigate short-term (construction-related) impacts. Where applicable, alternatives to these mitigation measures are also discussed together with the reasons for selecting the proposed approach.

9.1 Positive, Long Term Impacts of the Groin Improvements

At the completion of the project, the groin structures and beach nourishment will provide improved shoreline protection and increased tidal flow and flushing between groin structures. Additionally, these improvements will maintain and/or enhance protection of the shoreline from future storm damage through re-establishment of a more natural, sloping sand beach, and reduce detritus from accumulating and causing noxious smell to the neighborhood. The replacement of the existing dysfunctional breakwater system and the addition of minor spur groins at the heads of the existing groins, with sand fill, to create an embayment (pocket) beach design, is anticipated to increase the overall beach stability along and adjacent to the project area.

9.2 Long-Term Mitigation Measures

A pre- and post-construction monitoring program that documents the beach geometry and trends in the shoreline condition over time is to be implemented, and used to assess whether the groin reconfiguration and beach nourishment program is adversely effecting adjacent shoreline areas. This monitoring program is described below in Section 9.2.1. Data collected from these surveys will be use to evaluate the extent to which the project-adjacent beach profiles indicate erosion/ attrition relative to the beach condition before and immediately after construction beyond that which would be normally expected through natural background variations. This assessment would be provided for a 3-year monitoring period.

As an advanced effort to mitigate potential, unanticipated effects to adjacent shorelines the initial project construction includes an approximate 20% overfill of sand placement volume, in excess of the project's computed design beach volume, along with the removal of an originally proposed spur on the easterly groin. Periodic beach renourishment may be required to maintain the beach at its design contours. The ultimate requirement will depend upon storm impacts and project performance. Typical prudent guidance for similar projects includes renourishment at 2- to 5-year intervals at about 10% of the initial design volume per year.

9.2.1 Physical Monitoring Survey Program

Beach profile surveys shall be measured at eleven locations along the project and adjacent shorelines at the locations indicated in Figure 5 to assess pre- and post-construction beach conditions. A minimum of one

pre-construction survey will be conducted and the transects will be surveyed over a three-year period following construction. The monitoring program includes survey of two remote locations to serve as independent control to evaluate erosion effects.

Wading beach profile surveys will be conducted at two (2) locations west of the project site, four (4) locations along the project site, three (3) locations east of project site, comprising the shoreline between about 400 feet west and 650 feet east of the project area, along with two (2) control locations at approximately 1500 feet west and east of the project area. The profile surveys will be a minimum of 240 feet in length, from the upland to at least -4 to -5 ft NAVD'88 seabed elevation. The profile surveys will be repeated along the same locations and azimuths for each survey event. Owing to natural oscillations of the beach planform within each cell between the existing groins, the profile locations are indicated in the middle of each cell between the groins. The western- and eastern-most profiles are located beyond any anticipated direct impacts from the project, but still within the same general beach area and away from the inlets, to inform the nature of background changes. The limits of the monitoring area reflect the observed experience from similar projects, and are consistent with projects of similar scope and magnitude.

The beach profile surveys will be conducted pre-construction, post-construction, and thence twice per year at approximately mid-April and mid-September, through three years following completion of construction. Timing of the surveys shall be planned to coincide with the approximate dates of the prior biennial monitoring surveys, as possible.

The results of each post-construction survey will be compared to the pre-construction surveys and the prior surveys to assess, at minimum, (1) changes in the mean high water line and mean low water line locations, and (2) changes in the sectional beach profile volumes, at each monitoring location. The surveys will also serve to document the performance of the constructed project. A report summarizing the survey data, profile plots, calculated changes, and observations will be prepared within 65 days after each survey event (i.e., twice per year) and submitted to the Department of Environmental Protection, Wetlands Division, or other regulatory agencies as might be identified through the permitting program for this project. The scope, reporting and 3-year time span of the proposed monitoring surveys is consistent with that required by regulatory authorities and typical permit condition for similar projects in the northeast, southeast and the Great Lakes regions of the United States.

9.3 Short-term (Construction-Related) Mitigation Measures

Measures for minimizing or mitigating impacts associated with the construction activities associated with the project, and are therefore short-term impacts, are described below.

Wetland Resources

The proposed project will have temporary impacts to the costal resources in the project area as the groin geometry is reconfigured. Effort will be made to minimize impacts to the costal resource during construction. All equipment and materials that come into contact with the water will be thoroughly inspected prior to construction to ensure that no foreign substances enter the water.

Because of the granular character of the bottom sediment, turbidity conditions resulting from the construction activities are anticipated to be limited in character and duration. Any temporary turbidity impacts due to the construction activities will be mitigated through the placement of large temporary concrete blocks at the 25-foot opening of the breakwater so as to lessen the wave action within the “crib”, which will also reduce the possibility of rapid sand migration and turbidity during construction. In addition, a suitable silt curtain will be available for deployment in the event that any persistent turbidity is observed. Inspection of the construction area for the presence of turbidity will be performed to monitor turbidity conditions.

Endangered Species

Impacts to endangered species and eelgrass is being mitigated by limiting the construction activities to the immediate area where the groins are to be reconfigured. Rocks located at the end of the existing eastern groin (S1/S2) are to be left in place to avoid the likelihood of collateral environmental damage to the eelgrass bed that would result from the construction activities to remove them. Although removing them would increase the potential area for eelgrass colonization along the seabed, there is no practical method to reach and remove these scattered, mostly submerged rock boulders without affecting the existing eelgrass resources that are nearby. These boulders also provides a limited littoral barrier beyond the remainder of the existing structures, and leaving them in place will eliminate the potential for impacts to the adjacent eelgrass and will preserve the existing biotic community that exists among the submerged rocks. Additionally, equipment access will be limited to within the stone groin enclosure in order to keep equipment activity clear of submerged aquatic vegetation including eelgrass.

Invasive Species

There are no known invasive species within the project area.

Stormwater

Erosion and sediment control measures, including construction best management practices (BMPs), will be used to limit turbidity and water quality impacts during construction. These measures, including silt booms, if necessary, will be placed along the shoreline of the project area to ensure that stormwater runoff up-gradient of the site does not impact the project area during construction.

ACECs and Outstanding Resource Waters

The project will not impact ACECs and Outstanding Resource Waters.

Cultural and Historical Resources

The project will not impact cultural and historical resources.

Traffic Management and Construction Equipment

Access routes and staging areas are shown on the design plans included in Appendix B. During construction the Contractor will utilize to the extent possible equipment manufactured to Tier 4 emission standards, and will be required to maintain a list of the engines, their emission tiers and, if applicable, the best available control technology installed on each piece of equipment. This information will be kept by the Contractor and made available to the Department of Environmental Protection if requested by them. The Contractor will also be required to provide signage during the construction period that states that equipment idling is to be limited to five minutes or less.

Solid and Hazardous Waste

No hazardous waste is to be generated by the construction activities. The sand renourishment material has been classified as appropriate for beach nourishment, however, any solid waste found in the beach compatible material will be disposed of at an appropriate facility. All other material not recycled will be disposed of in accordance with the Massachusetts Solid Waste Regulations (310 CMR 19.00) and the waste ban plans described therein.

10. Proposed Section 61 Findings

As required by the Secretary's Certificate on the Expanded ENF, this Section provides a consolidated overview of the proposed mitigation and other environmental and community benefits proposed in order to minimize potential impacts from the proposed water system. A draft template for Section 61 Findings is also provided pursuant to the Secretary's Certificate and in accordance with MGL Chapter 30, Section 61 that states: "Any determination made by any agency of the Commonwealth shall include a finding describing the environmental impact, if any, of the project and a finding that all reasonable measures have been taken to avoid or minimize said impacts." Draft 61 Findings are provided for those issues that are within the scope of this Draft EIR, including the following state agencies, actions and/or statutory requirements:

- Massachusetts Department of Environmental Protection
- Massachusetts Division of Fish & Wildlife, Natural Heritage and Endangered Species Program (NHESP) Massachusetts Endangered Species Act (MESA) – "No Take" Determination
- United States Army Corps of Engineers

A proposed mitigation plan is provided in Table 3 (next page) and draft Section 61 Findings are provided for each anticipated State agency permit.

Table 3. Summary of Proposed Mitigation Measures.

Category	Impact	Mitigation Measures
Wetlands and Wetland Buffer Zones	Temporary alteration of groins within coastal wetland resources.	Seek Dennis Conservation Commission Notice of Intent (NOI) for construction activity within coastal wetland resources. Restore the buffer zones in-situ to pre-existing conditions. Work performed in these areas is to be performed in accordance with conditions associated with the RDA and NOI, and will include requirements for the installation and maintenance of erosion and sediment controls by the construction contractor.
Construction Stormwater	Temporary turbidity and water quality impacts due to construction.	Erosion and sediment control measures, including construction best management practices (BMPs), will be used to limit turbidity and water quality impacts during construction.
Construction Equipment	Diesel emissions from construction vehicles and equipment.	Construction contractors will be required to prohibit the excessive idling during the construction period; no idle time greater than 5 min. Construction equipment will be inspected prior to entry into the water so no foreign objects enter the water. Use of large temporary concrete blocks at the 25' opening of the breakwater so as to lessen wave action in the "crib" and the possibility of rapid sand migration and turbidity during construction.
Hazardous Waste Management	Potential for encountering solid waste during the construction activities.	Any solid waste found during construction activities must be disposed of at an appropriate facility. All other material not recycled will be disposed of in accordance with the Massachusetts Solid Waste Regulations.
Coastal Processes	Potential for up- and down-stream beach erosion due to reconfiguring the groins.	Pre-construction and post-construction monitoring surveys will be completed to ensure adverse effect are not incurred due to the reconfiguration of the groin structures.
Rare Species	Portions of the site are within the mapped priority habitat of the following state-listed "Species of Concern": eel grass.	To avoid a prohibited take of eelgrass, the proposed design will not remove the "excess" rocks at the end of the existing eastern groin (S1/S2) in order to avoid the likelihood of collateral environmental damage caused by construction activities to remove these rocks. Beach monitoring surveys will be completed.

**Executive Office of Energy and Environmental Affairs
Massachusetts Department of Environmental Protection**

Draft Findings Pursuant to MGL Ch 30, Section 61

Project Name: Lighthouse Inn Groin Improvements
Project Location: Dennis, Massachusetts
Project Proponent: Lighthouse Inn, Inc.
EEA Number: 15623

Permit: Chapter 91 Waterways License

Project Description: The project aims to restore a more natural, stable sand beach condition, improved water circulation and improve shore protection. The project plans to remove portions of the breakwater to create two gaps and reconfigure the existing groin structure into a T-head and embayment beach along the 550-foot shorefront.

MEPA History: The MEPA review was initiated on November 28, 2017 with the filing of an Environmental Notification Form (ENF) that was noticed in the December 7, 2016 edition of the Environmental Monitor. The Secretary issued a Certificate on January 6, 2017 requesting a Draft Environmental Impact Report (EIR) be submitted.

Project Impacts and Mitigation: Refer to Table A for a list of impacts and corresponding mitigation measures relative to the construction during the groin improvements.

Table A. Summary of Construction Mitigation Measures.

<i>Category</i>	<i>Impact</i>	<i>Mitigation Measures</i>
Wetlands and Wetland Buffer Zones	Temporary alteration of groins within coastal wetland resources.	Seek Dennis Conservation Commission Notice of Intent (NOI) for construction activity within coastal wetland resources. Restore the buffer zones in-situ to pre-existing conditions. Work performed in these areas is to be performed in accordance with conditions associated with the RDA and NOI, and will include requirements for the installation and maintenance of erosion and sediment controls by the construction contractor.
Construction Stormwater	Temporary turbidity and water quality impacts due to construction.	Erosion and sediment control measures, including construction best management practices (BMPs), will be used to limit turbidity and water quality impacts during construction. Placement of blocks at the 25' opening to further mitigate turbidity.
Construction Equipment	Diesel emissions from construction vehicles and equipment.	Construction contractors will be required to prohibit the excessive idling during the construction period.
Hazardous Waste Management	Potential for encountering solid waste during the construction activities.	Any solid waste found during construction activities must be disposed of at an appropriate facility. All other material not recycled will be disposed of in accordance with the Massachusetts Solid Waste Regulations.

Findings: Based in its review of the MEPA documents, the permit application, public comments, and with implementation by the Proponent of the mitigation measures described in the attached Table A, all practical means and measures will be taken to avoid or minimize the adverse impacts to the environment related to the Project.

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BY

DATE

**Executive Office of Energy and Environmental Affairs
Division of Fisheries and Wildlife**

Massachusetts Natural Heritage and Endangered Species Program

Draft Findings Pursuant to MGL Ch 30, Section 61

Project Name: Lighthouse Inn Groin Improvements
Project Location: Dennis, Massachusetts
Project Proponent: Lighthouse Inn, Inc.
EEA Number: 15623

Permit: Massachusetts Endangered Species Act Program (MGL c.131A; 321 CMR 10.00)

Project Description: The project aims to restore a more natural, stable sand beach condition, improved water circulation and improve shore protection. The project plans to remove portions of the breakwater to create two gaps and reconfigure the existing groin structure into a T-head and embayment beach along the 550-foot shorefront.

MEPA History: The MEPA review was initiated on November 28, 2017 with the filing of an Environmental Notification Form (ENF) that was noticed in the December 7, 2016 edition of the Environmental Monitor. The Secretary issued a Certificate on January 6, 2017 requesting a Draft Environmental Impact Report (EIR) be submitted.

Project Impacts and Mitigation: Refer to Table A for a list of impacts and corresponding mitigation measures relative to the construction of the distribution system in those areas where state-listed rare species are present.

Table A. Summary of Rare Species Mitigation.

<i>Category</i>	<i>Impact</i>	<i>Mitigation Measures</i>
Rare Species	Portions of the site are within the mapped priority habitat of the following state-listed "Species of Concern": eel grass.	To avoid a prohibited take of eelgrass, the proposed design will not remove the "excess" rocks at the end of the existing eastern groin (S1/S2) in order to avoid the likelihood of collateral environmental damage caused by construction activities to remove these rocks.

Findings: Based in its review of the MEPA documents, the permit application, public comments, and with implementation by the Proponent of the mitigation measures described in the attached Table A, all practical means and measures will be taken to avoid or minimize the adverse impacts to the environment related to the Project. NHESP will include appropriate conditions associated with this Section 61 Finding when issuing a determination.

DIVISION OF FISHERIES AND WILDLIFE

BY

DATE

11.0 Response to Comments

The ENF for the proposed groin improvements was noticed in the Environmental Monitor on December 7, 2017 and the Secretary's Certificate on the ENF was issued on January 6, 2017. The comments received on the ENF are summarized in the Certificate and the comment letters received from State agencies accompanies the Certificate. The Certificate and comment letters are provided in Appendix A. The comments received and responses to these comments are provided below.

11.1 MEPA

The Certificate requests that the Expanded ENF provide the following additional information in the EIR:

- *Updated site plans for existing and proposed conditions.*
Updated plans are provided in Appendix B. These plans provide the design description for the project through early March 2017.
- *An updated description of applicable statutory and regulatory standards and requirement, and how the project will meet these standards.*
A description of the applicable statutory and regulatory standards for the project and the status of the permitting for the project is provided in Section 8.
- *Provide a list of required State permits, financial assistance, or other State approvals and provide an update on the status of each of these pending actions.*
The status of the regulatory permitting activities for the project is provided in Section 8.3, and has been updated through March 2017.
- *Alternatives Analysis*
 - *Provide an alternatives analysis of the 'No-Build' Alternative, a modified groin alternative, and the preferred alternative.*
An alternatives analysis is provided in Section 4.
 - *Evaluate a preferred alternative that will not result in a net increase in permanent structures.*
As discussed in Section 4, the preferred alternative will not result in a net increase in permanent structures. Instead the preferred alternative will result in a slight net decrease in the project's overall structural footprint.
 - *Include data relevant to the use of "T-groins" in similarly dynamic coastal locations.*
Reference projects where the use of T-groins was implemented are described in Appendix E.
- *Wetlands and Waterways*
 - *Characterize the project Site with regard to marine fishery, including shellfish, finfish, and benthic habitat. Address how the project has been designed to avoid direct and secondary impacts to eelgrass beds.*
A Benthic Habitat and Eel Grass Assessment is included in Appendix F. The preferred alternative seeks to further minimize and avoid impacts by not reconfiguring the east-end groin structure nor removing excess structure from the seaward end of the west groin structure due to potential impacts to eelgrass beds.

- *Demonstrate that proposed groins are the minimum height, width and length necessary to maintain the beach form and volume. Clarify if the re-configuration of the groins and beach nourishment will result in a conversion of coastal resource areas in the post-construction static state.*

An assessment of coastal processes is included in Section 6 and Appendix E. Additionally, post-construction monitoring will be performed and is described in Section 9.

- *Describe any temporary impacts to the coastal wetland resource areas during the groin reconfiguration process. If material will be dredged to facilitate construction, the volume and type of material should be quantified along with its proposed use or disposal.*

Temporary short-term impacts are discussed in Section 6 and mitigation measures are discussed in Section 9. Excavation will occur below the high tide line for rock removal and excavation of the bottom stones for the groins. The granular material to be used for beach re-nourishment is to be consist with the character of the existing beach sand material. None of the existing sand material will be taken out of the system.

- *Identify the portions of the existing groins that will be lowered in elevation and provide cross-sectional details.*

Cross-sectional details are provided in the design plans included in Appendix B.

- *Identify the profile, volumes and areal extent of beach nourishment and confirm sediment source compatibility. Demonstrate that beach nourishment will be provided in a manner that fills the groins to entrapment capacity to minimize impacts to adjacent beaches. Additionally, address project impacts to the easternmost groin and the beach directly east of this groin with regard to erosion and the potential need for beach nourishment in this location.*

Cross-sectional details are provided in the design plans included in Appendix B. Description of the groins' volumetric sand (beach) capacity is described in Appendix E and is reflected in the project's beach fill plan, plus 20% additional overfill volume placement.

- *Identify the portions of the existing groins that will be lowered in elevation and provide cross-sectional details.*

Cross-sectional details are provided in the design plans included in Appendix B.

- *Discuss how public access will be provided pursuant to 310 CMR 9.35. Safe passage should be provided throughout the construction period and in the post-construction state.*

Safe pedestrian passage will be provided in front of the Lighthouse Inn and behind (landward of) the existing rock revetment and bulkhead during construction to ensure lateral access along the shoreline.

- *Outline a construction period and post-construction period monitoring plan to ensure successful installation and maintenance of the project. Thresholds and contingencies for determining when additional beach nourishment or other mitigation measures may be required.*

A monitoring plan that documents beach conditions before, during and after construction is provided in Section 9.

- *Rare Species*

- *Address specifically how the preferred alternative will be designed in a manner consistent with applicable MESA regulations and identify sufficient mitigation measures if rare species impacts cannot be avoided or minimized.*

An eelgrass assessment is included in Appendix F. The preferred alternative seeks to minimize and avoid impacts to eelgrass by not altering the seaward end of the east-end groin and by leaving the length of the west end groin structure in place. This approach avoids potential impacts to eelgrass beds in these areas associated with construction activities.

- *Greenhouse Gas (GHG) Emissions.*

- *Confirm that the project will produce minimal amounts of GHG emissions and formally request an exemption under the GHG policy.*

The project will produce minimal GHG emissions; an exemption under the GHG policy is requested in Section 7.

- *Construction – discuss proposed construction methodologies. Describe the types of equipment that will be used to relocate and reconstruct the groins and complete beach nourishment, identify access routes and staging locations on upland areas, and discuss how construction methods will avoid and minimize impacts to eelgrass beds. Discuss potential time-of-year restrictions on in-water and beach work.*

Short-term construction impacts, including equipment, access routes, and time-of-year restrictions are discussed in Section 9 and Table 3.

- *Mitigation and Section 61 Findings – include a separate chapter summarizing the proposed mitigation measures, with a draft Section 61 Findings for each State Agency that will issue permits for the project.*

The Section 61 proposed mitigation measures are provided in Section 10.

- *Responses to Comments/Circulation – Include a copy of the Secretary’s Certificate on the ENF and a copy of each comment letter received. Include direct responses to the comments the extent that they are within MEPA jurisdiction. Circulate a hard copy of the Draft EIR to each State and local Agency from which permits will be requested, and to all parties that submitted individual written comments.*

The Secretary’s Certificate and comment letters are provided in Appendix A. Response to comments are included in Section 11. The distribution list for the Single EIR is provided in Appendix F.

11.2 Board of Underwater Archaeological Resources

The BUAR’s review of the project concluded that the project is unlikely to impact submerged cultural resources. However, the project may be in an archaeologically sensitive area. Therefore, should unknown submerged or terrestrial cultural resources be encountered during the course of the project, the Board expects that the project proponent take steps to limit adverse effects and notify the Board and otherwise appropriate agencies. No response required.

11.3 Division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program (NHESP)

- *NHESP's review of the MESA Project Review and the ENF concluded that additional information is required for the Division to complete its review.*
 - *Provide an assessment of the coastal processes affecting this site and detail the effects the existing structure has on the shoreline. Said analysis should evaluate longshore and cross-shore sediment transport with wind and wave analysis for existing and proposed conditions.*

An assessment of the coastal processes is included in Section 6, Assessment of Impacts, and the detailed evaluation is provided in Appendix E.
 - *Provide an analysis of alternatives.*

An alternatives analysis is included in Section 4 (with figures in Appendix C).
 - *Provide engineered site plans showing existing and proposed conditions, elevations, profiles, etc.*

Project design plans are included in Appendix B.
 - *The total project disturbance and impacts are undefined. Please clarify the footprint/size of the existing structures, proposed structure modifications, reductions and new structures.*

Clarifications regarding the footprint/size of the existing structures and proposed modifications are included in Section 2 and Appendix B as well as in the alternatives analysis in Section 4.
 - *The description does not mention a nourishment component, however, the site figure references burying a rock revetment in sand with no details on amount or slope of material to be placed.*

The beach nourishment project component is discussed in detail in Section 2, in the alternatives analysis in Section 4, and is also described in the design drawings in Appendix B.

11.4 Massachusetts Division of Marine Fisheries

- *Given that the project area closely borders mapped eelgrass habitat, the proponent should perform an eelgrass survey to delineate current eelgrass distribution in and adjacent to the project area.*

A benthic habitat and eelgrass assessment is included in Appendix F.
- *If eelgrass is confirmed to be present in or adjacent to the project site, construction activities could potentially impact these resources through direct displacement or indirect effects. Additional design and construction modifications should be implemented if eelgrass is identified in or near the project to avoid such impacts.*
 - *The proposed new groin footprint should be located outside of any area identified in the survey as containing eelgrass.*

The preferred alternative has been revised such that the west-end groin structures are to be remain in place so as to further minimize and avoid impacts to eelgrass that is present in this area.
 - *The proponent should provide more details on construction methodology with regards to eelgrass impacts. Groin installation and removal can both potentially impact bordering*

eelgrass through turbidity and/or burial, and construction protocols should also include approaches to avoid such impacts.

Construction methodology is described in Section 2.5 and Table 2.

- *Depending on proposed construction protocols, post-construction monitoring of bordering eelgrass may also be warranted to assess potential project impacts.*

The construction approach has been developed to avoid and minimize construction activities in the areas where eelgrass is present. If required, post-construction monitoring can be provided through the use of aerial photographs, as described in Appendix F.

11.5 Massachusetts Office of Coastal Zone Management

The Office of Coastal Zone Management (CZM) is generally supportive of the concept that the applicant has presented and offers the following specific comments.

- *CZM requested that the applicant demonstrate that the proposed groins are the minimum height, width and length necessary to maintain beach form and volume.*

The design basis for the groin reconfiguration is presented in Section 2.2 and Appendix B.

- *CZM requested that the ENF include a plan for adding sand to the beach to fill the groins to entrapment capacity to minimize impacts to adjacent beaches. Although the ENF states that beach fill with compatible sand will be placed after the reconfiguration of the rock structures, there is no calculations provided to indicate that the proposed fill will be sufficient to fill the groins entrapment. In addition, there is no fill proposed to the east of the easternmost groin.*

An assessment of coastal processes is included in Section 6 and Appendix E.

- *CZM requested that the ENF include a plan for monitoring the proposed groins and beach fill, with provisions for mitigation of any adverse impacts.*

A monitoring plan is included in Section 9. Periodic beach renourishment may be required to maintain the beach at its design contours. The ultimate requirement will depend upon storm impacts and project performance. Typical prudent guidance for similar projects includes renourishment at 2- to 5-year intervals at about 10% of the initial design volume per year. However, that said, no project renourishment has been required to-date for the majority of the dozens of similar T-head and embayment projects constructed by this project's concept designer (Olsen Associates, Inc.) over the last 25 years (Bodge, 1998 & personal communication).=

- *CZM requested information regarding the extent of the existing eelgrass beds relative to the proposed project elements.*

A description of the extent of the existing eelgrass beds relative to the project is given in the eelgrass assessment provided in Appendix F.

- *The ENF states that “groins and beach nourishment are recommended shoreline management techniques included in the December 2015 Coastal Erosion Commission Report”. CZM notes that groins and beach nourishment were included in Table 11...This table was included by the Working Group to help advise the Commission regarding the range of shoreline management techniques that could be used to manage shorelines. The report states that the applicability of each option varies according to the nature of the risk, local conditions, and the resources that are available to apply the techniques. The report does not recommend the use of any one technique.*

So noted. See Section 3.3 for relevant data to support the use of groins and beach nourishment for the project.

11.6 Massachusetts Department of Environmental Protection / Southeast Regional Office

The Department is generally supportive of the project, particularly with elements that improve tidal flow and sediment transport.

- *This project involves work within flowed tidelands, therefore, the Proponent will be required to submit a Chapter 91 License Application. The DEP requested that the following be provided in the Chapter 91 License Application:*
 - *Alternative project proposals should consider a proposed plan that would not result in a net increase in permanent structures.*

Refer to the Alternatives Analysis in Section 4 and Appendix C.
 - *A detailed description of the temporary impacts to the coastal resources in the project area as the groin geometry is reconfigured.*

Refer to the assessment of impacts in Section 6.
 - *The volume and type of material that will be dredged to facilitate the construction of the groins should be quantified and details of the proposed use or disposal should be provided.*

No material will be dredged during the construction of the groins. Refer to Section 2.5 for construction methods.
 - *Details of the proposed work should be included in the application including cross-sections of the proposed structures.*

Refer to the design plans in Appendix B (Drawings 5, 6 and 7).
 - *Provide details regarding how public access along the shoreline will be provided pursuant to the Waterways Regulations at 310 CMR 9.35.*

Safe pedestrian passage between high tide and low tide has always been and will continue to be provided along the shoreline of the Lighthouse Inn. During construction public access will be provided behind the existing rock revetment or upland of the construction area.
 - *Provide details on the proposed beach nourishment. Including volume and source of material to be used, compatibility with existing substrate and long term nourishment plans including triggering mechanisms.*

Details on the proposed beach nourishment are included in Section 2. The monitoring plan provided in Section 9.2 includes provisions for providing additional sand for beach nourishment over the long term, should it be determined that the project is resulting in erosion of adjacent shorefront areas.
- *More information needs to be provided to demonstrate that the project will not increase erosion.*

An analysis of erosion due to coastal processes is included in Section 6 and Appendix E.
- *Demonstrate that the proposed groin reconfiguration is the minimum height, width, and length necessary to maintain a beach. And, that the proposed groins are filled to the entrapment capacity with beach compatible sediment.*

The design basis for the groin reconfiguration is described in Section 2.2, which includes a discussion on the entrapment capacity of the beach areas being renourished.

- *The Proponent should characterize the project area in terms of marine fishery habitat, including shellfish, finfish, and benthic habitat. The Proponent should delineate any existing eelgrass beds near the proposed project. Additionally, existing resource areas should be delineated and any resource area that will be changed due to the project should be determined.*

A benthic habitat and eelgrass assessment is included in Appendix F. The focus of this assessment is on the eelgrass present in the project area. With regard to the presence of shellfish, no oysters or quahog sets have been observed within the groin system. Finfish are transient in nature and are likely not affected by the short-duration of the proposed construction.

- *Depending on the nature of the activities, the proponent may have to obtain an EPA NPDES Dewatering General Permit.*

So noted. The contractor will be responsible for obtaining an EPA NPDES Dewatering General Permit if required.

- *Construction and operation activities shall not cause or contribute to a condition of air pollution due to dust, odor, or noise.*

So noted. Refer to Section 9 for mitigation measures.

- *MassDEP requests that the proponent use construction equipment with engines manufactured to Tier 4 federal emissions standards. The proponent should maintain a list of the engines, their emission tiers, and, if applicable, the best available control technology installed on each piece of equipment on file for Department review.*

So noted. Refer to Section 9 for mitigation measures.

- *MassDEP requests that the proponent state specifically in the subsequent environmental filing how it plans to prohibit the excessive idling during the construction period. In addition, to ensure compliance with this regulation once the project is occupied, MassDEP requests that the project establish permanent signs limiting idling to five minutes or less at the completed project.*

So noted. Please refer to Section 9 regarding short term construction mitigation measures.

- *The dredged material has been classified as appropriate for beach nourishment, however, any solid waste found in the dredged material must be disposed of at an appropriate facility.*

So noted. Refer to Section 9 for mitigation measures.

- *The Section 61 findings should contain clear commitments to implement mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation, and contain a schedule for implementation.*

So noted. Refer to Section 10 for Section 61 findings.

- *The Department confirmed the presence of an unpermitted wastewater discharge of 17,340 gpd...This volume of discharge of sanitary wastewater to groundwater is in violation of M.G.L c21, Chapters 26 through 53 and “The Groundwater Discharge Permit Regulations” at 314 CMR 5.03.. It is the Department’s belief that construction of a treatment plant may help mitigate the macrophyte algal blooms that deface its beachfront from its unpermitted septic discharge of untreated nitrogen.*

There have been no macrophyte algal blooms observed at Lighthouse Inn’s beachfront. LHI maintains that the odors emanating from the existing breakwater/groin system are due to the

fermentation of seaweed and detritus that entrapped within the groin enclosure, causing it to ferment and decay. These odors closely resemble that of sewage discharges and are frequently mistaken for that rather than from the fermenting seaweed. According to the operators of LHI, when the entrapped seaweed is properly and routinely removed, the odor in that area more closely resembles that of the ocean.

LHI's onsite wastewater disposal systems have always been and continue to be permitted discharges by the Town of Dennis. LHI and the Waterfront at Lighthouse Inn (the restaurant) is situated on three Land Court Parcels and there are individual onsite systems for each of these three parcels. The discharge from each of their respective systems are each less than 10,000 gallons per day. LHI made repairs to these systems in 1994 and received "Repair to Sewage Systems" Title V permits for each of these systems from the Town of Dennis for that work.

In February 2014 DEP, while reviewing all of the large water users on the south side of town, requested that LHI provide any information or existing plans of these onsite wastewater disposal systems. LHI responded by providing the design calculations, design plans and as-built plans of the three parcels together with a summary of the pumping history and Lighthouse Inn's occupancies for the previous five years, noting that the Inn is closed between Columbus Day and Memorial Day (mid-October through the end of May). If Lighthouse Inn were a year round operation, an On-Site Waste Water Treatment Facility would be appropriate, however being closed for seven months each year, during which as a result these systems receive no wastewater flow, is contrary to that need for these systems to work properly and effectively. This information was provided in 1992 from the Board of Health Agent for the Town of Dennis and the engineering firm hired to upgrade our systems. They stated that in order for an onsite system to operate effectively bacteria concentrations need to be consistently maintained, and that a period of continuous operation over an approximately five month period is required to achieve the performance needed to achieve the operational efficiency for nitrogen removal. The limited use of the onsite systems to the seasonal activity at the Lighthouse Inn does not allow for continuous operation of these systems on a year-round basis. It was on this basis that the Title V systems were permitted by Dennis and installed. LHI has remained diligent in the maintenance of these Title V Septic Systems.

Dennis is currently engaged in a Town-wide wastewater facilities planning process. The owner of LHI, Gregory Stone, has been an active member of the Dennis Comprehensive Wastewater Management Task Force for the past twelve years and is currently a member of the recently established Wastewater Implementation Committee for Dennis. Mr. Stone is therefore very familiar with the wastewater issues confronting the Town and the long-term programs being proposed to address them. This plan includes sewerage various key areas of the community through an eight phase construction program, and Phase 1 of this program would bring sewer service to the Lighthouse Inn area. LHI intends to connect to this sewer system as soon as it becomes available.

With regard to regional nitrogen discharges to the Bass River Embayment System, the MEP Nitrogen Loading Survey developed by DEP for the Bass River Lower section and School Street Marsh describe goals for Total Maximum Daily Limits (TMDLs) for nitrogen. These nitrogen thresholds have been met for both of these areas, showing no additional nitrogen reduction is needed to meet the TMDL goal as reported in the Town of Dennis August 2015 Water Quality Evaluation and Mitigation Alternative Study Final Report (Tables 2-2 and 2-

3). Lighthouse Inn is surrounded by Weir Creek, which is an estuary of the lower section of Bass River and is also in intertidal component of the School Street Marsh.

11.7 Private Residents

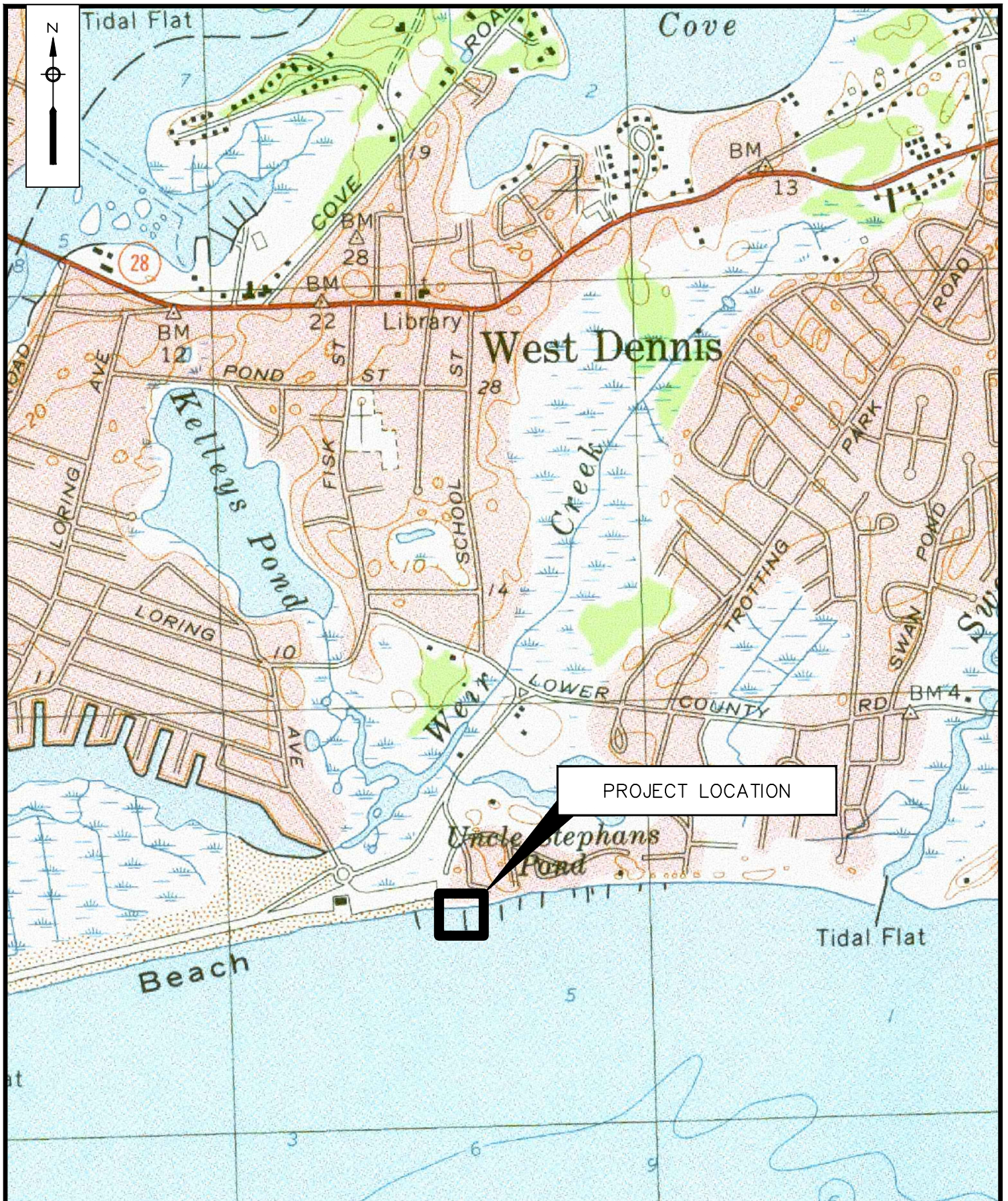
Comments were received by a nearby property owner located at 7 Ocean Avenue.

- *The property owner does not have an objection to the project but are concerned that the reconfiguration of the groins will result in a redirection of seaweed onto their beach.*

An assessment of the coastal processes is included in Appendix E. In addition, the proponent has proposed a monitoring plan as discussed in Section 9, the objective of which is to document the condition of the beaches both at LHI and to adjacent properties. Referring directly to the neighbor's concerns, the current configuration of groins at Lighthouse Inn and the eastern end of West Dennis beach retains seaweed very effectively. Since there is no change to the West Dennis Beach groin and because the prevailing southwest winds drive any loose detritus into Lighthouse Inn's western beach, seaweed removal will continue to be a necessity for the Town of Dennis and Lighthouse Inn.

REFERENCES

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- WHG, 2010. Waterways Assets and Resources Survey; Master Plan for Dredging and Beach Nourishment for Town of Dennis, MA. Prepared for Town of Dennis, by Woods Hole Group Inc. East Falmouth, MA. November 2010.
- WHSG, 2011. Longshore Sediment Transport; Cape Cod, Massachusetts. Woods Hole Sea Grant Program, Cape Cod Cooperative Extension. April 2011.





NOTE: IMAGE TAKEN OF THE BASS RIVER LIGHT, CIRCA 1890
(WHICH NOW FORMS THE CENTER SECTION OF LIGHTHOUSE INN).

FIGURE 2A

Lighthouse Inn Groin Improvements

March 2017

Environmental Partners
A partnership for engineering solutions. **GROUP**
Quincy, MA www.envpartners.com



NOTE: IMAGE TAKEN OF THE LIGHTHOUSE INN CIRCA 1938.

FIGURE 2B

Lighthouse Inn Groin Improvements

March 2017

Environmental Partners
A partnership for engineering solutions. **GROUP**
Quincy, MA www.envpartners.com



NOTE: IMAGE TAKEN OF THE LIGHTHOUSE INN CIRCA 1951

FIGURE 2C

Lighthouse Inn Groin Improvements

March 2017

Environmental Partners
A partnership for engineering solutions. **GROUP**
Quincy, MA www.envpartners.com



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www.capecodphotos.com

NOTE: IMAGE TAKEN OF THE LIGHTHOUSE INN CIRCA 2012

FIGURE 2D

Lighthouse Inn Groin Improvements

March 2017

Environmental Partners
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Quincy, MA www.envpartners.com



LEGEND

 PRIORITY AND ESTIMATED HABITAT AREA



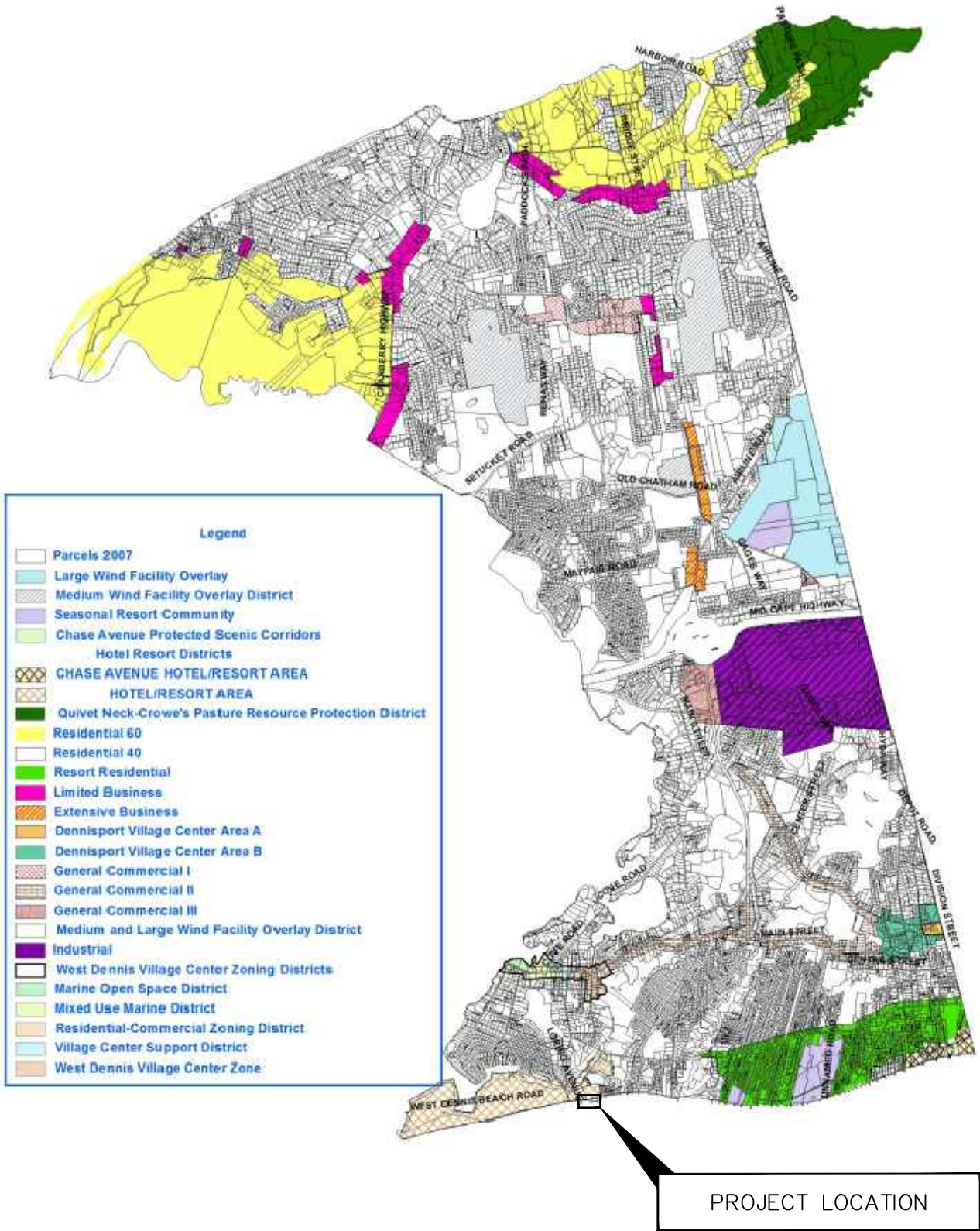
SCALE IN FEET
SCALE: 1"=40'

FIGURE 3

Lighthouse Inn Groin Improvements

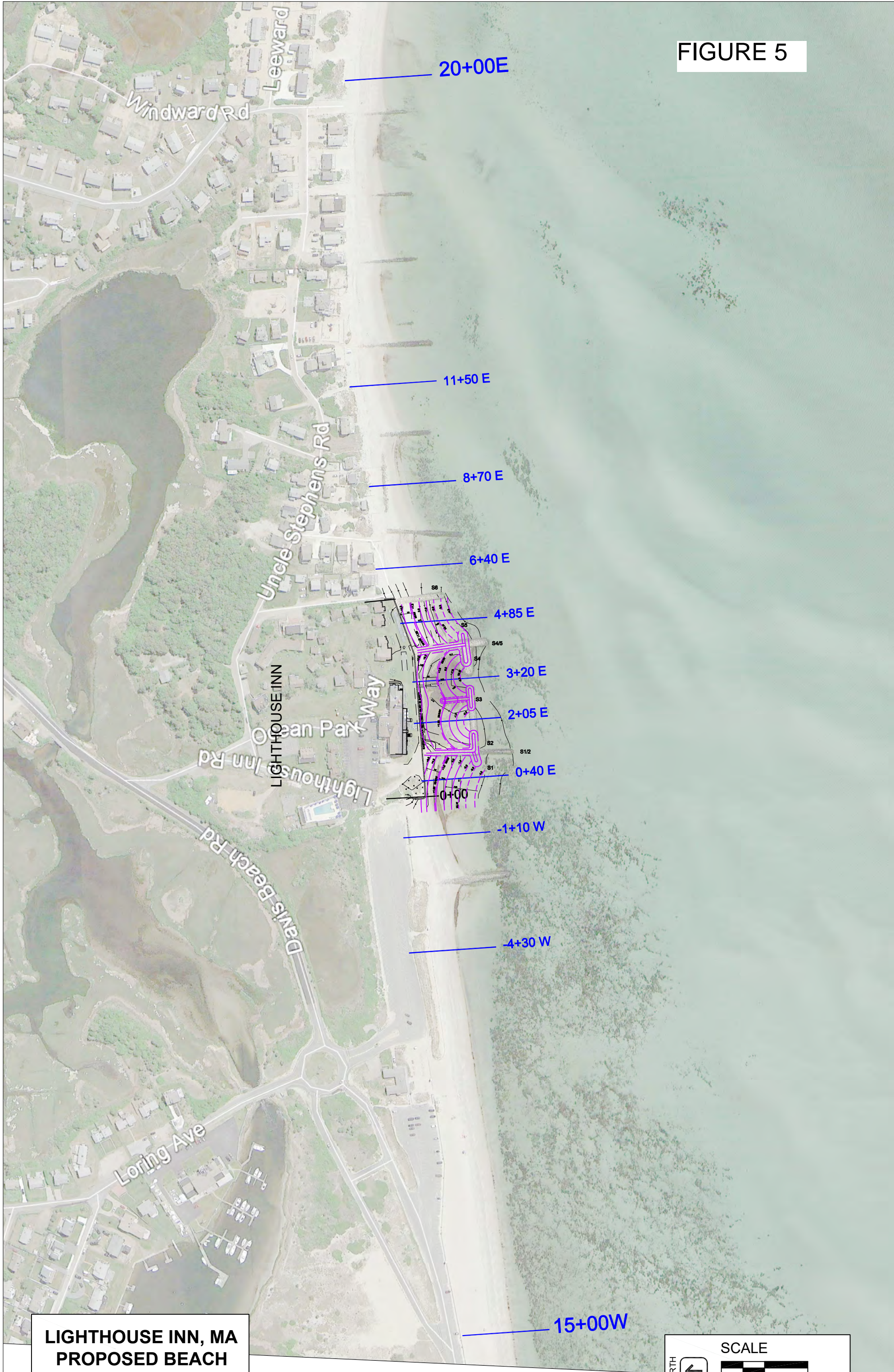
November 2016

Environmental Partners GROUP
A partnership for engineering solutions.
 Quincy, MA www.envpartners.com



PROJECT LOCATION

FIGURE 5



LIGHTHOUSE INN, MA
PROPOSED BEACH
MONITORING PLAN

NORTH

SCALE

0 120 240 FEET

Appendix A

***Certificate of The Secretary Of Energy And Environmental Affairs On
The Environmental Notification Form (January 6, 2017) and Additional
Comment Letter (January 18, 2017)***



The Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

Charles D. Baker
GOVERNOR

Karyn E. Polito
LIEUTENANT GOVERNOR

Matthew A. Beaton
SECRETARY

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

January 6, 2017

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

PROJECT NAME : Lighthouse Inn Groin Improvements
PROJECT MUNICIPALITY : Dennis
PROJECT WATERSHED : Cape Cod
EEA NUMBER : 15623
PROJECT PROPONENT : Lighthouse Inn, Inc.
DATE NOTICED IN MONITOR : December 7, 2016

Pursuant to the Massachusetts Environmental Policy Act (MEPA) (M.G. L. c. 30, ss. 61-62I) and Section 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). The project does not exceed a Mandatory EIR threshold. However, based upon the content of the filing and the comments received from State Agencies, I am requiring a discretionary EIR pursuant to 301 CMR 11.06(7). This Certificate includes a Scope for the Draft EIR (DEIR). I expect that the Proponent can prepare a Draft EIR that will adequately address the Scope such that I may determine, pursuant to 301 CMR 11.08, that no substantive issues remain to be addressed and allow the DEIR to be reviewed as a Final EIR (FEIR) or as a Response to Comments on the DEIR.

Project Description

As described in the Environmental Notification Form (ENF), the project consists of shorefront improvements at the Lighthouse Inn including reconfiguring the existing groin system and beach nourishment. These improvements are proposed to improve natural tidal flow and flushing between two groins while maintaining shore protection and a sand beach. Under existing conditions, lack of tidal

flushing has led to the accumulation of seaweed and detritus on the beach and in the embayment, resulting in noxious odor and inability to enjoy the beach or navigate waters along the shoreline.

Project Site

The 1.8-acre project site contains the Lighthouse Inn and approximately 600 feet of ocean shorefront facing Nantucket Sound, immediately east of West Dennis Beach, which is owned and operated by the Town of Dennis. The shorefront includes three rock groins that extend between 130 and 240-feet in length. A breakwater parallel to the shore spans the two center groins with a 25-foot wide gap opening. The on-site groins comprise the westernmost groins within a broader field of ten groins located east of the shoreline in front of the Inn. An existing rock revetment and vertical concrete bulkhead separate the beach area landward of the parallel breakwater from the upland grassy lawn in front of the Inn's primary building.

Coastal wetland resource areas identified in the ENF include Land Under Ocean (LUO), Coastal Bank, and Land Subject to Coastal Storm Flowage (LSCSF). The project site is located in a Velocity Zone as identified on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) (Map No. 25001C0593J, dated July 16, 2014) for the project site. This FIRM identifies 100-year storm at elevation 13 North American Vertical Datum of 1988 (NAVD88) on-site. A portion of the project site is mapped as *Estimated and/or Priority Habitat* for rare-species in the Natural Heritage Atlas (13th edition) issued by the Division of Fisheries and Wildlife's Natural Heritage and Endangered Species Program (NHESP). The project site is not located in an Area of Critical Environmental Concern (ACEC) and is not a designated Outstanding Resource Water (ORW). Surveys concluded that there are eelgrass (*Zostera marina*) beds located within and adjacent to the proposed work areas. According to the Division of Marine Fisheries (DMF), the project site lies within mapped shellfish habitat for blue mussel (*Mytilus edulis*).

Jurisdiction and Permitting

The project is undergoing MEPA review pursuant to 301 CMR 11.03(3)(b)(1)(a) because it requires a State Agency Action and includes alteration of a Coastal Bank. The project will require a Chapter 91 (c. 91) Waterways License and may require a Section 401 Water Quality Certification (401 WQC) from the Massachusetts Department of Environmental Protection (MassDEP).

The project will be subject to Federal Consistency Review by Coastal Zone Management (CZM). The project will require review by the U.S. Army Corps of Engineers (ACOE). The project will require an Order of Conditions from the Dennis Conservation Commission, or in the case of an appeal, a Superseding Order of Conditions from MassDEP. The project is subject to MEPA's Greenhouse Gas (GHG) Emissions Policy and Protocol (GHG Policy).

MEPA jurisdiction extends to those aspects of the project that are within the subject matter of required or potentially required State Agency Actions and that may cause Damage to the Environment, as defined in the MEPA regulations. Because the project requires a c. 91 License, subject matter jurisdiction is functionally equivalent to full scope jurisdiction in accordance with 301 CMR 11.01(2)(a)(3), and therefore extends to all aspects of the project that may cause Damage to the Environment.

Environmental Impacts and Mitigation

According to the ENF the project will permanently impact 4,225 square feet (sf) of Land Under Ocean (LUO) and 60,600 sf of Coastal Bank. The ENF did not identify any impact to Coastal Beach or Land Subject to Coastal Storm Flowage (LSCSF). The project is proposed to improve shoreline protection and increase tidal flow and flushing between the groin structures. The ENF indicated that erosion and sedimentation controls will be placed along the shoreline to reduce stormwater runoff. The ENF did not identify sufficient measures to avoid, minimize and mitigate environmental impacts associated with the project.

Review of the ENF

The ENF generally described existing and proposed conditions and included site plans and previously issued c. 91 Licenses. As described in the ENF, the project consists of the following elements:

- Decrease the length of the two existing groins from 237 feet to 147 feet and 187 feet to 140 feet, respectively;
- Remove approximately 77 feet of the existing breakwater between the two aforementioned groins;
- Lower portions of approximately 1,000 sf of the two groins to improve alongshore flow;
- Construct a T-head groin between the first and second groins using rock removed to decrease the length of the groins;
- Construct similar T-heads at the end of the first and second groins using repurposed rock from the reconfiguration of the groins; and
- Beach renourishment on approximately 60,600 sf of the beach in front of the Inn.

Reconfiguration of the groin field will create four pocket beaches in front of the Inn. The 65-foot to 95-foot wide gap-openings between the groins is anticipated to develop and maintain stable, predictable beach geometry within each pocket beach, while reducing the length of the groins along the shoreline. The reconfigured groins are expected to reduce detritus between the western groins while maintaining shoreline protection. Approximately 4,179 sf of rock structures will be removed and 4,225 sf of rock structures will be added, resulting in a net increase of 46 sf of rock within the groin field. Beach nourishment is designed to return the beach to conditions that existed prior to construction of the groin system (circa 1938).

Conclusion

The ENF did not provide sufficient information on existing and proposed conditions, proposed project impacts and mitigation, project alternatives, or project consistency with applicable State regulations. Comments from State Agencies request further analysis of alternatives and disclosure of potential environmental impacts in an EIR. Based on review of the ENF and consultation with State Agencies, I hereby require the Proponent to prepare a DEIR.

SCOPE

General

The DEIR should follow Section 11.07 of the MEPA regulations for outline and content, as modified by this Scope.

Project Description and Permitting

The DEIR should include a detailed description of the proposed project and describe any changes to the project since the filing of the ENF. The DEIR should include updated site plans for existing and post-construction conditions at a legible scale. These plans should clearly identify property boundaries, coastal wetland resource areas, elevations and water depths, limits of tidal inundation (e.g., mean low water, mean high water, etc.), areas of mapped eelgrass and shellfish resources, and construction staging and access areas. The DEIR should provide a brief description and analysis of applicable statutory and regulatory standards and requirements, and describe how the project will meet those standards. It should include a list of required State Permits, Financial Assistance, or other State approvals and provide an update on the status of each of these pending actions. I note that the project may require filing as a Development of Regional Impact under Cape Cod Commission (CCC) regulations. The Proponent should work with the CCC to determine whether filing a joint DRI/DEIR is appropriate for the project to satisfy CCC review.

Alternatives Analysis

The DEIR should include a discussion of the following project alternatives to ensure that environmental impacts are avoided, minimized, and mitigated to the maximum extent practicable.

- A No-Build Alternative that retains the existing layout of the groins;
- A Modified Groin Alternative that evaluates various layout and lengths of the groin system in front of the Inn. In particular, this should include a system that does not consist of “T-groins” for comparative purposes with the Preferred Alternative; and
- The Preferred Alternative.

I note MassDEP’s request that the Proponent present a Preferred Alternative that will not result in a net increase in permanent structures. The DEIR should also evaluate alternatives related to the placement and profile of beach nourishment areas on the project site. For each project alternative, the DEIR should include a schematic design with relevant jurisdictional and environmentally sensitive areas (e.g., mean high water, limits of coastal resource areas, eel grass beds, etc.) and a tabular summary of temporary and permanent impacts. The DEIR should describe the parameters of each alternative (e.g., amount of rock groin, amount of fill or dredging (if applicable), etc.). The DEIR should discuss the benefits and challenges associated with each alternative and explain why alternatives were not selected.

Furthermore, the DEIR should include data relevant to the use of “T-groins” in similarly dynamic coastal locations. The ENF noted the use, and relative success, of these structures outside of New England. To support the conclusion that these structures will avoid, minimize, and mitigate Damage to the Environment, the DEIR should summarize, and provide supporting documentation as

necessary, how these structures will not exacerbate erosion, hinder sediment transportation processes along the shoreline, or create additional hazards.

Wetlands and Waterways

The DEIR should clearly identify and characterize on-site coastal wetland resource areas. The DEIR should also characterize the project site with regard to marine fishery habitat, including shellfish, finfish, and benthic habitat. The DEIR should discuss the project's consistency with applicable Wetlands Protection Act performance standards, c. 91 Waterways regulations and CZM Federal Consistency requirements. MassDEP has concluded that the project will be classified as a water-dependent use pursuant to 310 CMR 9.12. The DEIR should confirm whether or not a Section 401 Water Quality Certificate (WQC) will be required for the project. If so, the DEIR should discuss project consistency with associated performance standards. Finally, the DEIR should summarize the Army Corps of Engineers (ACOE) review and permitting process for the project and how compliance with requirements may influence project design.

As requested by CZM, the DEIR should demonstrate that the proposed groins are the minimum height, width and length necessary to maintain the beach form and volume. Therefore, the DEIR should include existing bathymetric and beach profile data, sediment characterization data, and sediment transport data and analysis for existing and proposed conditions. The DEIR should address how the project has been designed to avoid direct and secondary impacts to eelgrass beds. The DEIR should clarify if the reconfiguration of the groins and beach nourishment will result in a conversion of coastal resource areas (e.g., LUO to Coastal Beach) in the post-construction static state. The DEIR should describe any temporary impacts to coastal wetland resource areas during the groin reconfiguration process. If material will be dredged to facilitate construction of the groins, the volume and type of material should be quantified in the DEIR, along with its proposed use or disposal (if applicable).

The DEIR should identify those portions of the existing groins that will be lowered in elevation and provide cross-section details. The DEIR should discuss how public access along the shoreline will be provided pursuant to 310 CMR 9.35. Safe passage should be provided throughout the construction period and in the post-construction state.

The DEIR should clearly identify the profile, volumes, and areal extent of beach nourishment and confirm sediment source compatibility. Furthermore, the DEIR should demonstrate that beach nourishment will be provided in a manner that fills the groins to entrapment capacity to minimize impacts to adjacent beaches. The DEIR should address project impacts to the easternmost groin and the beach directly east of this groin with regard to erosion and the potential need for beach nourishment in this location.

The DEIR should outline a construction period and post-construction period monitoring plan to ensure successful installation and maintenance of the project. At a minimum, the post-construction monitoring plan should include beach profiles and bathymetry data to evaluate erosion and accretion of sediment along the shoreline and within proximity of the groins; location of eelgrass beds; and accumulation of detritus along the Inn's shoreline. The Proponent should work with State Agencies and the Town to determine the extent of monitoring on adjacent Town-owned and private properties. The DEIR

should discuss thresholds and contingencies for determining when additional beach nourishment or other mitigation measures may be required.

Rare Species

The DEIR should directly respond to comments submitted by the NHESP, both in its comment letter on the ENF and a separate letter issued to the Proponent on November 29, 2016. This information is critical to facilitate project review in accordance with the Massachusetts Endangered Species Act (MESA) and its regulations (321 CMR 10.00). Many of the items requested by NHESP for their review process overlap with those identified in this Scope. The DEIR should address specifically how the Preferred Alternative will be designed in a manner consistent with applicable MESA regulations and identify sufficient mitigation measures if rare species impacts cannot be avoided or minimized.

Greenhouse Gas Emissions

The project is subject to the MEPA Greenhouse Gas Policy and Protocol (GHG Policy). The GHG Policy includes a de minimus exemption for projects that will produce minimal amounts of GHG emissions. The DEIR should confirm that the project will produce nominal amounts of GHG emissions and formally request an exemption under the GHG Policy.

Construction Period

The DEIR should discuss proposed construction methodologies. Specifically, the DEIR should describe the types of equipment that will be used to relocate and reconstruct the groins and complete beach renourishment, identify access routes and staging locations on upland areas, and discuss how construction methods will avoid and minimize impacts to eelgrass beds. The DEIR should discuss potential time-of-year (TOY) restrictions on in-water and beach work and the estimated length of the construction period for both groin reconfiguration and beach nourishment.

The DEIR should describe construction period erosion and sediment control measures, including the types of best management practices (BMPs) (e.g., silt booms, cofferdams) that will be used to limit turbidity and other water quality impacts during the reconfiguration of the groins and beach nourishment. All activities should be managed in accordance with applicable MassDEP Solid Waste and Air Pollution Control regulations pursuant to M.G.L. c.40, §54. The DEIR should discuss if the Proponent will require contractors to use construction equipment with engines manufactured to Tier 4 federal emissions standards or, if a piece of equipment is not available in the Tier 4 configuration, then construction equipment should be used that has been retrofitted with the best available after-engine emissions control technology, such as oxidation catalysts or diesel particulate filters, to reduce exhaust emissions.

Mitigation/Draft Section 61 Findings

The DEIR should include a separate chapter summarizing proposed mitigation measures. This chapter should also include draft Section 61 Findings for each State Agency that will issue permits for the project. The DEIR should contain clear commitments to implement mitigation measures, estimate

the individual costs of each proposed measure, identify the parties responsible for implementation, and contain a schedule for implementation.

Responses to Comments

The DEIR should contain a copy of this Certificate and a copy of each comment letter received. In order to ensure that the issues raised by commenters are addressed, the DEIR should include direct responses to comments to the extent that they are within MEPA jurisdiction. This directive is not intended to, and shall not be construed to enlarge the scope of the DEIR beyond what has been expressly identified in this certificate.

Circulation

In accordance with Section 11.16 of the MEPA Regulations and as modified by this Certificate, the Proponent should circulate a hard copy of the DEIR to each State and Town Agency from which the Proponent will seek permits. A copy of the DEIR should be made available for review at the Dennis Public Library.

January 6, 2017

Date



Matthew A. Beaton

Comments Received:

12/13/2016	Board of Underwater Archaeological Resources
12/20/2016	Natural Heritage and Endangered Species Program
12/22/2016	Office of Coastal Zone Management
12/27/2016	Division of Marine Fisheries
12/27/2016	Massachusetts Department of Environmental Protection – Southeast Regional Office (MassDEP – SERO)

MAB/HSJ/hsj





The COMMONWEALTH OF MASSACHUSETTS
BOARD OF UNDERWATER ARCHAEOLOGICAL RESOURCES
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
251 Causeway Street, Suite 800, Boston, MA 02114-2136
Tel. (617) 626-1141 Fax (617) 626-1240 Web Site: www.mass.gov/eea/agencies/czm/buar/

December 13, 2016

Secretary Matthew A. Beaton
Executive Office of Energy and Environmental Affairs
Attention: Holly Johnson, MEPA Unit
100 Cambridge St., Suite 900
Boston, MA 02114

RECEIVED

DEC 13 2016

MEPA

RE: Lighthouse Inn Groin Improvements, Nantucket Sound, West Dennis (EEA#15623)

Dear Secretary Beaton:

The Massachusetts Board of Underwater Archaeological Resources (BUAR) has completed its review of the proposed project's ENF (EEA#15623) prepared by Environmental Partners Group on behalf of Lighthouse Inn, Inc. We offer the following comments.

The Board has conducted a preliminary review of its files and secondary literature sources to identify known and potential submerged cultural resources in the proposed project area. No record of any underwater archaeological resources was found. Based on the results of this review and the nature of the proposed project activities, the Board expects that this project is unlikely to impact submerged cultural resources.

However, the Board notes the area may be generally archaeologically sensitive. Therefore, should heretofore-unknown submerged or terrestrial cultural resources be encountered during the course of the project, the Board expects that the project's sponsor will take steps to limit adverse affects and notify the Board and the Massachusetts Historical Commission, as well as other appropriate agencies, immediately in accordance with the Board's *Policy Guidance for the Discovery of Unanticipated Archaeological Resources*.

The Board appreciates the opportunity to provide these comments as part of the review process. Should you have any questions regarding this letter, please do not hesitate to contact me at the address above, by email at victor.mastone@state.ma.us, or by telephone at (617) 626-1141.

Sincerely,

A handwritten signature in blue ink, appearing to read "Victor T. Mastone".

Victor T. Mastone
Director

/vtm

Johnson, Holly (EEA)

From: Hoenig, Amy (FWE)
Sent: Tuesday, December 20, 2016 3:04 PM
To: Johnson, Holly (EEA)
Cc: Medeiros, Daisy M (FWE); mnw@envpartners.com; gstone@lighthouseinn.com
Subject: EEA No. 15623, Lighthouse inn Groin Improvements, West Dennis
Attachments: Dennis_16-36164_11292016.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Project Name: *Lighthouse Inn Groin Improvement Project*
Proponent: *Lighthouse Inn Inc.*
Location: *1 Lighthouse Road, West Dennis*
Project Description: *Groin Reconfiguration and Beach Nourishment Project*
Document Reviewed: *Environmental Notification Form*
EEA File Number: *15623*

Good afternoon, Holly –

The Division of Fisheries & Wildlife's Natural Heritage & Endangered Species Program received a copy of the Environmental Notification Form (ENF) for the proposed groin reconfiguration and beach nourishment project. As indicated within the ENF package, the proponent's representative has submitted information to our office for review pursuant to the Massachusetts Endangered Species Act. The Division would like to offer the following comments on the ENF.

According to the information provided a goal of the project is to increase tidal flushing to reduce detritus within the embayment. In order to achieve increased flushing, the existing groins will be reduced in length and partially lowered and an additional T groin will be installed in the center. As stated within the ENF, this would result in an overall decrease in the total footprint of groin onsite by 1,465 square feet (Project Description). However, according to the calculations accompanying the Concept Sketch (Appendix D), there will be a net increase of 46 square feet of new structure. There are additional elements of the project that the Division has required submission of either supplemental information or clarification.

As part of the Massachusetts Endangered Species Act review of this project, the Division issued the attached letter on 11/29/2016. The information contained within the ENF has been reviewed by our office and the Division has determined that the information necessary to continue our review is not contained within the ENF; therefore, the Division has no additional comments on the project at this time.

We appreciate the opportunity to comment on this project.

Sincerely,
Amy Hoenig
Endangered Species Review Biologist
Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife
1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6364 | e: Amy.Hoenig@state.ma.us
mass.gov/masswildlife | facebook.com/masswildlife



MASSWILDLIFE

DIVISION OF FISHERIES & WILDLIFE

1 Rabbit Hill Road, Westborough, MA 01581
p: (508) 389-6300 | f: (508) 389-7890
MASS.GOV/MASSWILDLIFE

Jack Buckley, *Director*

November 29, 2016

Gregory Stone
Lighthouse Inn, Inc.
PO Box 128
West Dennis, MA 02670

Project Location: 1 Lighthouse Road
Town: West Dennis
Project Description: Reconfigure Groins
NHESP Tracking No.: 16-36164

RE: Notice that additional information is required to take further action on your application for MESA review under 321 CMR 10.18

Dear Applicant:

On November 2, 2016 you filed an application for review of the above referenced proposed project in Priority Habitat by the Natural Heritage and Endangered Species Program (NHESP) in the Division of Fisheries and Wildlife (the "Division") pursuant to 321 CMR 10.18 of the Massachusetts Endangered Species Act (MESA) regulations. The purpose of the review is for the Division to determine whether a Take of state-listed species will result from the proposed project. Under 321 CMR 10.18(1), the Division is required to notify the Record Owner of the property where the project is proposed within 30 days whether the submitted application contains the information required to be submitted to the Division pursuant to 321 CMR 10.20, including the applicable review fee. The Division also has the authority under 321 CMR 10.20 to require an applicant to provide additional information beyond the minimum information specified therein.

This letter is to inform you that the Division has reviewed the materials submitted with your application and has determined that additional information is required in order for the Division to complete its review pursuant to 321 CMR 10.18, as specified below:

- 1) Please provide an assessment of the coastal processes affecting this site and detail the effects the existing structure has on the shoreline. Said assessment should evaluate longshore and cross-shore sediment transport with wind and wave analysis for existing and proposed conditions.
- 2) Please provide an analysis of alternatives.
- 3) Engineered site plans showing existing and proposed conditions, elevations, profiles, etc.
- 4) The total project disturbance and impacts are undefined. Please clarify the footprint/size of the existing structures, proposed structure modifications, reductions and new structures.

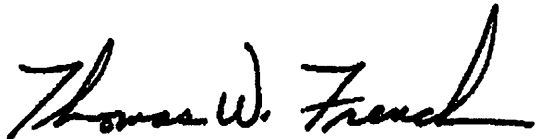
MASSWILDLIFE

Additionally, the description does not mention a nourishment component, however, the site figure references burying a rock revetment in sand with no details on amount or slope of the material to be placed.

No work or other activities related to your filing may be conducted anywhere on the project site while the Division completes its review. If you have decided to withdraw with your application for review under 321 CMR 10.18, please notify the Division of that decision in writing so that we can close out our review file for this project.

If you have any questions concerning this notice, please contact Amy Hoenig, Endangered Species Review Biologist, (508) 389-6364.

Sincerely,

A handwritten signature in black ink that reads "Thomas W. French". The signature is written in a cursive style with a large, sweeping initial 'T'.

Thomas W. French, Ph.D.
Assistant Director

cc: Mark White, Environmental Partners Group, Inc.



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

MEMORANDUM

TO: Matthew A. Beaton, Secretary, EEA
ATTN: Holly Johnson, MEPA Unit
FROM: Bruce Carlisle, Director, CZM
DATE: December 22, 2016
RE: EEA-15623 – Lighthouse Inn Groin Improvements, Dennis

The Massachusetts Office of Coastal Zone Management (CZM) has completed its review of the above-referenced Environmental Notification Form (ENF), noticed in the *Environmental Monitor* dated December 7, 2016, and recommends the development of an Environmental Impact Report (EIR).

Project Description

The project involves the proposed reconfiguration of existing groins along 600 feet of shoreline on Nantucket Sound. The shorefront includes three rock groins, and a shore parallel breakwater which spans between two of the groins, with a small gap opening. The proposed reconfiguration would decrease the length of the two existing groins from 237 feet to 147 feet and from 187 feet to 140 feet, respectively. Portions of the existing groins would be lowered to improve alongshore sediment flow. A new T-head groin is proposed to be constructed between the two existing groins. Beach nourishment is proposed to rebuild the beach along the entire site.

Project Comments

CZM staff have reviewed the ENF, attended the MEPA site visit, and also provided consultation to the project proponent at an agency pre-application meeting. CZM and the other agencies who participated in the meeting provided extensive feedback on the project concept and the types of information that should be included in the permit applications, including the filing with MEPA. Based on our review of the ENF, the information requested by the agencies has not been included in the ENF. CZM believes that the information contained in the ENF is insufficient to fully evaluate potential direct and indirect impacts from the proposed project, and recommends an EIR be developed to present necessary supporting information and a thorough alternatives analysis.

CZM is generally supportive of the concept that the applicant's consultants have presented and offers the following specific comments:

- CZM requested that the applicant demonstrate that the proposed groins are the minimum height, width and length necessary to maintain the beach form and volume. There is no information in the ENF regarding the basis for the size of the proposed structures, and no detail regarding the alternative configurations and sizes for the groins and proposed T heads.
- CZM requested that the ENF include a plan for adding sand to the beach to fill the groins to entrapment capacity to minimize impacts to adjacent beaches. Although the ENF states that beach fill with compatible sand will be placed after the reconfiguration of the rock structures, there is no calculations provided to indicate that the proposed fill will be sufficient to fill the groins to entrapment. In addition, there is no fill proposed to the east of the easternmost groin. CZM expressed concern about the potential impacts of the groins on



the beach directly east of the easternmost groin at the pre-application meeting and recommended that this be addressed in the filing.

- CZM also requested that the ENF include a plan for monitoring the proposed groins and beach fill, with provisions for mitigation of any adverse impacts. No information was included in the ENF to address this.
- Information was requested regarding the extent of the existing eelgrass beds relative to the proposed project elements. No information was included in the ENF regarding this resource area.

The ENF states that “groins and beach nourishment are recommended shoreline management techniques included in the December 2015 Coastal Erosion Commission Report”. CZM notes that groins and beach nourishment were included in Table 11 in the Science and Technology Working Group Report in the Coastal Erosion Commission Report. This table was included by the Working Group to help advise the Commission regarding the range of shoreline management techniques that could be used to manage shorelines. The report states that the applicability of each option varies according to the nature of the risk, local conditions, and the resources that are available to apply the techniques. The report does not recommend the use of any one technique.

The proposed project is subject to CZM federal consistency review. For further information on this process, please contact, Robert Boeri, Project Review Coordinator, at 617-626-1050 or visit the CZM web site at www.state.ma.us/czm/fcr.htm.

BKC/sm/rh

cc: Stephen McKenna, CZM Cape & Islands Regional Coordinator
Mark White, Environmental Partners Group
1900 Crown Colony Drive, Suite 402, Quincy, MA 02169
Karen Johnson,, Director of Natural Resources
P.O. Box 2060, Dennis, MA 02660
Jim Mahalla, DEP
Southeast Regional Office



David E. Pierce, Ph.D.
Director

Commonwealth of Massachusetts

Division of Marine Fisheries

251 Causeway Street, Suite 400

Boston, Massachusetts 02114

(617) 626-1520

fax (617) 626-1509



Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Matthew A. Beaton
Secretary

George N. Peterson, Jr.
Commissioner

Mary-Lee King
Deputy Commissioner

December 27, 2016

Secretary Matthew A. Beaton
Executive Office of Energy and Environmental Affairs (EEA)
Attn: MEPA Office
Holly Johnson, EEA No. 15623
100 Cambridge Street, Suite 900
Boston, MA 02114

Dear Secretary Beaton:

The Division of Marine Fisheries (*Marine Fisheries*) has reviewed the Environmental Notification Form by Lighthouse Inn Inc. for the proposed Lighthouse Inn Groin Improvements project, 1 Lighthouse Road, on Nantucket Sound in the Town of Dennis. Proposed improvements include the reconfiguration of three existing rock groins to improve flushing and tidal flow. Two existing groins would be shortened and lowered, and an existing breakwater running parallel to the shoreline would be reconfigured. The existing design would be converted to a series of T-shaped groins to promote the maintenance of pocket beaches along the bordering shoreline. Beach nourishment is also proposed over a 60,600 square foot area to establish beach along the eroded shoreline. Proposed groin improvements would result in a net increase of 46 square feet of hardened structures. Existing marine fisheries resources and potential project impacts are outlined in the following paragraphs.

The project site lies within mapped shellfish habitat for blue mussel (*Mytilus edulis*). Waters within the project site have habitat characteristics suitable for this species. Land containing shellfish is deemed significant to the interest of the Wetlands Protection Act (310 CMR 10.34) and the protection of marine fisheries.

The shoreline bordering the proposed groin improvement project site has been mapped by the Department of Environmental Protection as an eelgrass (*Zostera marina*) meadow. Eelgrass provides one of the most productive habitats for numerous marine species [1,2]. Eelgrass has declined in Massachusetts by approximately 20% in the past decade [3], and every effort should be made to avoid impacts to remaining eelgrass habitat.

Marine Fisheries offers the following comments for your consideration:

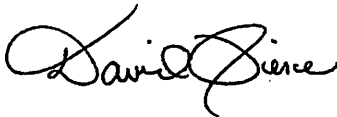
- Given that the project area closely borders mapped eelgrass habitat, the proponent should perform an eelgrass survey to delineate current eelgrass distribution in and adjacent to the project area.
- If eelgrass is confirmed to be present in or adjacent to the project site, construction activities could potentially impact these resources through direct displacement or indirect effects. Additional design and construction

modifications should be implemented if eelgrass is identified in or near the project to avoid such impacts.

- The proposed new groin footprint area should be located outside of any area identified in the survey as containing eelgrass.
- The proponent should provide more details on construction methodology with regards to eelgrass impacts. For example, if a work barge is used, it should be staged to avoid grounding at all times. Groin installation and removal can both potentially impact bordering eelgrass through turbidity and/or burial, and construction protocols should also include approaches to avoid such impacts.
- Depending on proposed construction protocols, post-construction monitoring of bordering eelgrass may also be warranted to assess potential project impacts.

Questions regarding this review may be directed to John Logan in our New Bedford office at (508) 990-2860 ext. 141.

Sincerely,

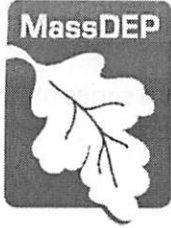


David E. Pierce, Ph.D.
Director

cc: Dennis Conservation Commission
Mark White, Environmental Partners Group
Chris Southwood, Dennis Shellfish Constable
Christopher Boelke & Alison Verkade, NMFS
Robert Boeri, CZM
Ed Reiner, EPA
Ken Chin, DEP
Richard Lehan, DFG
Terry O'Neil, Tom Shields, Kathryn Ford, Pooja Potti, DMF

References

1. Jackson EL, Rowden AA, Attrill MJ, Bossey SJ, Jones MB. The importance of seagrass beds as a habitat for fishery species. *Oceanogr Mar Biol Annu Rev.* 2001;39: 269–303.
2. Heck KL Jr, Carruthers TJB, Duarte CM, Hughes AR, Kendrick G, Orth RJ, et al. Trophic transfers from seagrass meadows subsidize diverse marine and terrestrial consumers. *Ecosystems.* 2008;11: 1198–1210.
3. Costello CT, Kenworthy WJ. Twelve-year mapping and change analysis of eelgrass (*Zostera marina*) areal abundance in Massachusetts (USA) identifies statewide declines. *Estuaries Coasts.* 2011;34: 232–242. doi:10.1007/s12237-010-9371-5



Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

Southeast Regional Office • 20 Riverside Drive, Lakeville MA 02347 • 508-946-2700

Charles D. Baker
Governor

Karyn E. Polito
Lieutenant Governor

Matthew A. Beaton
Secretary

Martin Suuberg
Commissioner

December 27, 2016

Mathew A. Beaton,
Secretary of Environment and Energy
ATTN: MEPA Office
Executive Office of Environmental Affairs
100 Cambridge Street, Suite 900
Boston, MA 02114

RE: ENF Review EOEEA # 15623 -
DENNIS. Lighthouse Inn Groin
Improvements at 1 Lighthouse Road, West
Dennis

Dear Secretary Beaton,

The Southeast Regional Office of the Department of Environmental Protection (MassDEP) has reviewed the Environmental Notification Form (ENF) for the Lighthouse Inn Groin Improvements at 1 Lighthouse Road, West Dennis, Massachusetts for the proposed (EOEEA # 15623). The project proponent provides the following information for the project:

The proposed project area comprises approximately 600 feet of ocean shorefront along the Lighthouse Inn shoreline. The shorefront includes three rock groins which are the westernmost of a broader field of ten groins. The groins extend between 130 and 240-feet in length from the upland. A shore parallel breakwater spans between the two center groins with a gap opening of about 25-feet. The small size of this gap does not allow sufficient wave energy into the embayment, behind the breakwater, to maintain a natural sand beach and it acts to trap detritus within the embayment.

The proposed shorefront improvements, shown in the attached proposed improvements plan (Appendix D), would reconfigure the existing groins to a design that is more conducive to maintaining shore protection and a sand beach while improving natural tidal flow and flushing between the two western groins. These improvements would remove most of the breakwater and shorten the length of the two western groins. It would reconfigure the rock to a geometry that is more effective in stabilizing the beach, reducing detrital accumulation, and restoring more natural sand beach conditions along the shorefront. The proposed plan entails removal of about 200-ft of existing groin and breakwater structures and relocation to a more effective geometry as shown on the plans. The proposed plan likewise requires placement of beach compatible sand fill after reconfiguration of the rock structures, in order to establish and improve the sand beaches.

Wetlands and Waterways Comments:

The SERO Wetlands and Waterways Program has reviewed the Lighthouse Inn Inc.'s proposal to remove 125 feet of the existing breakwater and shorten two existing western groin structures currently armoring

the shoreline directly in front of the facility. The plan would reconfigure the structures to create a series of three T groins and three pocket beaches, within which the Proponent proposes beach nourishment.

Waterways

- This project involves work within flowed tidelands, therefore the Proponent will be required to submit a Chapter 91 License Application. Based on the information contained in the ENF, it is the opinion of the Waterways Program that the project would be classified as a water-dependent use pursuant to the Waterways Regulations at 310 CMR 9.12.
- The ENF states that the proposed reconfiguration will result in a net increase in 46 square feet of groin structures. Alternative project proposals should consider a proposed plan that would not result in a net increase in permanent structures.
- The ENF explains that “the proposed project will have temporary impacts to the coastal resources in the project area as the groin geometry is reconfigured”. The Chapter 91 application should include a detailed description of these impacts.
- The volume and type of the material that will be dredged to facilitate the construction of the groins should be quantified. The Chapter 91 application will need to include the details for the proposed use or disposal of this material.
- If the volume of material to be dredged exceeds 100 cubic yards or the footprint of the new structures below the high tide line exceeds 5000 square feet then a 401 WQC will be required.
- The ENF states that portions of the groins would be lowered, details of the proposed work should be included in the Chapter 91 application, including cross sections of the proposed structures.
- The Chapter 91 application should include details regarding how public access along the shoreline will be provided pursuant to the Waterways Regulations at 310 CMR 9.35.
- Details on the proposed beach nourishment should also be included in the Chapter 91 application. Including volume and source of material to be used, compatibility with existing substrate and long term nourishment plans including triggering mechanisms.

Wetlands

- As indicated in the ENF the Proponent will need to submit a Notice of Intent to the Department and the Dennis Conservation Commission for the project under the Wetlands Protection Act. A Final Order of Conditions must be obtained before any work within Areas Subject to Jurisdiction commences.
-
- Although the proposed reconfiguration of coastal structures may improve tidal flow and flushing between the groins, more information needs to be provided to demonstrate that the project will not increase erosion.
- The Proponent must demonstrate that the proposed groin reconfiguration is the minimum height, width, and length necessary to maintain a beach.
- The Proponent must demonstrate that the proposed groins are filled to the entrapment capacity with beach compatible sediment.

- The Proponent should characterize the project area in terms of marine fishery habitat, including shellfish, finfish and benthic habitat.
- The Proponent should delineate any existing eelgrass beds near the proposed project.
- Existing resource areas should be delineated and any resource areas that will be changed due to the project should be determined.
- The Department is generally supportive of the project, particularly with elements that improve tidal flow and sediment transport.
- The Department believes that the additional information, as noted above, should be provided in an Environmental Impact Report (EIR).

Wastewater Management Comments

Based on information provided by the Proponent in response to a Request for Information by the Department, the Proponent confirmed the presence of an unpermitted wastewater discharge of 17,340 gpd (based on 94 bedrooms, 200 restaurant seats and 50 seats at a tavern (bar)). This volume of discharge of sanitary wastewater to groundwater is in violation of M.G.L. c. 21, §§ 26 through 53 and “The Groundwater Discharge Permit Regulations, at 314 CMR 5.03. It’s the Department’s belief that construction of a treatment plant may help mitigate the macrophyte algal blooms that deface its beachfront from its unpermitted septic discharge of untreated nitrogen.

Bureau of Waste Site Cleanup Comments

ENF #15623 – The Bureau of Waste Site Cleanup (BWSC) searched its databases for disposal sites and release notifications that have occurred at or might impact the proposed project area. A disposal site is a location where there has been a release to the environment of oil and/or hazardous material that is regulated under M.G.L. c. 21E, and the Massachusetts Contingency Plan [MCP – 310 CMR 40.0000].

There are no listed MCP disposal sites located at or in the vicinity of the site that might impact the proposed project. Interested parties may view a map showing the location of BWSC disposal sites using the MassGIS data viewer (Oliver)

at: http://maps.massgis.state.ma.us/map_ol/oliver.php Under “Available Data Layers” select “Regulated Areas”, and then “DEP Tier Classified 21E Sites”. The compliance status and report submittals for specific MCP disposal sites may be viewed using the BWSC Waste Sites/Reportable Release Lookup at: <http://public.dep.state.ma.us/SearchableSites2/Search.aspx>

The Project Proponent is advised that if oil and/or hazardous materials are identified during the implementation of this project, notification pursuant to the Massachusetts Contingency Plan (310 CMR 40.0000) must be made to MassDEP, if necessary. A Licensed Site Professional (LSP) should be retained to determine if notification is required and, if need be, to render appropriate opinions. The LSP may evaluate whether risk reduction measures are necessary if contamination is present. The BWSC may be contacted for guidance if questions arise regarding cleanup.

Dewatering Activities

Depending on the nature of the activities at the Project site, the proponent may have to obtain an EPA NPDES Dewatering General Permit <http://www.epa.gov/region1/npdes/dewatering.html> or a Remediation General Permit <http://www.epa.gov/region1/npdes/rgp.html> .

Air Quality Comments

Construction and operation activities shall not cause or contribute to a condition of air pollution due to dust, odor or noise. To determine the appropriate requirements please refer to:

- 310 CMR 7.09 Dust, Odor, Construction, and Demolition
- 310 CMR 7.10 Noise

Construction-Related Measures. MassDEP requests that the proponent use construction equipment with engines manufactured to Tier 4 federal emission standards, which are the most stringent emission standards currently available for off-road engines. If a piece of equipment is not available in the Tier 4 configuration, then the proponent should use construction equipment that has been retrofitted with the best available after-engine emission control technology, such as oxidation catalysts or diesel particulate filters, to reduce exhaust emissions. The proponent should maintain a list of the engines, their emission tiers, and, if applicable, the best available control technology installed on each piece of equipment on file for Departmental review.

Massachusetts Idling Regulation. MassDEP requests that the proponent state specifically in the subsequent environmental filing how it plans to prohibit the excessive idling during the construction period. Typical methods of reducing idling include driver training, periodic inspections by site supervisors, and posting signage. In addition, to ensure compliance with this regulation once the project is occupied, MassDEP requests that the proponent establish permanent signs limiting idling to five minutes or less at the completed project.

Solid Waste Dredging

The dredged material has been classified as appropriate for beach nourishment, however, any solid waste found in the dredged material must be disposed of at an appropriate facility.

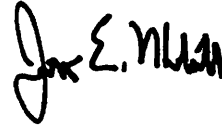
Proposed s.61 Findings

The “Certificate of the Secretary of Energy and Environmental Affairs on the Environmental Notification Form” may indicate that this project requires further MEPA review and the preparation of an Environmental Impact Report. Pursuant to MEPA Regulations 301 CMR 11.12(5)(d), the Proponent will prepare Proposed Section 61 Findings to be included in the EIR in a separate chapter updating and summarizing proposed mitigation measures. In accordance with 301 CMR 11.07(6)(k), this chapter should also include separate updated draft Section 61 Findings for each State agency that will issue permits for the project. The draft Section 61 Findings should contain clear commitments to implement mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation, and contain a schedule for implementation.

Recommendations:

The Department recommends that the Secretary’s Certificate requires the submission of an Environmental Impact Report that fully addresses the comments in this letter.

Very truly yours,



Jonathan E. Hobill,
Regional Engineer,
Bureau of Water Resources

JH/GZ

Cc: DEP/SERO

ATTN: Millie Garcia-Serrano, Regional Director
David Johnston, Deputy Regional Director, BWR
Maria Pinaud, Deputy Regional Director, BAW
Gerard Martin, Deputy Regional Director, BWSC
Jennifer Viveiros, Deputy Regional Director, ADMIN
Allen Hemberger, Site Management
Jim Mahala, Chief, Wetlands and Waterways
David Hill, Wetlands and Waterways
Dahlia Medeiros, Wetlands and Waterways

RECEIVED

JAN 20 2017

LAW OFFICES OF
PAUL R. TARDIF, ESQ., P.C.

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(508) 362-7799 (508) 362-7199 fax

Executive Office of Energy
& Environmental Affairs

Paul R. Tardif, Esq.
ptardif@tardiflaw.com

www.tardiflaw.com

Melissa G. MacLeod, Esq.
melissa@tardiflaw.com

REFER TO FILE NO.

January 18, 2017

Secretary of Energy and
Environmental Affairs
100 Cambridge Street
Suite 900
Boston, MA 02114

Attn: MEPA Office

RE: Project: Lighthouse Inn Groin Improvements
Proponent: LHI, Incorporated
Location: 1 Lighthouse Road, West Dennis, MA

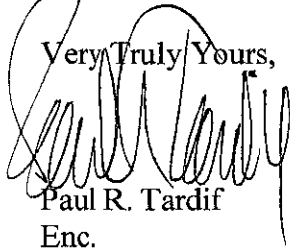
To whom it may concern:

Please be advised that this office represents 7 Ocean Avenue, LLC, the entity which owns the property at 7 Ocean Avenue, West Dennis, Massachusetts (the Property). The principals of the LLC, namely William D. Finnegan and Kerri A. Finnegan, have contacted me regarding their receipt of notice of the Notice of Environmental Review of a project to reconfigure the stone groins at the Lighthouse Inn. The project is located approximately 3 properties to the west of my client's property. First, let me apologize for the tardiness of this letter, as we now know that public comment would be accepted up to December 27, 2016, and that your agency would make a determination by January 6, 2017. Despite these deadlines, my client wanted to at least outline their position regarding this project, if not for consideration, then for the file.

Initially, the Finnegans do not have an objection to the project. The Lighthouse Inn has always been a good neighbor and they run a first class operation. My clients are, however, concerned that the reconfiguration of the stone groins will result in the re-direction of seaweed onto their beach. We can only assume that the collection of seaweed was one of the reasons for the commencement of this project in the first place. We hope that the work on the stone jetties will not have this result, which as you know, would clearly constitute a nuisance, and could be considered a trespass due to the artificial direction of the seaweed onto properties to the east. Please note the Finnegans' concern for your file, and if this issue in fact comes to fruition, we will be in touch again.

We thank you for your consideration and please feel free to contact me if you can opine about this issue.

Very Truly Yours,

A handwritten signature in black ink, appearing to read 'Paul R. Tardif', written over the typed name.

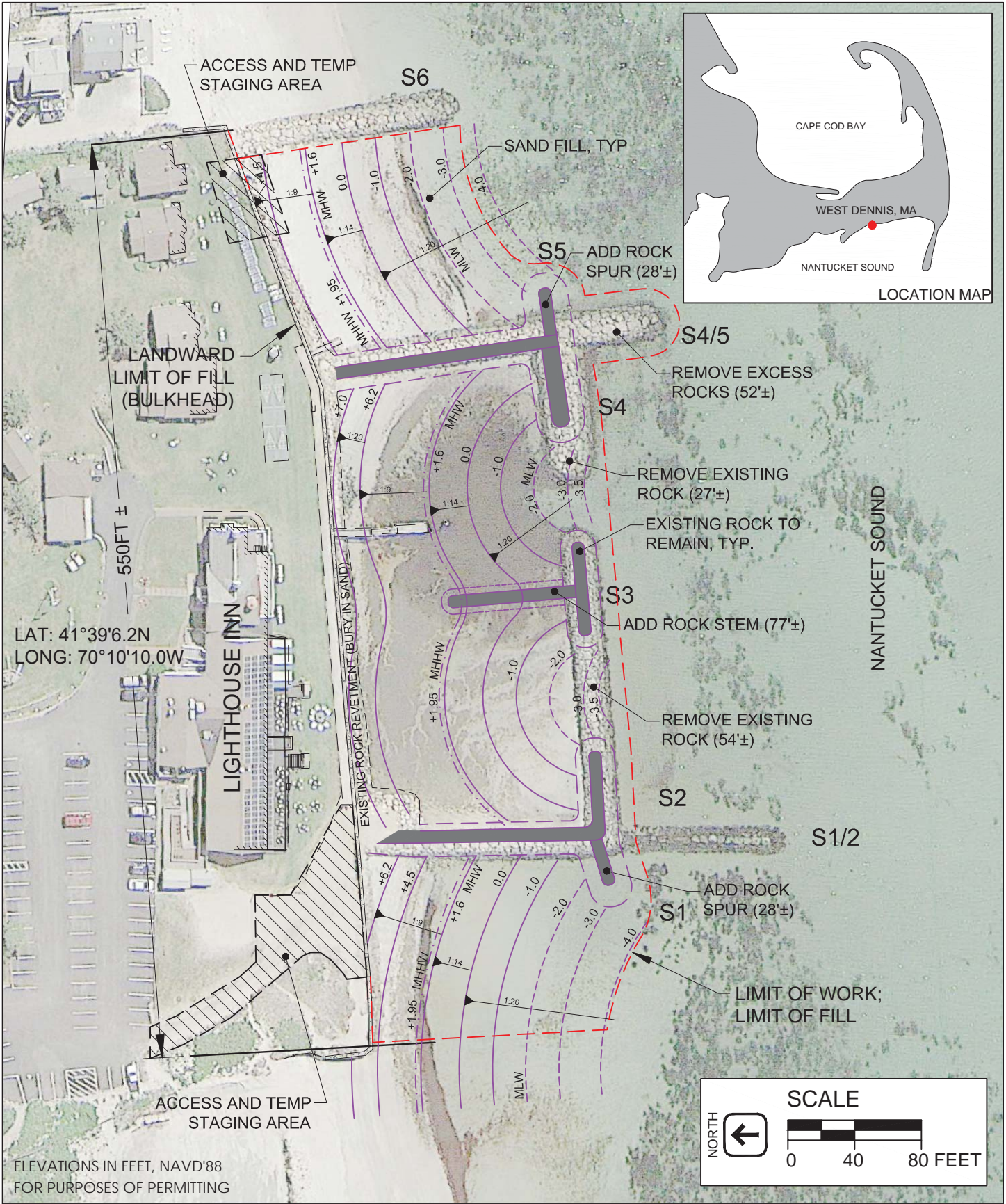
Paul R. Tardif

Enc.

Cc: William and Kerri Finnegan

Appendix B

Design Plans



<p>LIGHTHOUSE INN; WEST DENNIS, MA BEACH PROJECT</p> <p>PROPOSED IMPROVEMENTS</p>	<p>01/30/17</p>
	<p>DRAWN BY: ML</p>
	<p>SHEET 1 of 7</p>

CHARLES
CHRISTIE
REVOCABLE
TRUST 2004

LHI, INC.

LIGHTHOUSE INN

TOWN OF DENNIS

ELEVATIONS IN FEET, NAVD'88
FOR PURPOSES OF PERMITTING

NOTES:

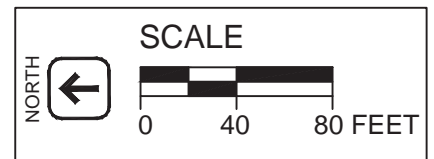
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2. THE DATA CONTAINED HEREON WAS GENERATED BY AN ON-THE-GROUND OPTICAL FIELD SURVEY EFFORT BY ROBERT FREEMAN, PLS DURING SEPTEMBER 2016.
3. SURVEY PREPARED BY CAPE COD ENGINEERING, INC.

TIDE DATUMS

+2.5'	H.A.T.
+1.95'	MHHW
+1.6'	MHW
0.0	NAVD'88
-2.0'	MLW
-2.8'	L.A.T.

EXISTING ROCK
STRUCTURE, TYP.

NANTUCKET SOUND



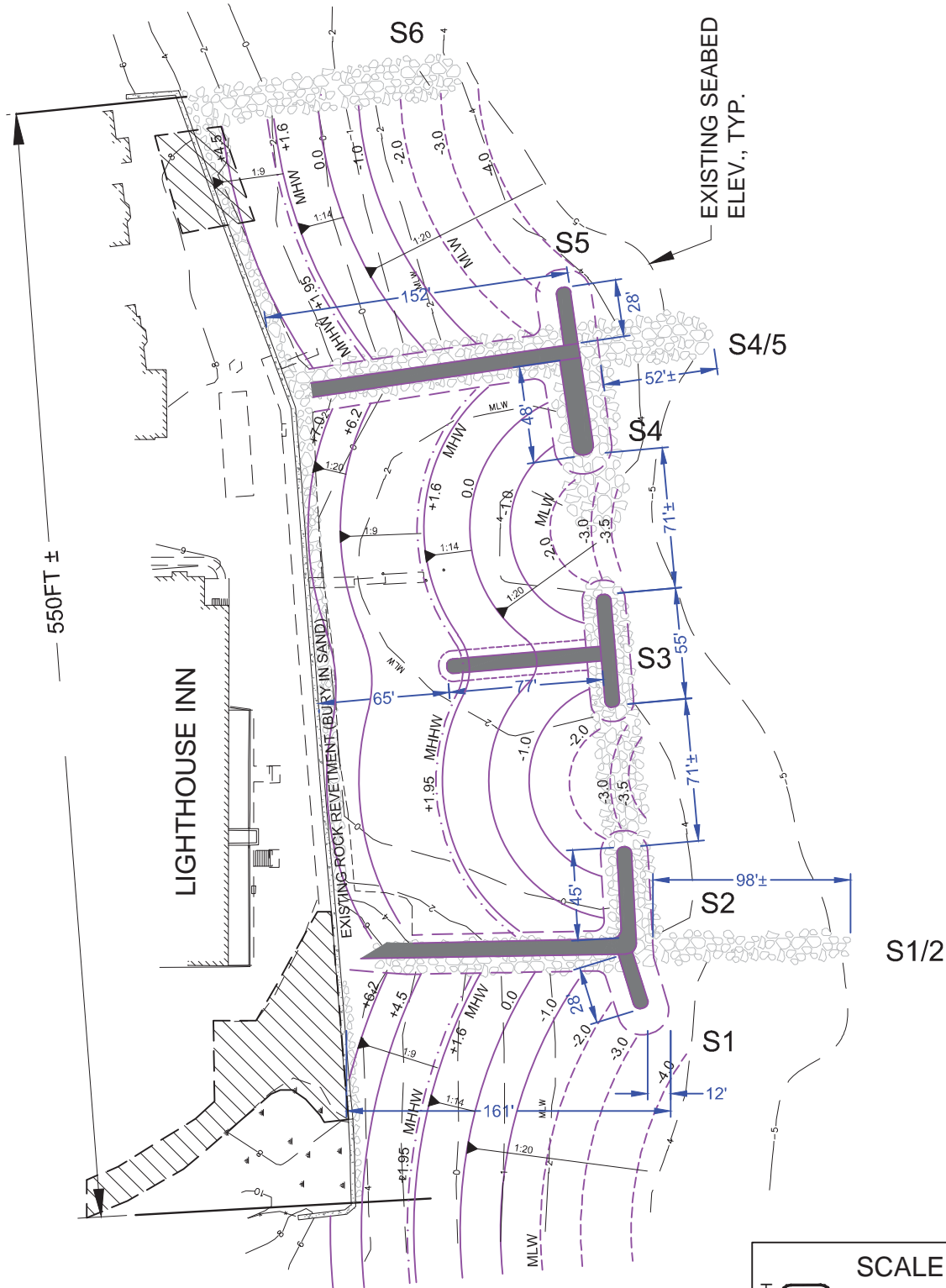
LIGHTHOUSE INN; WEST DENNIS, MA
BEACH PROJECT

EXISTING CONDITIONS

01/30/17

DRAWN BY:
ML

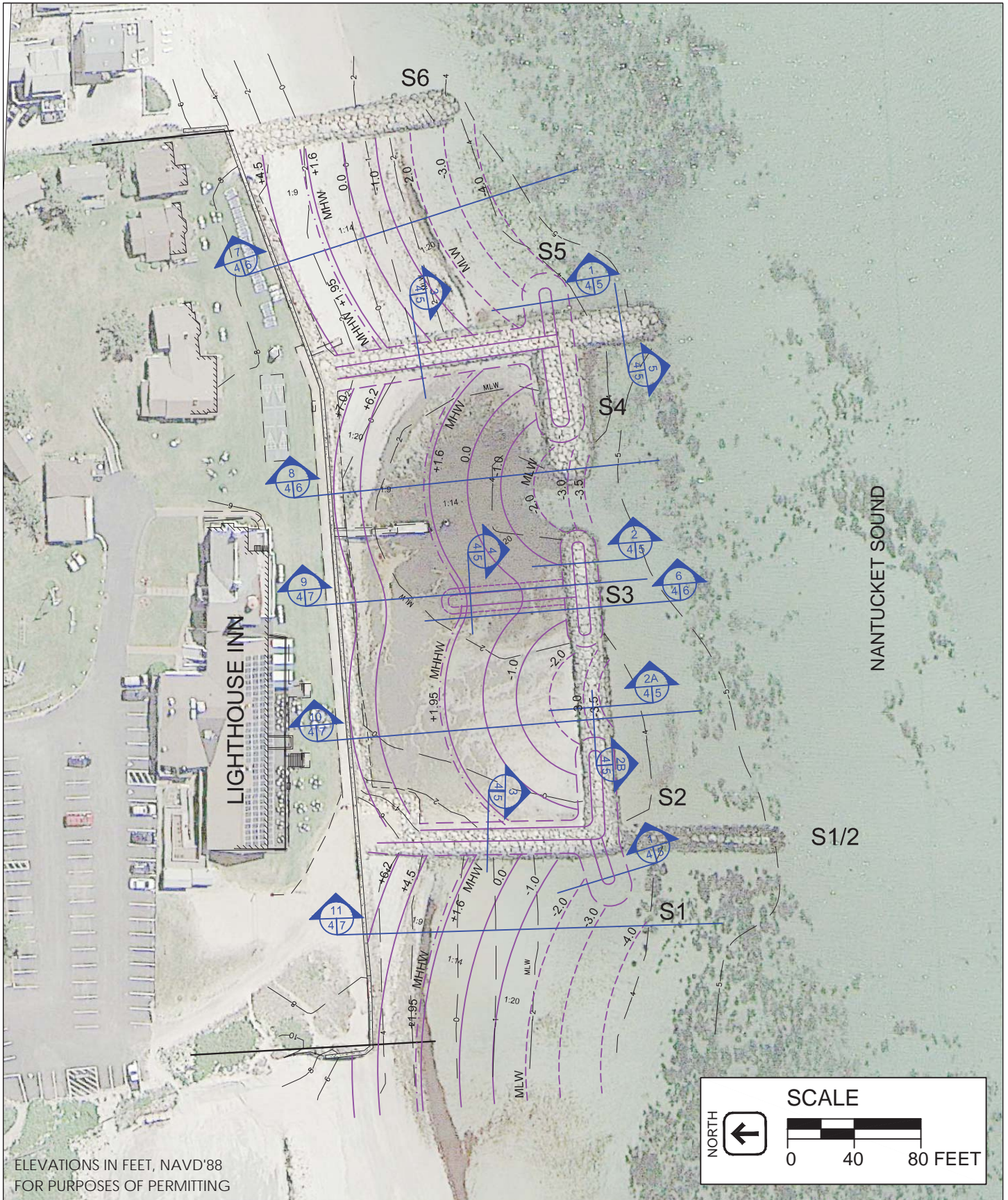
SHEET
2 of 7



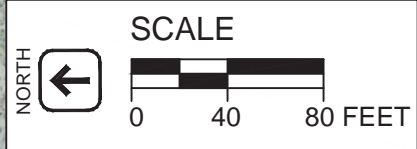
ELEVATIONS IN FEET, NAVD'88
FOR PURPOSES OF PERMITTING

LIGHTHOUSE INN; WEST DENNIS, MA
BEACH PROJECT
PLAN OF IMPROVEMENT

01/30/17
DRAWN BY:
ML
SHEET
3 of 7



ELEVATIONS IN FEET, NAVD'88
FOR PURPOSES OF PERMITTING



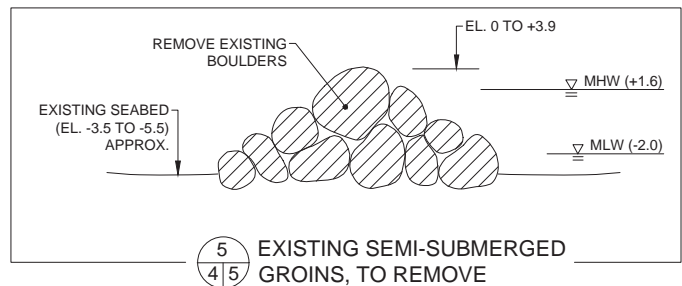
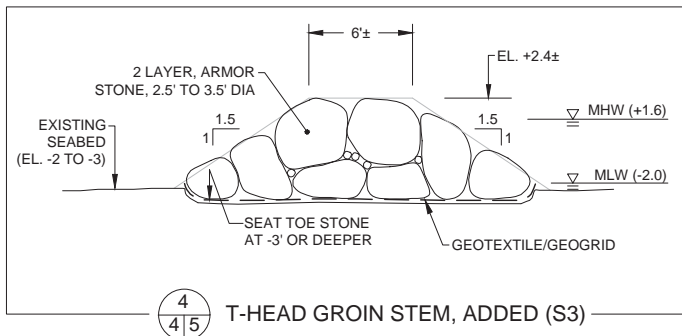
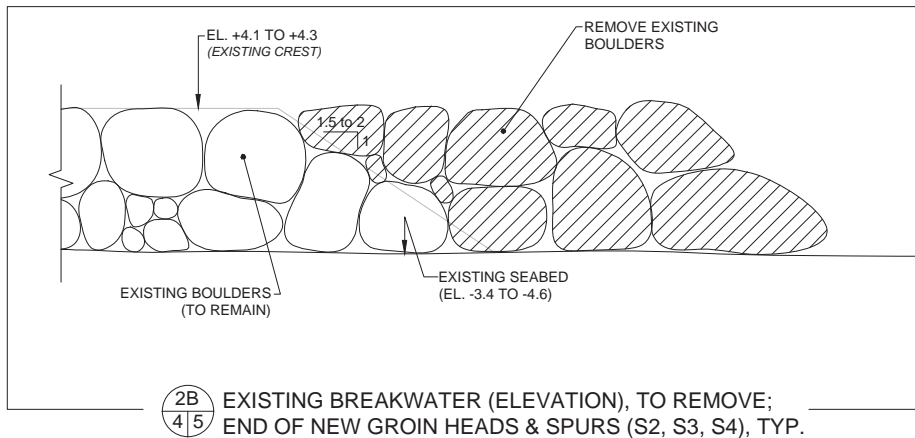
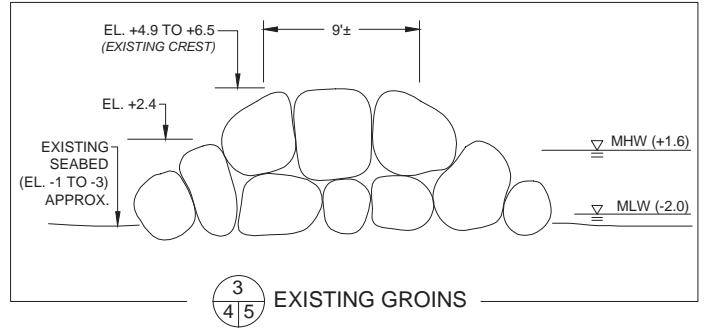
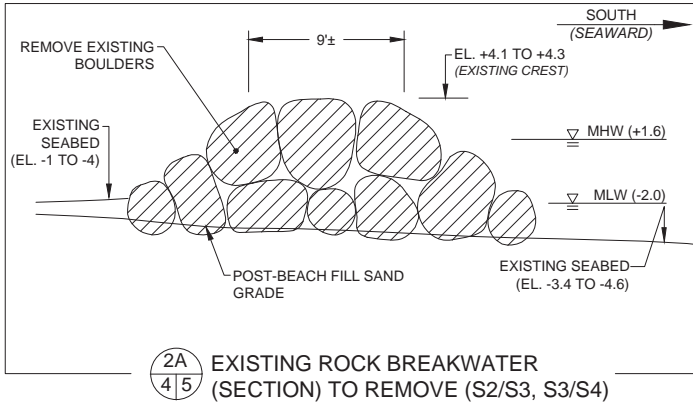
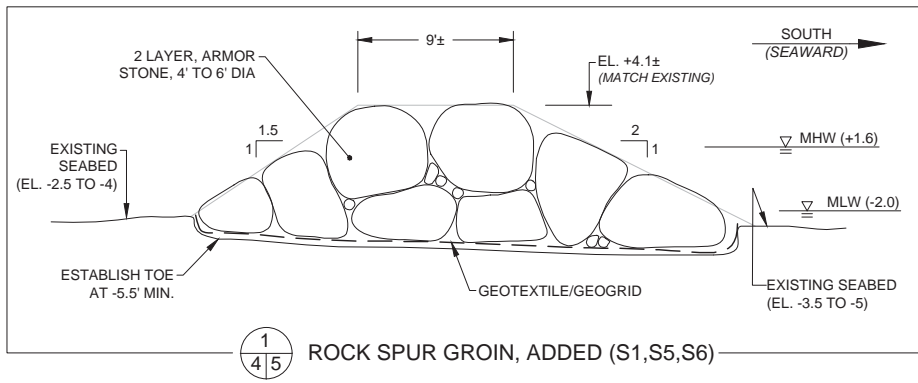
LIGHTHOUSE INN; WEST DENNIS, MA
BEACH PROJECT

PLAN & SECTION LOCATIONS

01/30/17

DRAWN BY:
ML

SHEET
4 of 7



FOR PURPOSES OF PERMITTING

SCALE VARIES

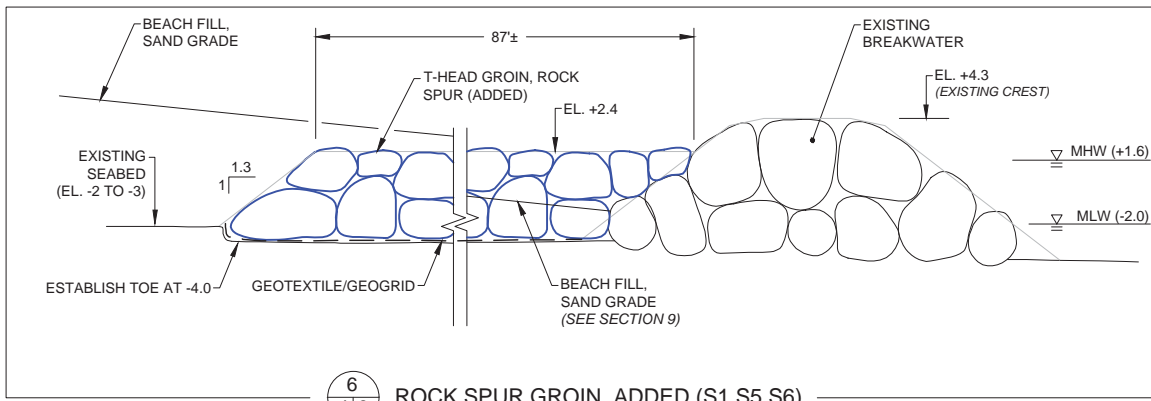
LIGHTHOUSE INN; WEST DENNIS, MA
BEACH PROJECT

01/30/17

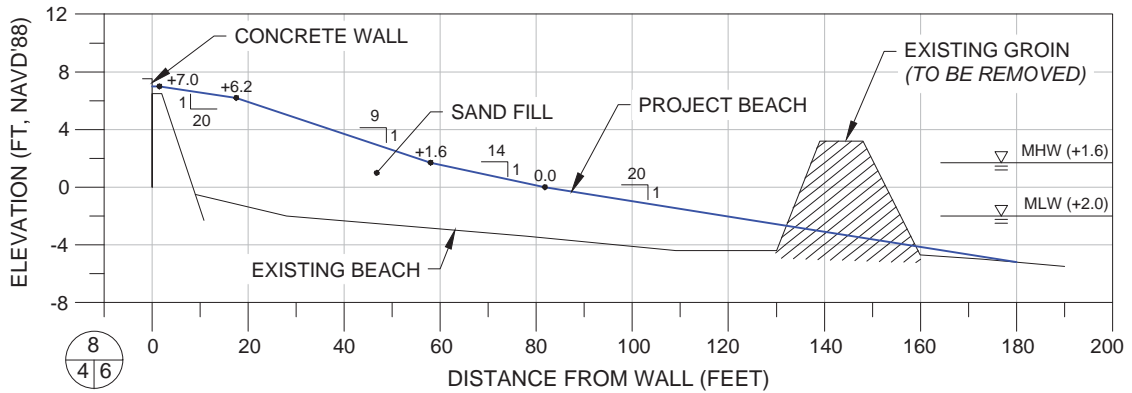
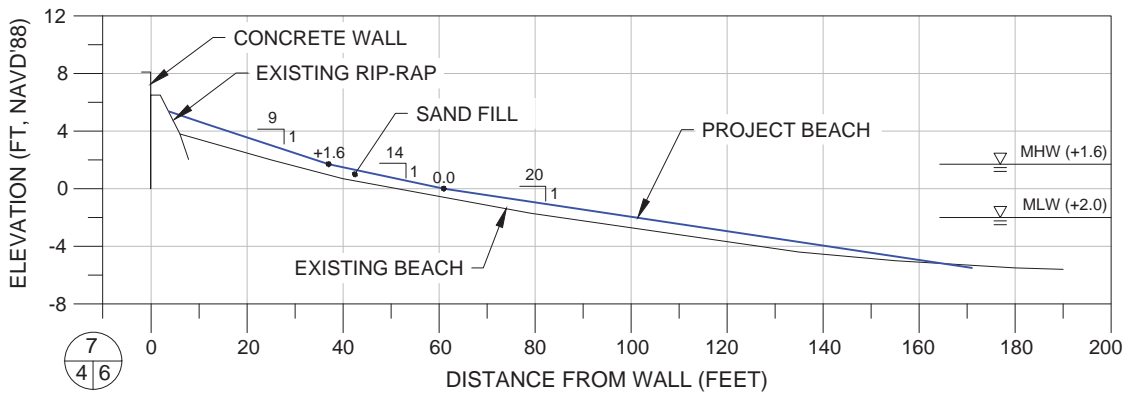
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SECTIONS & DETAILS - 1

SHEET
5 of 7



NOTE: SECTIONS 7-11 DEPICT 3:1 VERTICAL EXAGGERATION



FOR PURPOSES OF PERMITTING

SCALE VARIES

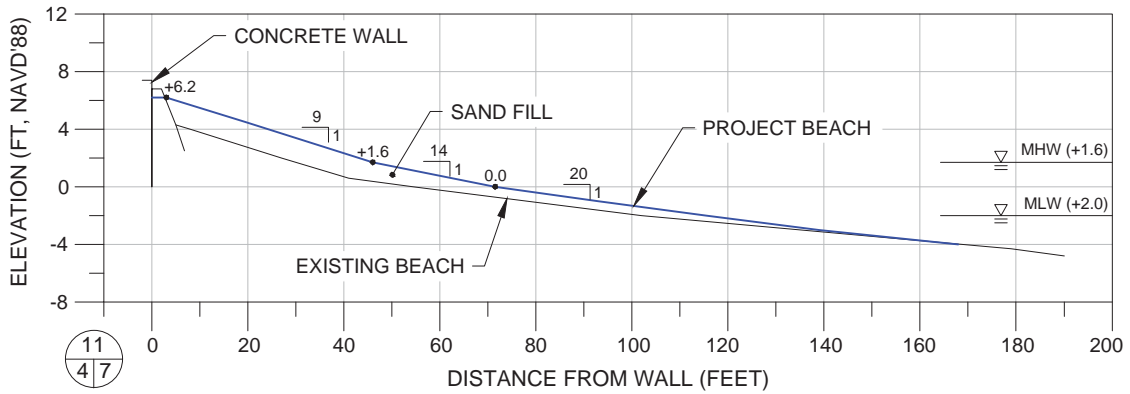
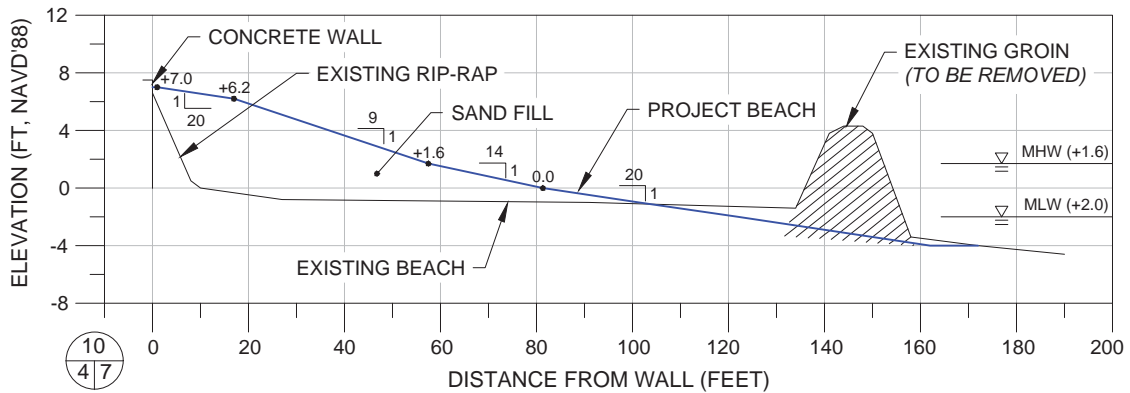
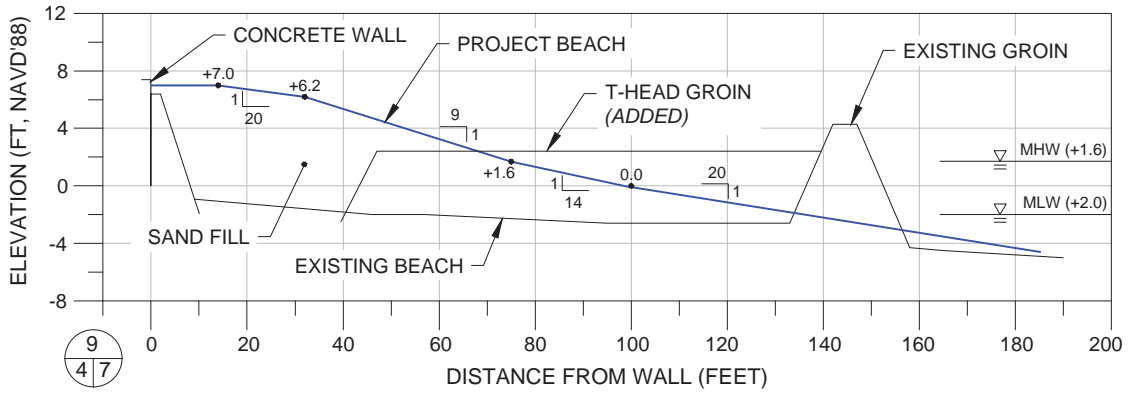
LIGHTHOUSE INN; WEST DENNIS, MA
BEACH PROJECT

SECTIONS & DETAILS - 2

01/30/17

DRAWN BY:
ML

SHEET
6 of 7



FOR PURPOSES OF PERMITTING

SCALE VARIES

LIGHTHOUSE INN; WEST DENNIS, MA
BEACH PROJECT

SECTIONS & DETAILS - 3

01/30/17

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SHEET
7 of 7

Appendix C
Alternative Analysis Figures

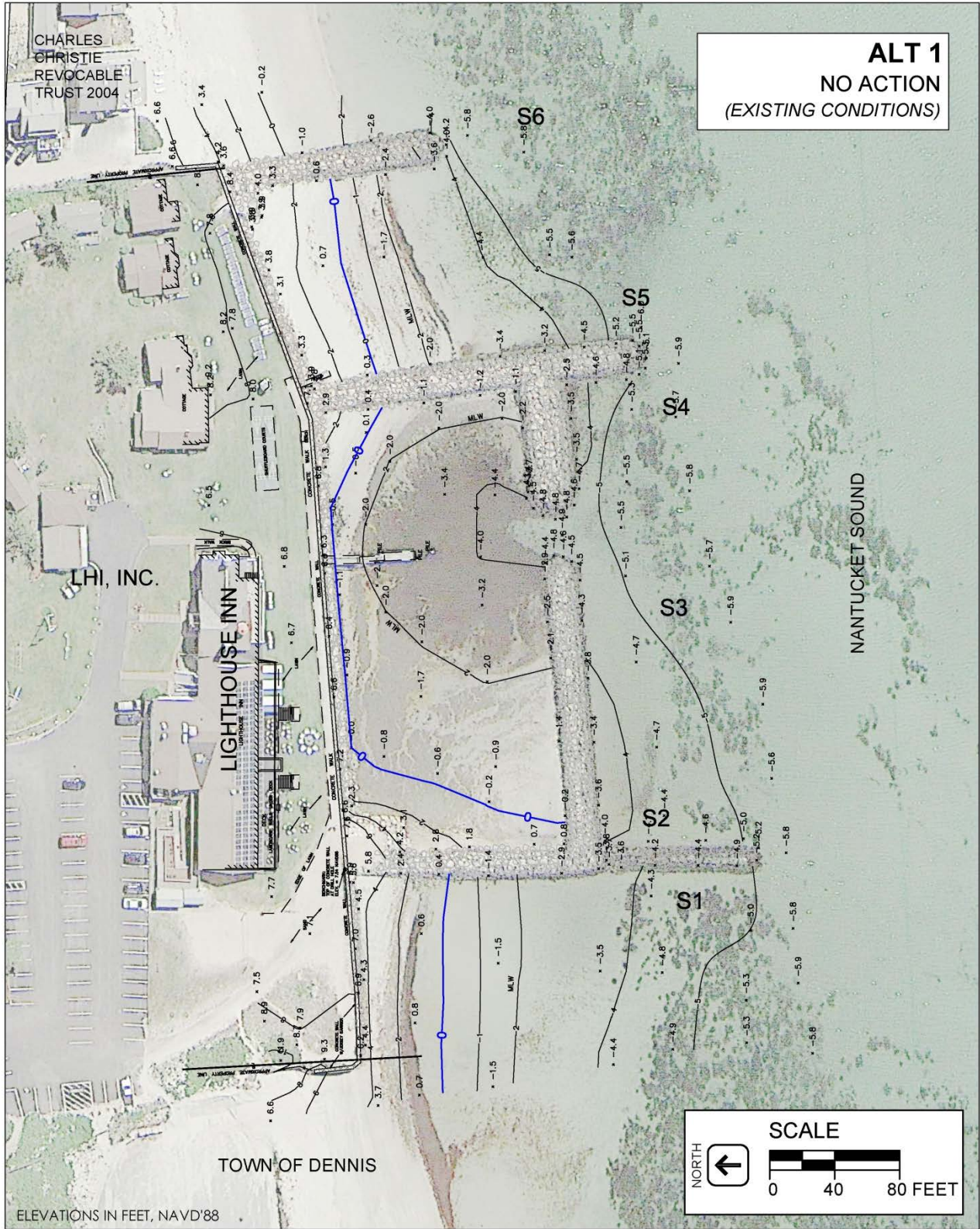


Figure 1: Alternative 1 -- No Action (Existing Conditions, Status Quo)

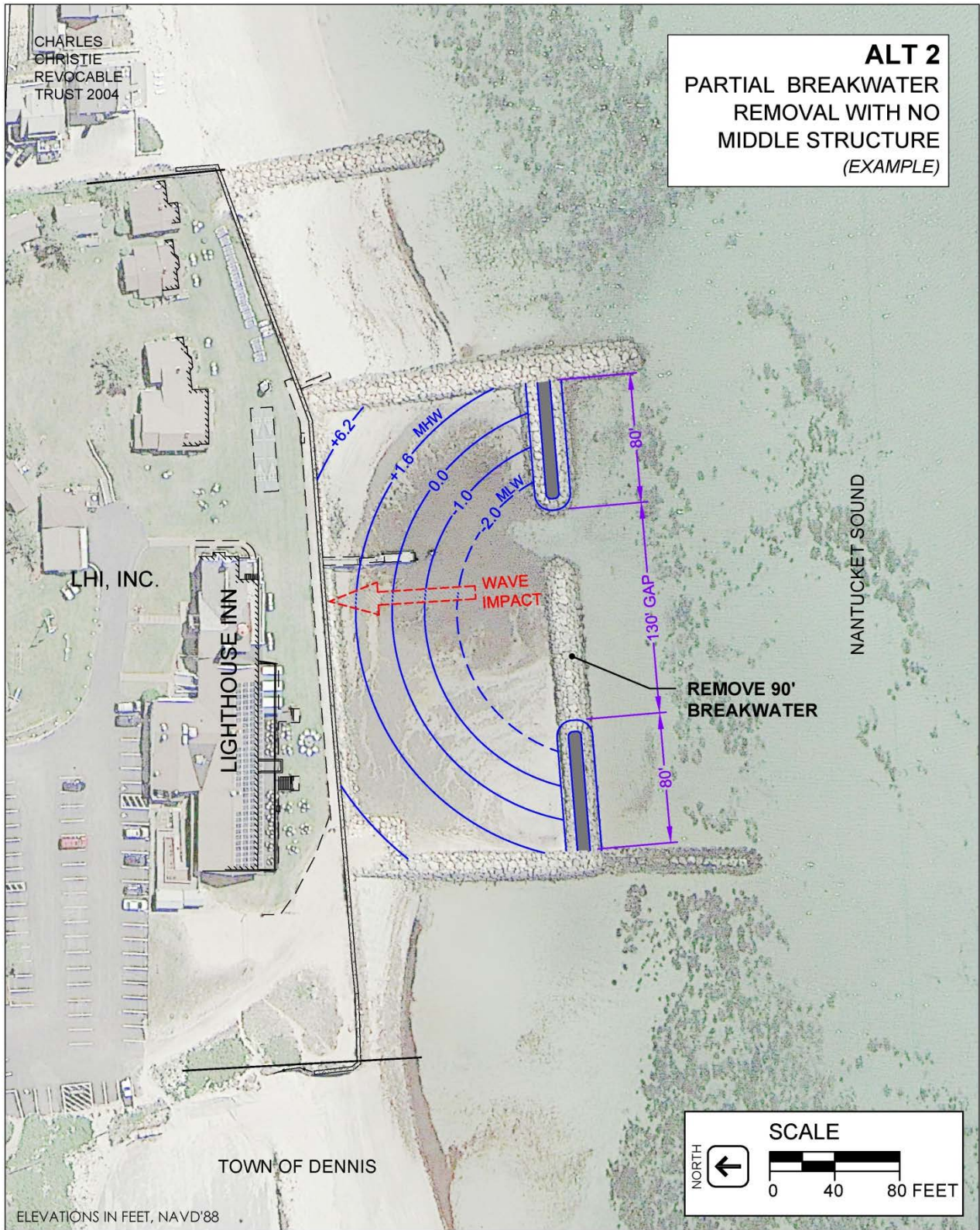


Figure 2: Alternative 2 – Breakwater removal with no middle structure (representative example, with predicted stable beach geometry in the lee of the gap). The gap exposes the upland to wave attack and flooding, and a smaller gap results in longer spur groins that are not conducive to flushing.

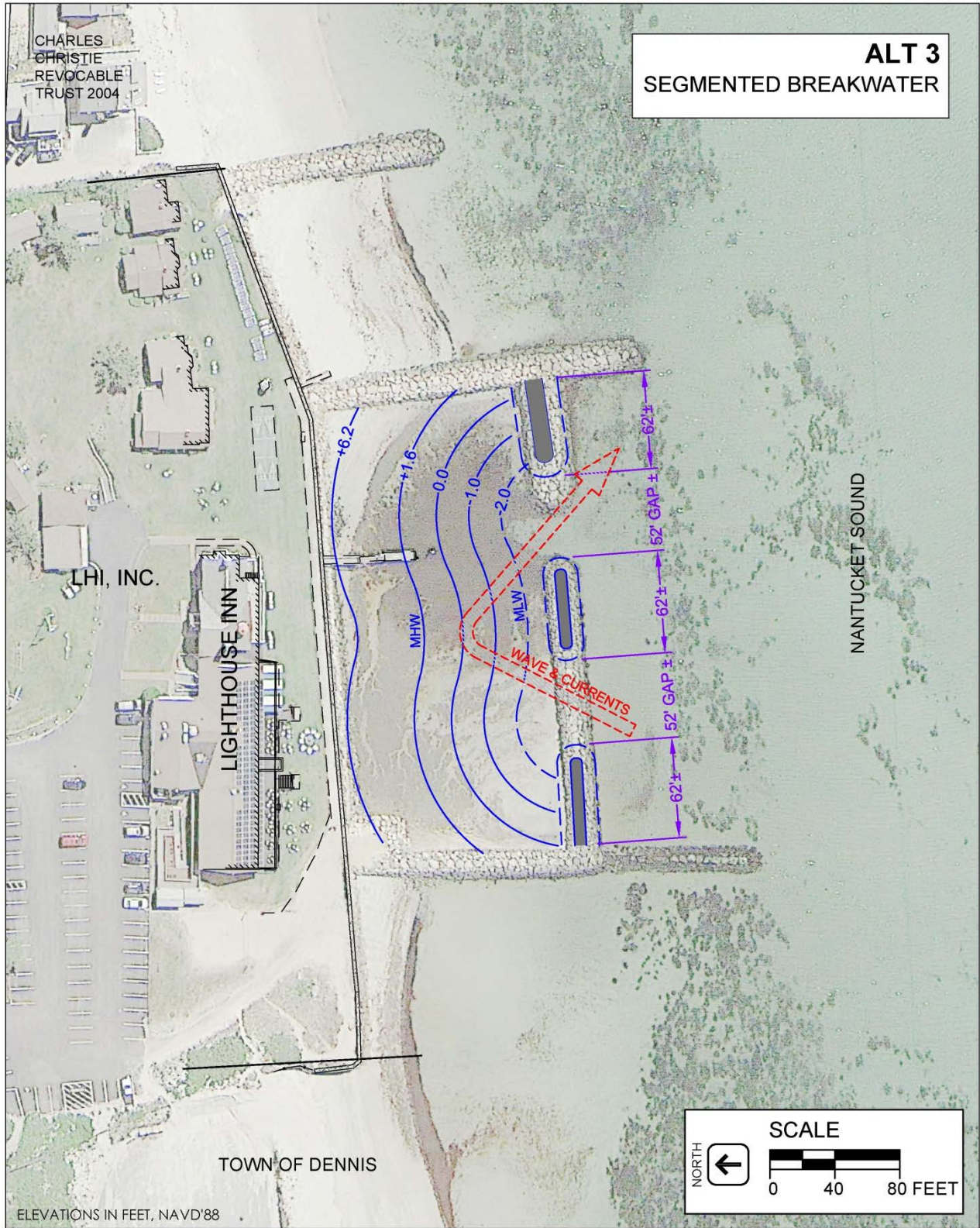


Figure 3: Alternative 3 – Partial breakwater removal resulting in a central segmented breakwater. Waves and currents between the two gaps ultimately act to erode the beach in the lee, compromising the beach and shore protection. There is no improvement along the east or west ends of the shorefront.

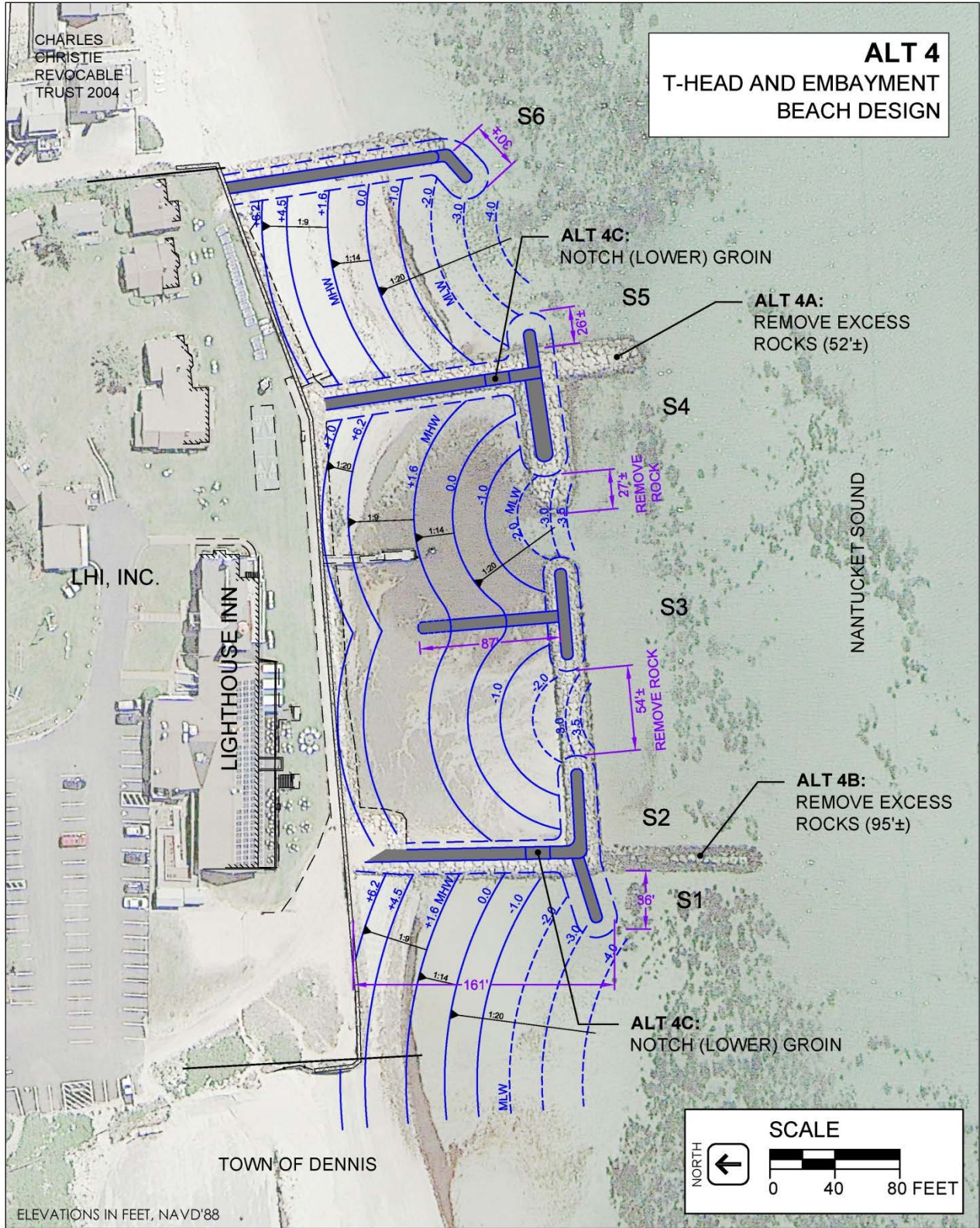


Figure 4: Alternative 4 – T-head and Embayment Beach Design develops pocket or semi-pocket beaches and a stable dry beach berm and slope along most of the property’s seawall. Sub-alternatives 4A and 4B consider removal of excess rocks seaward of the groin heads, and notching of the existing groins.

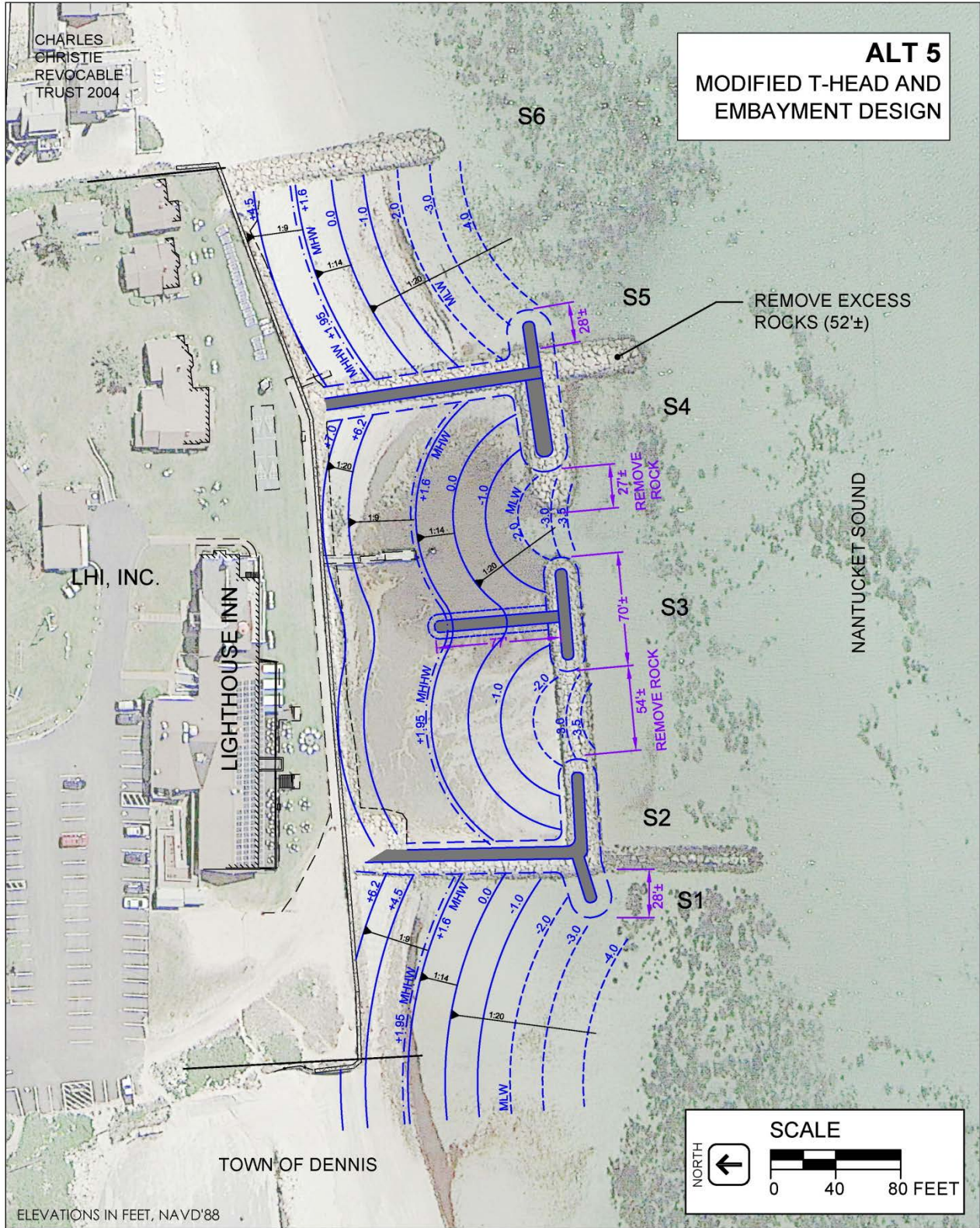


Figure 5: Alternative 5 – Reduced T-head and Embayment Beach Design develops two embayment beaches behind the breakwater, improves beach stability and berm elevation along the western and eastern seawalls by addition of short spur groins, and removes excess seaward boulders from S4/S5.

Appendix D

SEDIMENT SAMPLING RESULTS

CAPE COD ENGINEERING, INC.

P.O. Box 1517

East Dennis, MA 02641

Tel 508-385-1445 / Fax 508-385-1446

bobperry@capecod.net

January 27, 2017

Greg Stone
Lighthouse Inn
P.O. Box 128
West Dennis, MA 02670

Re: Sediment Sampling - Lighthouse Inn

Dear Greg,

I have completed sampling and the grain size analysis of the offshore sediment at three locations at the Lighthouse Inn beach area for purposes of the beach nourishment component of the groin renovation project. The results are available for the various applications for review, e.g. Water Quality Certification, USACE application and the Chapt. 91 fill permit / license as well as for inclusion into the MEPA EIR. The USACE often seeks specifics for the likely sediment source during the permitting stage. Should you have a source in mind, please request a grain size analysis from the supplier or let me know if you wish to have us check it. I have results available from a source in South Dennis.

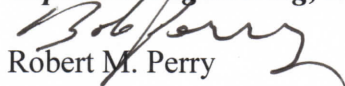
Three locations at Lighthouse Inn were sampled to an approx. 8 in depth with composite samples sieve tested. Two sample locations # 1 (east) and #2 (central) are within the intertidal zone; sample 3 was slightly farther out just seaward of the low tide line. Locations are plotted on an attached diagram. All samples had a measure of shell fragments but are otherwise very clean. Some minor variation in grain size is noted perhaps the result of sheltering action by the stone formations. Minor variations notwithstanding the sediment through out is clean uniformly graded med. sand. Sand observed on the higher beach areas is of a finer texture because it is primarily windblown.

In the event that any agency is attaching sediment quality interest to activity of sub-tidal or inter-tidal excavation (e.g. dredging) the clean sand composition obviates any need for chemical analysis.

Please let me know if you have questions.

Sincerely,

Cape Cod Engineering, Inc


Robert M. Perry

Enclosures. 3 Sieve reports w. location plan.

Sieve Analysis Data Sheet - Cape Cod Engineering, Inc.

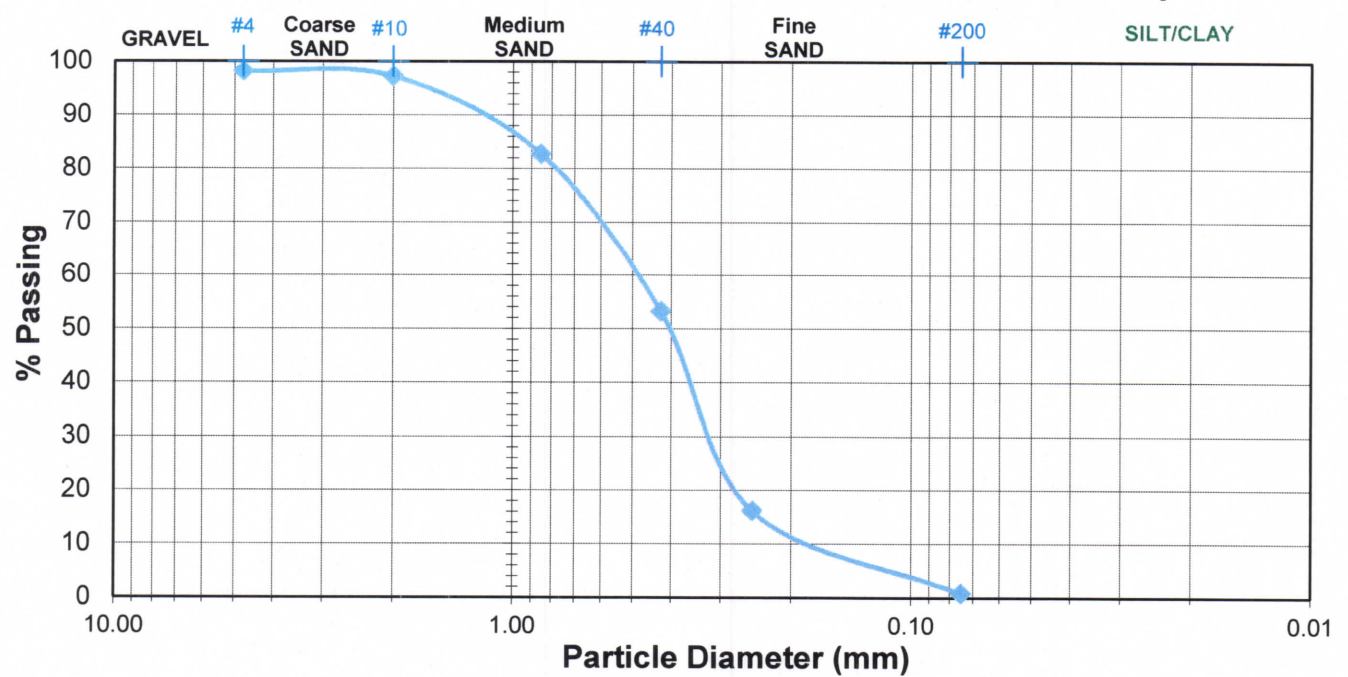
ASTM D422-63(2007)

Project Name: LIGHTHOUSE INN **Tested By:** R. Perry **Date:** 1/22/2017
Location: 1 Lighthouse Road, W. Dennis **Checked By:** N.Keith **Date:** 1/23/2017
Boring No: 1 - East intertidal beach **Test Number:** 1
Sample Depth: 8 inch composite **Gnd Elev.:** _____

USCS Soil Classification: Uniform graded med. Sand (clean)
AASHTO Soil Classification: N/A

Weight of Container (g): N/A **Weight of Container & Soil (g):** N/A
Weight of Dry Sample (g): 285.9

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
#4	4.75			5.3	1.9	98.1
#10	2.00			2.7	0.9	97.2
#20	0.85			41.4	14.5	82.7
#40	0.43			84.4	29.5	53.2
#60	0.25			105.9	37.0	16.2
#200	0.075			43.8	15.3	0.8
Pan				0.2	0.1	0.0
TOTAL:				283.7	99.2	



Grain Size Distribution Curve Results:

% Gravel: 0 **D₁₀:** 0.2 **C_u:** 2.5
% Sand: 99 **D₃₀:** _____ **C_c:** _____
% Fines: 1 **D₆₀:** 0.5

Sieve Analysis Data Sheet - Cape Cod Engineering, Inc.

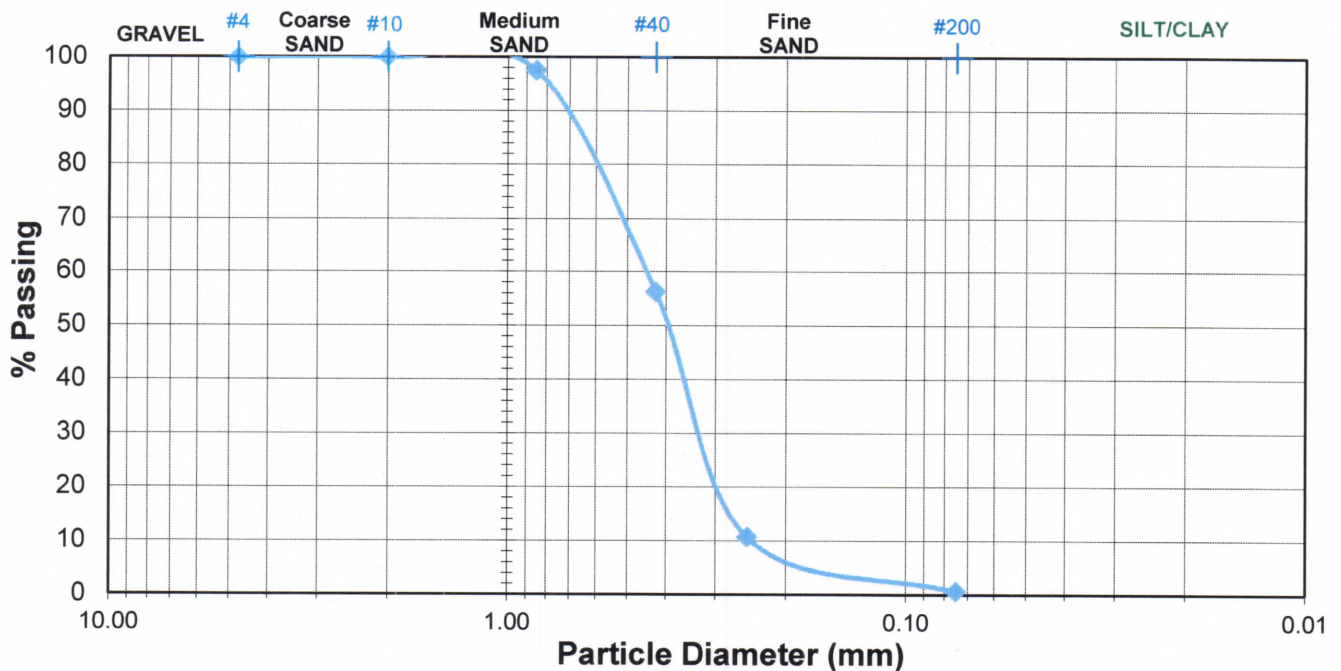
ASTM D422-63(2007)

Project Name: LIGHTHOUSE INN **Tested By:** R. Perry **Date:** 1/22/2017
Location: 1 Lighthouse Road, W. Dennis **Checked By:** N.Keith **Date:** 1/23/2017
Boring No: 2 - Central intertidal **Test Number:** 2
Sample Depth: 8 inch composite **Gnd Elev.:** _____

USCS Soil Classification: Uniform med. to fine sand (clean)
AASHTO Soil Classification: N/A

Weight of Container (g): N/A **Weight of Container & Soil (g):** N/A
Weight of Dry Sample (g): 175.4

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
#4	4.75			0.0	0.0	100.0
#10	2.00			0.1	0.1	99.9
#20	0.85			4.3	2.5	97.5
#40	0.43			72.5	41.3	56.2
#60	0.25			79.8	45.5	10.7
#200	0.075			17.7	10.1	0.6
Pan				0.1	0.1	0.0
TOTAL:				174.5	99.5	



Grain Size Distribution Curve Results:

% Gravel: 0 **D₁₀:** 0.25 **C_u:** 1.8
% Sand: 99 **D₃₀:** _____ **C_c:** _____
% Fines: 1 **D₆₀:** 0.44

Sieve Analysis Data Sheet - Cape Cod Engineering, Inc.

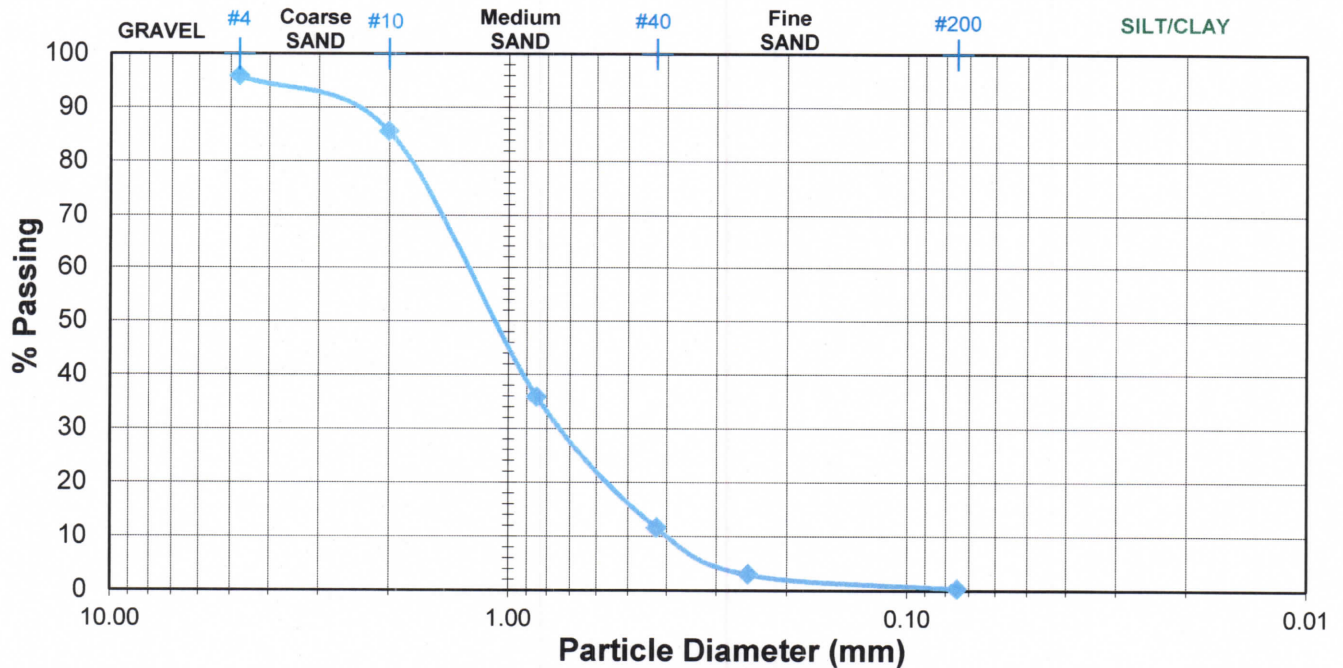
ASTM D422-63(2007)

Project Name: LIGHTHOUSE INN **Tested By:** R. Perry **Date:** 1/22/2017
Location: 1 Lighthouse Road, W. Dennis **Checked By:** N.Keith **Date:** 1/23/2017
Boring No: 3 - west subtidal **Test Number:** 3
Sample Depth: 8 inch composite **Gnd Elev.:** _____

USCS Soil Classification: Uniform graded med. sand (clean)
AASHTO Soil Classification: N/A

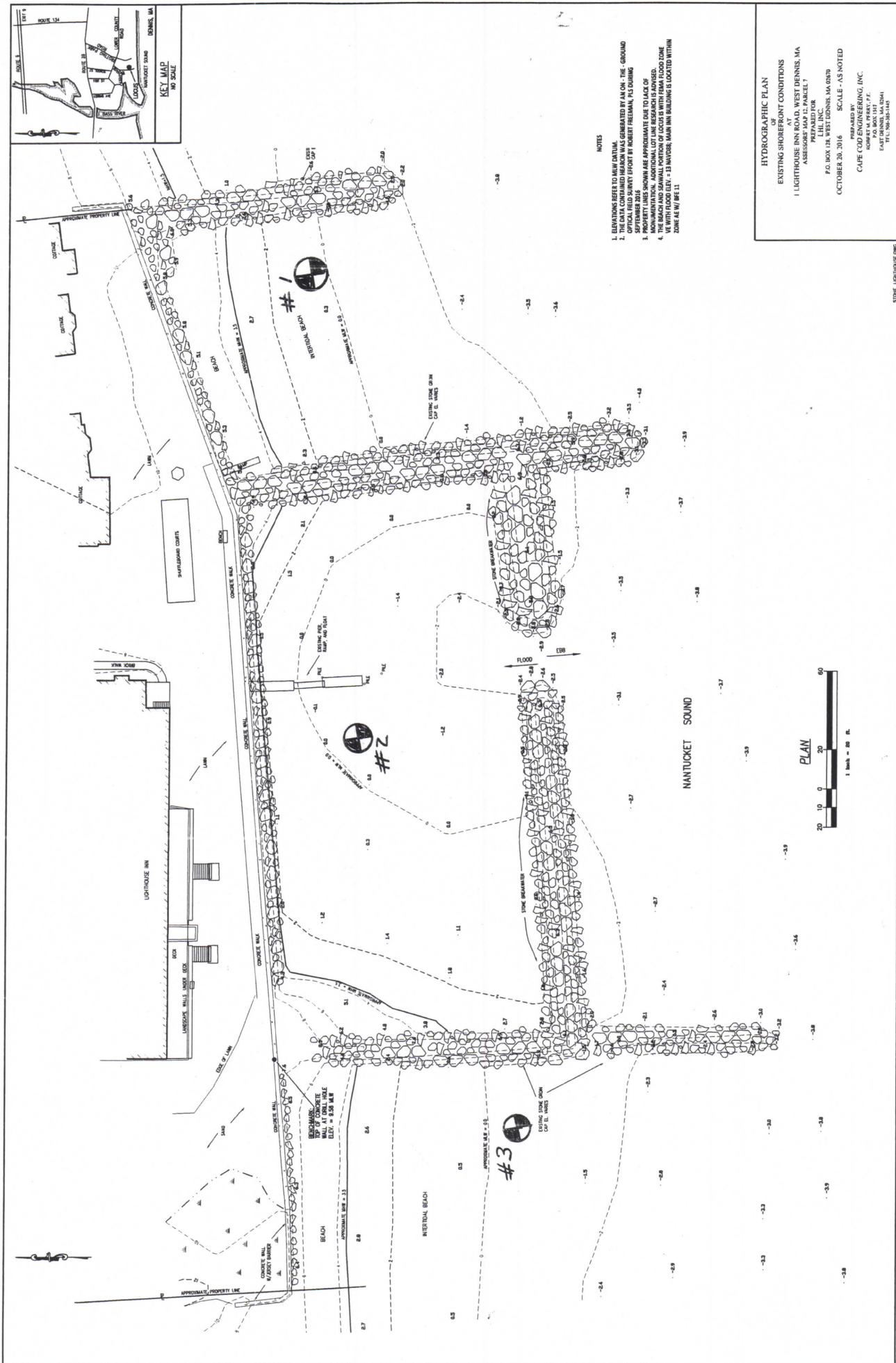
Weight of Container (g): N/A **Weight of Container & Soil (g):** N/A
Weight of Dry Sample (g): 296.5

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
#4	4.75			12.0	4.0	96.0
#10	2.00			30.9	10.4	85.5
#20	0.85			147.2	49.6	35.9
#40	0.43			71.9	24.2	11.6
#60	0.25			25.5	8.6	3.0
#200	0.075			7.8	2.6	0.4
Pan				0.2	0.1	0.0
TOTAL:				295.5	99.7	



Grain Size Distribution Curve Results:

% Gravel: 0 **D₁₀:** 0.42 **C_u:** 2.9
% Sand: 98 **D₃₀:** _____ **C_c:** _____
% Fines: 1 **D₆₀:** 1.2



SEDIMENT GRAIN SIZE SAMPLE LOCATIONS

Appendix E

COASTAL PROCESSES MEMORANDUM (BY OLSEN ASSOCIATES)

LIGHTHOUSE INN – COASTAL PROCESSES ASSESSMENT

1.0 Project Location and Setting

The Lighthouse Inn project site comprises approximately 550 feet of ocean shorefront along Nantucket Sound, on the southern coast of Cape Cod, Barnstable County, MA (*Figure 1*). It is located 3000 feet west of the Swan Pond River inlet and 7500 feet east of the Bass River inlet, immediately east of West Dennis Beach (*Figure 2*).

The overall project area is a sandy beach environment with existing rock groin and breakwater structures (*Figure 3*). The project shorefront includes three rock groins that extend between approximately 130- and 240-ft in length from the upland (*Figure 4*). A shore-parallel breakwater spans the two center-west groins with an approximate 25-ft wide gap opening. An existing rock revetment and vertical concrete bulkhead spans the 550-ft project area shorefront length -- separating the sand beach and semi-enclosed cell, landward of the breakwater, from the upland grassy lawn and the Inn's primary building and facilities. The three groins at the

Lighthouse Inn project area are located among a field of ten existing rock groins (*Figure 3*). There is one groin 340 feet to the west on West Dennis Beach; and there are six groins within 1,350 feet to the east along the adjacent residential beach area. The groin field is about 2150 feet in shorefront length and the groins are spaced about 240-ft apart on overall average.

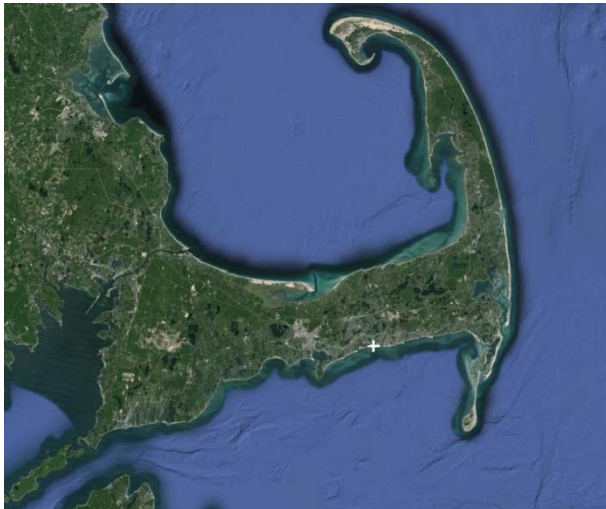


Figure 1: Lighthouse Inn project location on Cape Cod, indicated by white cross.

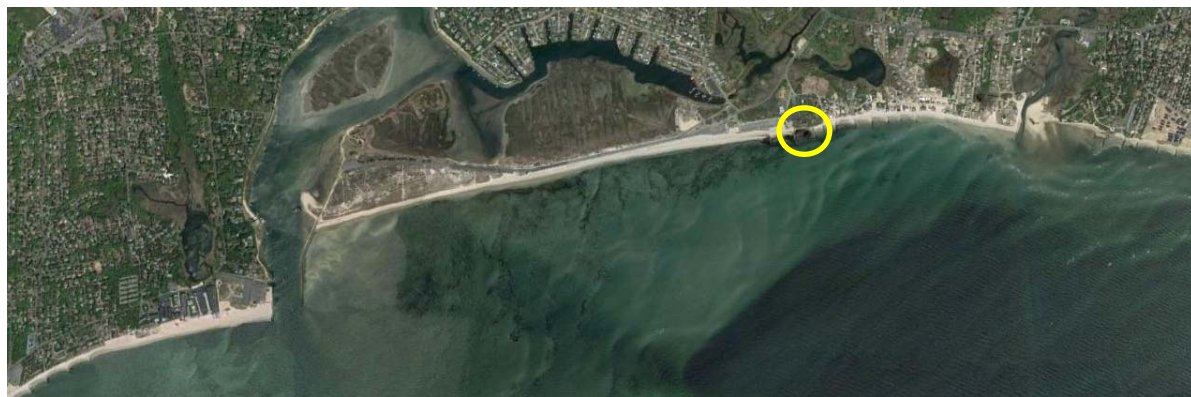


Figure 2: Project location (yellow circle) along the Nantucket Sound shoreline, between Bass River and Swan Pond River inlets.

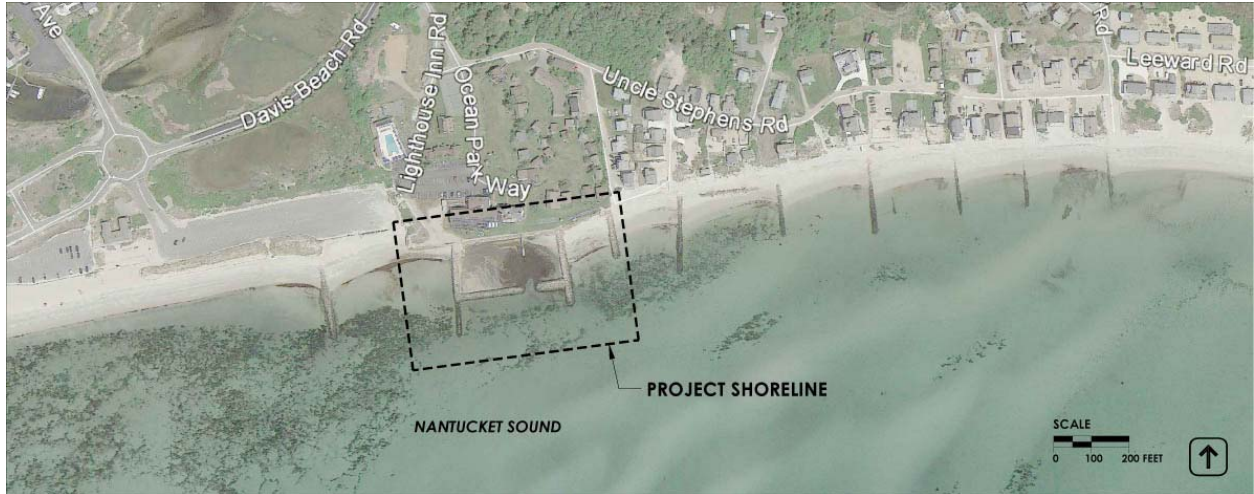


Figure 3: Project shorefront vicinity.



Figure 4: Lighthouse Inn Project shorefront, existing conditions.

2.0 Existing Coastal Conditions and Littoral Processes

Astronomical tides at the site are semi-diurnal with a mean range of approximately 3.6 feet. Tidal datums at the site, indicated in the project drawings, are approximately -2.0 ft MLW, +1.6 ft MHW, and +1.95 ft MHHW, relative to NAVD'88. Spring tides range from approximately -2.7 ft to +2.3 ft NAVD'88 (approximately 5-ft), more or less.

Beach sediments along this shoreline are composed of medium- to fine-grained sand with median grain size of about 0.3 to 0.33 mm (WHG 2010). Sediments dredged from the adjacent

Bass River and Swan Pond River inlets are typically as coarse or coarser than the native beach sediments (WHG 2010).

The site constitutes an ‘open coastline’, but the nearshore waters are generally shallow and the Nantucket Sound is likewise a generally shallow semi-embayment with irregular bathymetry sheltered by the offshore barrier islands of Martha’s Vineyard, Nantucket, and Monomoy *et al* (**Figure 5**).

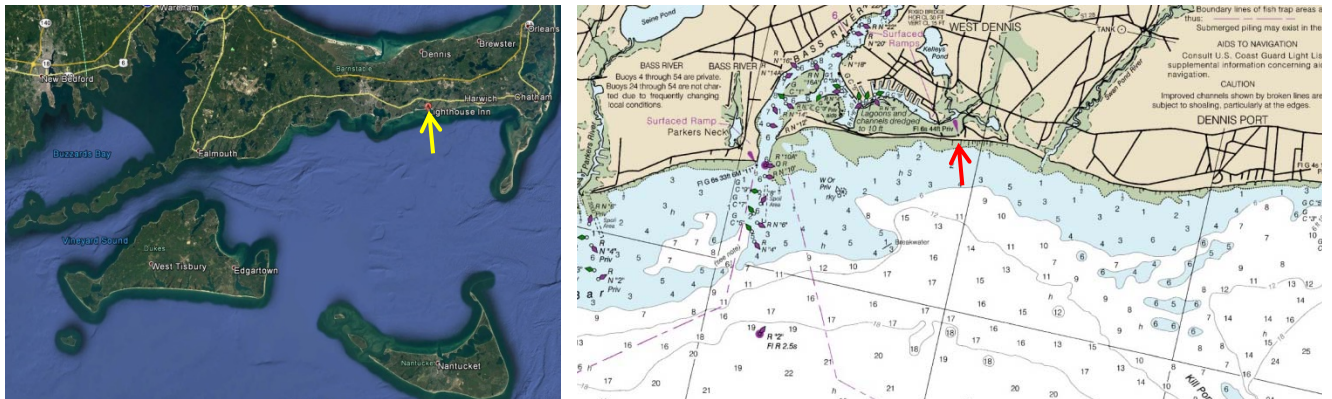


Figure 5: Location of Lighthouse Inn site on Nantucket Bay & excerpt from Nautical Chart 13229.

The net littoral drift along the project shoreline is easterly-directed as described by WHG (2010) and WHSG (2011), and as indicated by the shoreline response to the jetties constructed at the Bass River and Swan Pond River entrances (**Figure 2**, prior page). It is noted, however, that this shoreline appears to be characterized by both significant westward- and eastward-directed gross littoral transport, with some dominance of the latter that results in net transport in the easterly direction. The reasons for this are described as follows.

The shoreline offset from west-to-east across the Bass River entrance, with wide beach on the western side (**Figure 2**) clearly indicates a dominant easterly-directed drift, impounded by the inlet jetties. At the same time, the West Dennis beach immediately east (downdrift) of the jetties has also accreted significantly after the jetties’ construction. WHG (2010) indicates a contemporary shoreline accretion rate of +3.1 to +5.1 ft/yr from 1978 to 2009 along the western end of West Dennis Beach (**Figure 6**), impounded on the east side of the Bass River jetties. This, along with the sand spit transported westerly from West Dennis Beach across the jetty and into the inlet (**Figure 2**), indicates substantial gross westerly-directed transport along this shoreline toward the Bass River inlet. At the same time, the central shoreline – along the eastern end of West Dennis Beach and Lighthouse Inn – exhibits net shoreline retreat of -0.9 to -1.2 ft/yr from 1978 to 2009.

At the east end of this coast, the shoreline offset from west-to-east across the Swan Pond River entrance likewise indicates easterly-directed drift, along with intermittent easterly-directed

sand spits across the entrance; but there is also shoaling on the east (downdrift) side of the inlet jetties. WHG (2010) indicates a shoreline accretion rate of +0.4 to +1.8 ft/yr along the west, updrift side of the Swan Pond River jetty, with shoreline erosion rates of -0.4 ft/yr further to the west (**Figure 7**). These observations suggest robust, gross littoral transport in both the westerly- and easterly-directions, trapped (impounded) by the inlets and jetties at each end of the shoreline. This indicates significant sand transport along the shoreline in both east- and west-directions, and that the inlets on each end act as littoral sinks that reduce the volume of sand otherwise available to drift along, and maintain, the shoreline between the inlets. The net result is long-term historical accretion at the ends of the coastline, and erosion in the middle. This is not to say that the beach conditions at the project site are wholly due to inlet influences; but instead, that the adjacent inlets have impounded littoral material (thus adding to the erosion distress) and that there is evidence of both substantial westerly- and easterly-directed littoral drift along this shoreline beyond the overly simplified view of net easterly-directed drift.



Figure 6: Shoreline change rates along West Dennis Beach (WHG 2010).



Figure 7: Shoreline change rates east of Lighthouse Inn, at South Village Beach, west of Swan Pond River entrance (WHG 2010).

In terms of order-of-magnitude transport rates, littoral drift modeling of the shoreline well east of the project area, along Chatham (ACRE 2011), indicates gross transport rates of between 2500- to 5000-cubic yards/year easterly and 500- to 1500-cy/yr westerly, for a net total drift rate of about 2000 to 3500 cy/yr (easterly).

To the immediate west of the project site, WHG (2010) reports average shoaling (dredging) rates of the Bass River entrance of 8,780 cubic yards per year, for the period 1998 through 2006, when dredging was undertaken more or less annually. (Most of this dredging was required in the entrance channel. Sediment dredged from the outer channel was placed west of the inlet in Yarmouth, and sediment dredged from the inner channel was placed east of the inlet on West Dennis Beach.) To the immediate east of the project site, WHG (2010) reports average shoaling (dredging) rates of the Swan Pond River entrance of between 2500 and 4500 cy/yr (average = 3,430 cy/yr from 1980-2010), with the dredged sand placed both east and west of the inlet. These inlet shoaling (dredging) rates may under-predict the total littoral drift rate – at least that rate intercepted by the inlets -- to the extent that they do not reflect the rate of sand accumulation adjacent to the jetties and channel.

The rate and direction of littoral transport along the Nantucket Sound shoreline is determined as much by local wind-generated seas within the Sound as by external Atlantic Ocean waves, given the complex shelter of the bounding barrier islands, morphology and shallow seabed of the Sound. Wave hindcast data are reported for numerous locations around the Cape, but all are outside Nantucket Sound and beyond 10 miles from shore. These data describe broadly east-southeast wave dominance for the hindcast locations east of the Sound, and they describe specific south-southwest wave dominance for the hindcast locations south of the Sound.

Directional wave data measurements are available from Buoy 44020 located near the middle of Nantucket Sound, adjacent to the Hyannis-Nantucket ferry route (*Figure 7*). The wind and wave roses from this data buoy, for the period 10 March 2009 to 31 December 2015, are illustrated in *Figure 8*. Winds are clearly dominant from the southwest quadrant, with the most strong and frequent winds from the west. The southwest winds give rise to the dominant easterly-directed waves and littoral drift that characterizes most of the shoreline near the project area. Owing in part to its location, the buoy's wave data describe a bilateral wave climate – with more or less equal wave energy and occurrence from the west and from the east.

Relative to an east-west shoreline orientation that faces due south (180°), the total wave energy density and flux at the buoy, directed toward the shore, are about 1.6- and 1.3-times greater from the west than from the east – implying easterly-directed transport potential. This is the average shoreline orientation immediately east of the groin field. But, relative to the slightly declined shoreline that faces south-southeast (175°), the wave energy & flux directed toward the

shore are approximately equal from the west and the east (null transport). This is the average shoreline orientation along the groin field east of Lighthouse Inn. Relative to the more greatly declined shoreline that faces further south-southeast (171°), the wave energy & flux directed toward the shore are about 1.1 and 1.5 times greater from the east than from the west – implying wester-directed transport potential. This is the average shoreline orientation along West Dennis Beach, west of Lighthouse Inn.

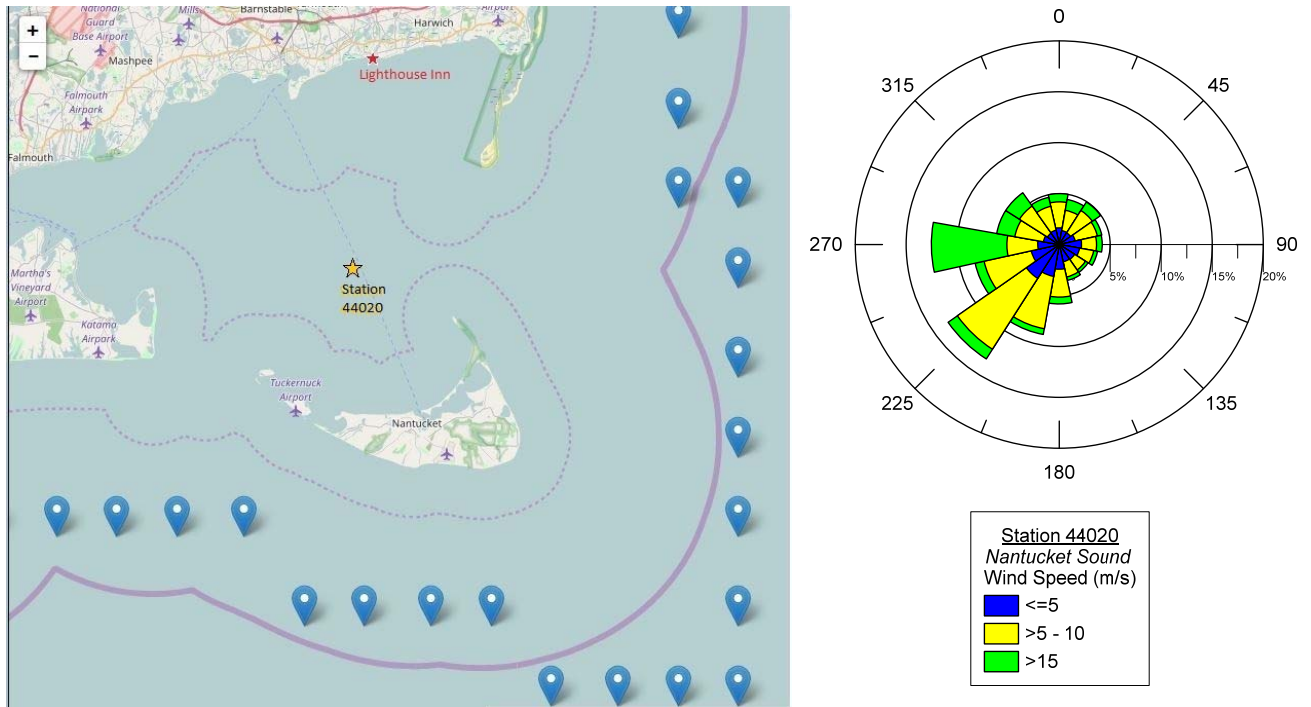


Figure 7: Locations of WIS hindcast stations (blue pins) and wave buoy 44020.

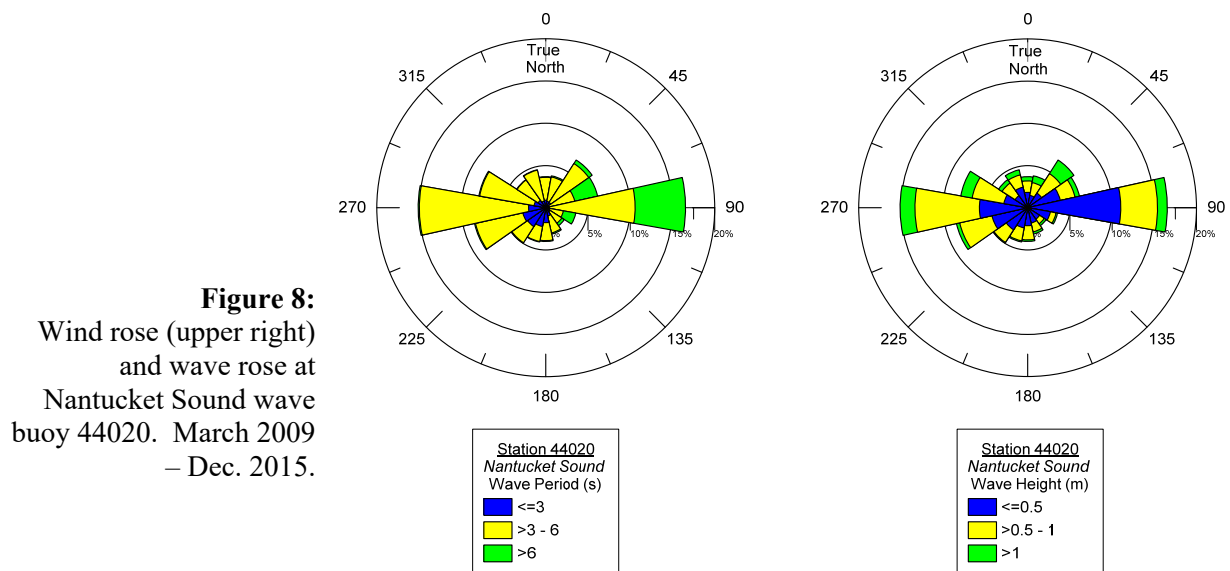


Figure 8: Wind rose (upper right) and wave rose at Nantucket Sound wave buoy 44020. March 2009 – Dec. 2015.

Thus, wave conditions measured at the Nantucket Sound buoy suggest a greater tendency to promote westerly-directed drift west of Lighthouse Inn, and easterly-directed drift east of the Lighthouse Inn and groin-field. This is consistent with the observed accretion (impoundment) at the west and east ends of the overall coastline, adjacent to the inlets.

Examination of the 16 historical aerial photographs of this site from April 1995 through May 2016 (G. Earth) indicate the following apparent transport directions based upon the visual littoral signature within the groin field:

- 50% of the images show no clear direction or a split direction (westerly-directed drift west of the Inn, and easterly-directed drift east of the Inn);
- 25% show clear easterly-directed transport;
- 12.5% show weak easterly-directed transport; and
- 12.5% show westerly-directed transport.

Seasonal trends are not apparent in this limited database.

In sum, it is evident that the gross transport at this location plays as great a role in shoreline behavior as does the net transport. There is a greater tendency for westerly-directed drift west of Lighthouse Inn, and for easterly-directed drift east of Lighthouse Inn, with an overall indication of net easterly-directed transport.

The rock groin field has been in place for 30+ to 40+ years. The groins at Lighthouse Inn were rebuilt to their current condition in the early- to mid-1970's. The local shoreline appears to have more or less equilibrated – responded – to the presence and effects of the groin field. The general shoreline trend is reported to be overall mildly erosional – about -1 ft/yr from 1978 to 2009 (WHG 2010). The Town of Dennis adds sand to the east end of its beach, adjacent to Lighthouse Inn, at the beginning of most summer seasons. However, there is not otherwise evident a critical erosion issue (excepting the lack of beach at Lighthouse Inn) or chronic erosional signature adjacent to any of the groins or the groin field.

In describing conditions at South Village Beach, east of the groin field and immediately updrift of Swan Pond River, WHG (2010) observes that “Although the shoreline areas to the west have been stabilized with a series of shore perpendicular groins [i.e., the 10-groins at and east of Lighthouse Inn], the supply of sediment to South Village Beach has not been significantly impacted.” Overall, the groins lend some beneficial stability to the local shoreline and without significant downdrift erosion, where the latter indicates that (i) there is some level of natural bypassing around the structures, and/or (ii) the magnitude of alongshore transport is fairly modest.

The purpose of the proposed project at Lighthouse Inn is to improve natural tidal flow and flushing between the two western groins while maintaining shore protection and a sand beach, and to improve the sand beach immediately west and east of these two groins by providing a dry beach berm along the existing bulkhead and rock revetment. Under existing conditions, lack of tidal flushing has led to the accumulation of seaweed and detritus on the beach and in the cell behind the breakwater. There is little or no accessible sand beach behind the breakwater, and the seabed is mostly silt and mud. The accumulated seaweed results in a noxious odor and inability to use the limited beach resources that exist.

The physical causes of the existing adverse conditions at the site are mostly self-evident – as are the practical solutions. The existing breakwater provides requisite protection against wave damage and flooding to the main Inn building and lighthouse; but the gap in the breakwater is too small to allow adequate flushing in the breakwater lee. Seaweed (detrital seagrass), silt and clay enter the gap and deposit within the sheltered area behind the breakwater. A stable sloping beach cannot develop within this area because there is insufficient wave energy and uprush to maintain the proper slopes and embayment geometry behind the narrow gap. Overly narrow gaps in breakwaters often result in siphoning of sand from the leeward side. Replacement of the poorly flushed cell with a sloping beach of proper geometry would (i) displace the deposition of seaweed/seagrass, and (ii) provide storm protection. Because of the advanced position of the seawall along the center of the property (immediately west of the western groin and east of the middle groin), there is insufficient width to develop a stable dry beach berm along the seawall and over the rocks. A minor ‘anchor’ or headland is necessary to support the toe of the beach at these locations and to disrupt the seaward-directed current that otherwise flows along straight groins and carries sand seaward.

The proposed plan of improvements is illustrated in **Figure 9**, including depiction of the project relative to the overall shoreline setting. The Alternatives Analysis describes the formulation and selection of the proposed (selected) plan. The following section describes the coastal engineering methodology and coastal processes associated with the project.

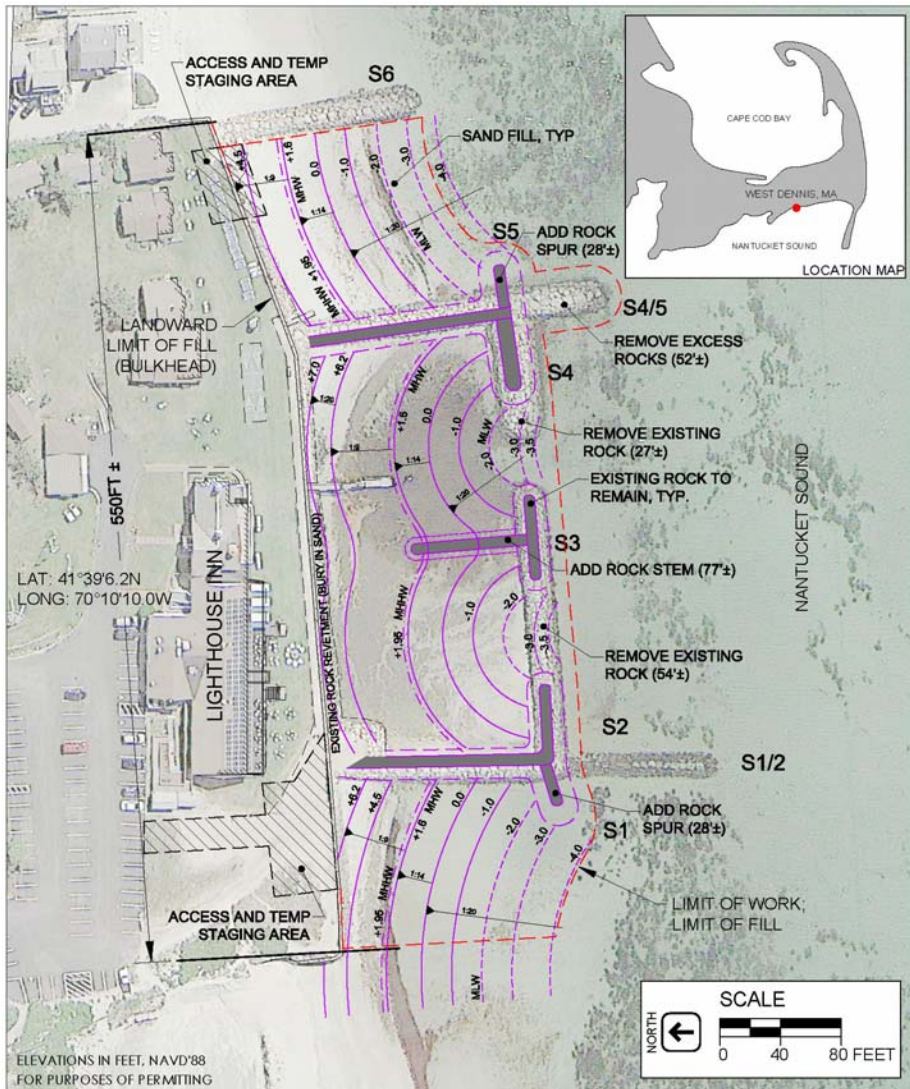


Figure 9: Proposed project plan of improvement.

3.0 Coastal Processes and the Proposed Project

The proposed project reflects an embayment (pocket) beach design between the site's two western groins and a semi-embayment (headland) beach design to improve the beach east and west of these two groins. The project removes portions of the existing breakwater to create two gaps of approximately 54-ft width each, and removes the excess rocks beyond the breakwater from the seaward end of the center groin. The removed rock is relocated to construct a shore-perpendicular stem behind the remaining center section of breakwater, and a short spur groin at the ends of the western and central groins. The result transforms the existing breakwater 'crib' to three (3) T-head groins along the center of the Lighthouse Inn property, within the footprint of the existing structures, with a net reduction in the total overall area of rock structures. Approximately 7100 cubic yards of beach-compatible fill would be imported from off-site permitted sources to create and augment the beach behind the T-heads.

Embayment beaches provide a reliably predictable beach geometry and stability that is described in the literature and understood through experience with many projects constructed during the past 30 years, including projects of scale and setting similar to the proposed project (Silvester & Hsu, 1993; Berenguer & Enriquez, 1988; Bodge, 1998; Hardaway & Gunn, 1999; Hanson & Kraus, 2001; among others). The incorporation of T-head (or 'fishtail') style groins is central to most of these projects.

The project design employs the observed principle that the 'design shoreline' is located between 0.35 to 0.65 times the gap-width behind the gap opening, where the latter value is germane to the central portion of the cell, particularly in higher energy and tide range regimes.¹ The design shoreline is between the mid-tide and low-water shoreline elevations; or, about -1.0 ft NAVD'88 at this site.

The project beach behind the breakwater reflects a design shoreline set-back of (i) about 0.65 times the gap distance in the middle of the beach cell, and (ii) about 0.38 times the gap distance at the corners of each cell. The project beach slopes above and below the design shoreline reflect the ambient beach slopes measured along the adjacent natural beach profiles; i.e., about 1(v):9(h) from the dry berm(+6.2') to MHW(+1.6'); 1:14 from MHW to NAVD (0.0); and 1:20 below 0.0' to intersection of the existing seabed at about -3.5' to -4.0'. The elevations of the bulkhead and the rock revetment (rip-rap) crest along the property are about +7.8' and +6.5', respectively (the elevations vary). The project design, with the beach slopes described above, seeks to create a stable beach berm of +6.2' to +7.0' along the central bulkhead between the two western groins to mostly bury the rock revetment with a dry sand berm, improve direct access between the sand beach and the upland, and create an additional sand reservoir along the

¹ Sites with larger gap openings and persistently high angles of wave incidence reflect a similar, but slightly skewed 'spiral bay' shoreline geometry. That design geometry is less applicable to this site.

back beach for storm protection. The observed dry beach berm elevation along the ambient, adjacent shorelines is about +6.2' at most higher high tides, more or less.

The project beach west of the western groin, and east of the middle groin, reflects a semi-embayment (headland) design. Here, the design beach elevations are determined by the short spurs (S1 and S5) at the ends of the groins. At beaches with limited sediment supply, such as this site, empirical data indicate that the beach elevation at the base of the bounding groin, or headland, is about ½ the mean tide range below MLW (Bodge, 1998); or, about -3.8' NAVD at this site. The elevation may be slightly shallower at the downdrift end of a beach cell (e.g., -3.5') such as at structure S1 on the western end of the site; and, it may be slightly deeper at the updrift, anchor end of a beach cell (e.g., -4.0') such as at structure S5 near the eastern end of the site. The design beach elevation at the seaward ends of the spur groins is thus established at -3.5' and -4.0' at these two locations (S1, S5) respectively. From that elevation, the design beach grade immediately behind the spur groins is thence established by the same beach slopes described above (*Figure 9*). The design profile is mostly limited to the reach immediately leeward of the spur groin, beyond which the profile transitions to the adjacent, ambient beach profile.

In this way, there is a modest increase in beach elevation and stability along the bulkhead immediately west of the western groin (behind spur S1), and immediately east of the central groin (behind spur S5). At the western end (S1), the berm elevation is increased to +6.2' (from about +4') to marginally cover the rock revetment along the bulkhead and improve lateral beach access from West Dennis Beach. At the eastern end (S5), the berm elevation is increased to +4.5' (from about +3.1'), which will improve -- but not complete -- the sand cover over the rocks along the bulkhead and improve lateral beach access from the east. No substantial change in the resultant beach profile is predicted at the far east end of the project site (immediately west of the existing eastern groin S6); however, placement of advance sand fill is included at this location in the project design anyway, as a conservative contingency to provide additional sand supply to the east.

The project beach contours described above and shown in the design drawings (including *Figure 9*) represent the target beach geometry expected from the project and as computed from dozens of similar prototype projects constructed of similar scale. The ultimate achieved beach geometry may be lesser (lower or narrower), but not likely greater. Project construction will fill the beach to the contours indicated in the design drawings plus an advance fill contingency. Based upon the September 2016 beach geometry, the volume required to fill the design beach contours is about 5,900 cubic yards. Initial project construction will place at least 7,100 cubic yards of beach-compatible sand fill, which includes the 5,900 cy design volume plus 1,200 cy advance fill (20%). The latter is intended to overfill the design template as pre-emptive mitigation against potential erosion impacts to the adjacent shorelines from project construction.

Sand fill placement to the adjacent shorelines (viz., east of Lighthouse Inn) is not included in the project plan because this is not the property of Lighthouse Inn. Instead, as a mitigative measure, additional sand overfill – included in that described above -- will be placed within the eastern project cell. Beach conditions will be surveyed prior to construction and adjustments made to the sand fill volume to account for erosion since the September 2016 survey.

Periodic beach renourishment may be required to maintain the beach at its design contours. The ultimate requirement will depend upon storm impacts and project performance. Typical prudent guidance for similar projects includes renourishment at 2- to 5-year intervals at about 10% of the initial design volume per year. However, that said, no project renourishment has been required to-date for the majority of the dozens of similar T-head and embayment projects constructed by this project's concept designer (Olsen Associates, Inc.) over the last 25 years (Bodge, 1998 & personal communication). [This is a surprising record, and it is not warranted to apply for the proposed project or any other project.]

Adverse (erosion) impacts to the adjacent shorelines from the proposed project are not reasonably anticipated because of the following factors:

- (1) The project's structural footprint is not changed, and there is a slight reduction in overall structural area. The project is built within the area of the existing rock structures; the length of the existing shore-perpendicular groins is not increased; and, the length of the existing central groin is decreased by the removal of rocks from its seaward end.
- (2) The physical performance of the embayment beaches created by the reconfigured T-head design and embayment beaches, and the predicted beach geometries, have been established through extensive prior, successful project experience in similar conditions.
- (3) The rock spur groins to be added to the ends of the western and central groins are of minimum practical dimension (28-feet) and will influence the beach geometry only in their immediate vicinity to anchor the leeward beach toe, with the purpose of reducing offshore-directed currents/sand losses.
- (4) The project will be overfilled with sand nourishment to its predicted design beach capacity plus approximately 20% volume, with the latter intended as overfill for purposes of precautionary mitigation.
- (5) No modification to the downdrift, easternmost groin is proposed, in order to further minimize & avoid potential impacts to the eastern properties.
- (6) The overall project shoreline exhibits a more or less stable configuration that has equilibrated to, and apparently benefitted from, the long-term presence of the existing groin field; and no substantial changes are proposed to the overall magnitude of that groin field.
- (7) The overall littoral drift regime at the site is net easterly, but otherwise appears to exhibit a subtle slight neutrality by which transport is directed both westerly and easterly across the project site. This suggests that potential littoral impacts to the east, from modifying the project

structures, may be lesser than that which would be otherwise anticipated. Post-project monitoring of the adjacent shorelines, proposed per the project, will inform this observation.

The only probable physical means by which the proposed project may affect adjacent shorelines would be if the embayments impound (trap) additional sand beyond their predicted design beach capacity or impound sand after storm erosion. In regard to the first point, it is possible -- though unlikely -- that the stable beach geometry will be greater than the design geometry; and for that purpose, the project's initial sand fill includes an overflow volume. In regard to the second point, the existing cells along the groin field are currently refilled after storms by sand transport from onshore sand transport and/or in a sequential updrift to downdrift direction. To-date, this does not appear to have resulted in adverse, sequential erosion along the beach (i.e., from east to west). And, prototype experience indicates that the embayment (pocket) beaches developed by the proposed project exhibit less storm erosion than open beach cells between straight groins; and in that case, they would require less sand recovery (impoundment) after a storm than the adjacent beach cells.

An additional possible project impact may result if the seaweed (detrital seagrass) that is currently deposited along Lighthouse Inn is subsequently deposited elsewhere along the adjacent shores. This is clearly a possibility, since a principal objective of the project is to reduce the anomalous accumulation of detritus along Lighthouse Inn. In that instance, it is presumed that the seaweed would be deposited equivalently along the shoreline, or it would drift further alongshore, and be thence swept or cleared from the beach by those means that currently exist. It is otherwise unreasonable to expect that Lighthouse Inn would be the ultimate repository for an unequal or excess abundance of detrital deposition along this shoreline.

As noted above, the project's design and anticipated performance is based upon the prototype, empirical engineering experience of numerous similar projects constructed since the early 1990's. Several relevant examples are highlighted below. Additional examples are presented at the end of this section.

A very similar example is the eastern beach of the Sandals Royal Bahamian Resort (Nassau, Bahamas). It was modified in 2009 to deconstruct an existing offshore breakwater and reconfigure the east-end groin to create a central T-head groin, two adjoining spur groins, and two pocket beaches, with initial sand fill of about 5,000 cy (*Figure 10*.) The project length of 360-ft is similar to the central beach length of Lighthouse Inn behind the existing breakwater (280-ft). The pre-project shoreline featured little or no usable sand beach that was covered daily by detrital seagrass. Since project construction, the restored beach has remained stable and there is little or no accumulation of seagrass -- owing to the restoration of wave & tidal circulation, and the replacement of the unnatural embayment (behind the old structures) by a proper, stable beach. No adverse impacts to adjacent shorelines have been observed.

Pre-project



2004

Post-project



2015

Pre-project



2008

Post-project



2010

Figure 10: Sandals Royal Bahamian (Nassau, Bahamas). An existing breakwater and groin were partly removed and reconfigured to build two pocket-beach embayments with central T-head groin and sand fill in 2009, and eliminating the daily accumulation of detrital seagrass. (Top and third photograph – pre-project (2004 & 2008). Second and bottom photograph – post-project (2015 & 2010).

The Fisher Island, Florida project, at Miami Beach, was constructed in 1991. The project employed seven T-head and spur-groins, with initial sand fill from the Bahamas, to restore the sand beach that had been completely eroded after the 1904 opening of the adjacent Government Cut inlet (*Figure 11*). The project has not required renourishment since its initial construction, despite numerous hurricane impacts.



Figure 11: Fisher Island, Florida. Seven T-head and spur groin structures, with sand fill, constructed in 1991 to restore a beach eroded after the construction of Government Cut at Miami Beach in 1904.

At Fort Clinch, St. Mary's River Entrance (Florida), a half-dozen existing straight rock groins were reconfigured in 1994 as T-head groins with beach fill, to protect the foundation of this U.S. Civil War era fort from being undermined by chronic beach erosion along the St. Mary's River inlet (**Figure 12**). The site is a popular museum, historical re-enactment site and recreational beach & campground operated by the Florida Park Service near the Florida-Georgia state line. The project site is periodically renourished with sand dredged from the inlet.



Figure 12: Fort Clinch, Florida, St. Mary's River Entrance. Six rock groins were re-configured as T-head groins in 1994, with sand fill, to provide shore protection along the undermined foundation of this Civil War fort monument.

Numerical modeling of the Lighthouse Inn project shoreline and improvements was not employed for purposes of this analysis. The complex physical processes associated with the small-scale embayment (pocket) and semi-embayment beaches of this project are not readily modeled at a scale that can accurately describe the effects of the breakwater modifications and pocket beach response amidst the response of the large-scale adjacent shorelines. The beach embayments behind the gapped breakwater are both small and shallow in depth. If modeled with readily available wave transformation software, the computed difference in the overall wave regime between the existing and post-project conditions would be almost immeasurable. The dynamics of wave diffraction and current flow within a small pocket beach embayment are too fine and three-dimensional in nature to be readily translated to a larger-scale shoreline assessment, particularly over long time periods.

Moreover, for any reliable accuracy, the numerical modeling results of pocket beach response must be calibrated to some rational measure; and that measure would be the empirical

prototype beach response described above. Accordingly, at best, the numerical model would seek to replicate (proxy) the empirical prototype predictions already described herein -- at least in terms of modeling the small-scale pocket beach improvements. And these predictions cannot be accurately modelled except at a very fine grid scale that is not suitable for extrapolation to potential larger far-field effects.

In sum, given the small-scale nature of the proposed modifications, and the inability of numerical models to accurately assess the effect of such small modifications amongst a broader littoral field, particularly with the project's minor changes in the nearshore seabed depth and morphology -- along with inherent uncertainties associated with the nearshore wind and wave field -- there is no net apparent benefit or value in numerically modelling the proposed project improvements for the purposes of assessing overall littoral impacts. Given the practical abilities, limitations, accuracies and data requirements of contemporary numerical modelling – relative to the small-scale nature of the proposed project modifications – a numerical-modelling assessment is unlikely to provide any more accurate assessment of the project performance and impacts than competent coastal engineering assessment based upon experience and observation of similar prototype projects. For this reason, modeling was not considered to be warranted or of net beneficial value for this specific project.

Prototype examples of other similar T-head and embayment beach projects are presented below.



Figure 13: John U. Lloyd State Park, Port Everglades Entrance, Florida.

The two T-head structures and jetty spur, with beach fill, were constructed in 2007 to restore and stabilize the chronically eroded shoreline immediately south (downdrift) of the Port Everglades inlet. The project provides public beach recreation along the Park and shore protection to the US Navy facility adjacent to the jetty.



Figure 14: Tybee Island, Georgia

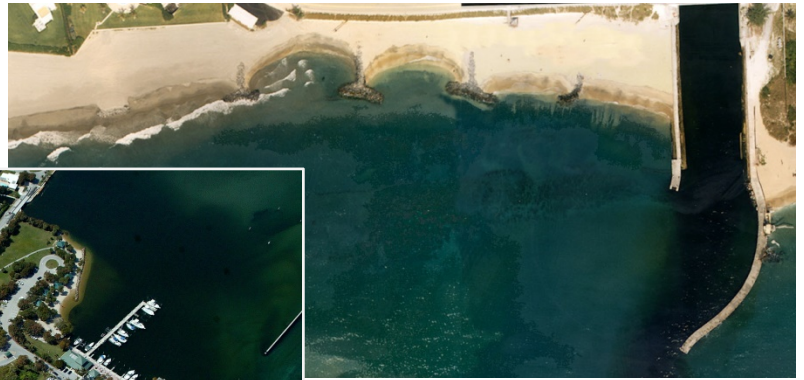
Two T-head groins and a terminal groin & spur were constructed in 1995 at the south end of Tybee Island, Georgia to create and stabilize a sand beach along this chronically eroded shoreline. The pre-existing jetties were modified as part of the plan. The shoreline has maintained the condition shown in the photograph since its construction.



**Figure 15:
Iroquois Pt.
Oahu, Hawaii.**

Nine T-head groins and sand fill, constructed in 2013, restored this U. S. Navy shoreline adjacent to the Pearl Harbor ocean inlet. The sand fill came from maintenance-dredging along the west bank of the inlet channel (background), by excavator and dump-truck. This is the first large-scale beach nourishment project constructed in Hawaii during the last 30+ years.

Figure 16: Ocean Ridge, Palm Beach County, Florida



Eight rock T-head structures (mostly buried in sand in these photographs) were constructed in 1998 to stabilize the beach immediately downdrift of South Lake Worth Inlet, FL, and to limit the beach encroachment upon nearshore reefs. Sand is pumped from a bypassing plant, across the inlet, and placed within the groin field.



**Figure 17:
Montagu Foreshore,
Nassau Bahamas**

Left: Pre-Project Condition

Above: Post-Project Condition



The sand beach along this popular public beach park in Nassau was restored with seven T-head and spur-groin structures and sand fill in 2011, eliminating the seagrass and debris deposits along the shoreline.



**Figure 18:
Sandals - La Source, Grenada**

Existing breakwaters and rock revetments were re-configured & removed to improve the sand beach and restore tidal circulation. Constructed in 2012-13 (bottom left); completed in Dec 2013 (below).



Figure 19: One&Only Reethi Rah Resort, Maldives

Over 50 rock structures, including numerous T-head and pocket-beach designs, were used to stabilize the architectural shoreline at this island resort, constructed in 2004. Through 2016, the beaches have performed per design without need for renourishment.





Figure 20: Palm Cay, New Providence, Bahamas

T-head, terminal and spur groins were constructed in 2012 – along with sand fill placement -- to replace derelict groins and breakwaters along a 1400-ft long residential shoreline near Nassau, Bahamas. The project created five 275-ft long pocket-beach embayments.

Above Right: Pre-Project
Right: Post-Project



4.0 References.

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- Berenguer, J. and Enriquez, J. 1988. Design of Pocket Beaches, The Spanish Case. Proc. Int'l Conf. on Coastal Engineering. ASCE, 1411-1425.
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- Hanson, H. and Kraus, N.C., 2001. Chronic Beach Erosion Adjacent to inlets and Remediation by Composite (T-Head) Groins. ERDC/CHL CHETN-IV-36. US Army Corps of Engineers Coastal Hydraulic Laboratory. June 2001.
- Hardaway, C.S. and Gunn, J. R. 1999. Chesapeake Bay: Design and Early Performance of Three Headland Breakwater Systems. Proceedings Coastal Sediments '99, ASCE, 828-43.
- Silvester, R. and Hsu, J. R., 1993. Coastal Stabilization. Prentice Hall, Inc., Englewood Cliffs, NJ; pp 212-244.
- WHG, 2010. Waterways Assets and Resources Survey; Master Plan for Dredging and Beach Nourishment for Town of Dennis, MA. Prepared for Town of Dennis, by Woods Hole Group Inc. East Falmouth, MA. November 2010.
- WHSg, 2011. Longshore Sediment Transport; Cape Cod, Massachusetts. Woods Hole Sea Grant Program, Cape Cod Cooperative Extension. April 2011.

Appendix F

BENTHIC HABITAT/EELGRASS ASSESSMENT (BY CAPE COD ENGINEERING, INC.)

CAPE COD ENGINEERING, INC.

Robert M. Perry, P.E.

P.O. Box 1517

East Dennis, MA 02641

Tel 508-385-1445 / Fax 508-385-1446

bobperry@capecod.net

March 14, 2017

Mark N. White
Environmental Partners
1900 Crown Colony Drive
Suite 402
Quincy, MA 02169

**Re: Lighthouse Inn Groin Improvements - Benthic Habitat / Eel Grass Assessment
1 Lighthouse Rd. West Dennis, MA**

Dear Mark,

At the request of Greg Stone of Lighthouse Inn, *Cape Cod Engineering, Inc.* has completed an assessment of the submerged conditions in the vicinity of the existing stone groins in the near shore zone at the Lighthouse Inn.

During the late summer and early fall of 2016 direct observations were made throughout the offshore area surrounding the stone groin formation at Lighthouse Inn. A topographic survey acquired hydrographic data representative of existing hydrographic / topographic conditions. The multiple discreet patches and random distribution of the submerged aquatic vegetation (SAV) rendered the idea of topographic survey efforts to map the individual pockets of SAV as an impractical undertaking.

Rather, visual inspections of the growth were made in combination with a series of small grab samples from typical growth patches obtained via bull rake. A general evaluation of the composition was made using the samples. Aerial photos were reviewed for the best indication for locations the SAV growth and compared with visual confirmation.

As a means of adequately mapping the discreet patches of SAV a selected aerial photo of April 16, 2016 is superposed over the topographic survey data. The visual and sampled inspection of a series of these patches enables a conclusion as to the locations of the SAV.

The image is attached with this summary.

To evaluate the image, a distinction is made between the vast quantity of wrack material clustered along the intertidal zone, outside and entrapped within the stone groin and the patches of SAV that appear in the aerial photo. The wrack material is landward of the (-4) contour. SAV patch growth is seaward of the (-4) contour and appears as small, contrasting patches in the sand bottom sediment. With exception of brown algae, no rooted SAV exists within the stone groin enclosure.

The SAV patches observed and sampled consisted of three primary constituents:

- red macro-algae (likely *Grinnellia americana*)
- green macro-algae (*codium*)
- eel grass (*Zostera marina*)

The distribution for these species within the discreet patches is estimated to be approximately 33% each.

The SAV patches were, without exception anchored within a substrate of dense limpet shell deposits integrated with root rhizomes. Bottom area adjacent to and outside the SAV patches consisted of a clean sand substrate to an undetermined depth, containing clean medium sand, shell fragments and minor gravel content.

Based upon the overall observation of the substrate within and outside the visually observed areas of SAV, the substrate for holdfast anchorage is lacking in the sandy areas adjacent to the SAV patches. The patches have a consistent visual signature evidenced in a series of aerial views over several years leading to the conclusion that eel grass density is likely to fluctuate seasonally within the observable SAV patches with potential patch expansion limited to the availability of limpet collection for anchorage and rhizome expansion from each area of discreet growth.

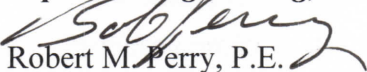
The stone groins, below the low tide level were populated with common brown algae (rockweed, *fucaceae* family)

The proposed project activity will cause for disruption of the brown algae involved with shifting the stones to modify the groin configuration. Our review of the work protocol, limiting equipment access to within the stone groin enclosure, keeping such activity clear of the discreet SAV patches, and by examination of location of the proposed groin modification we believe the project is unlikely to adversely affect the eel grass found in this area.

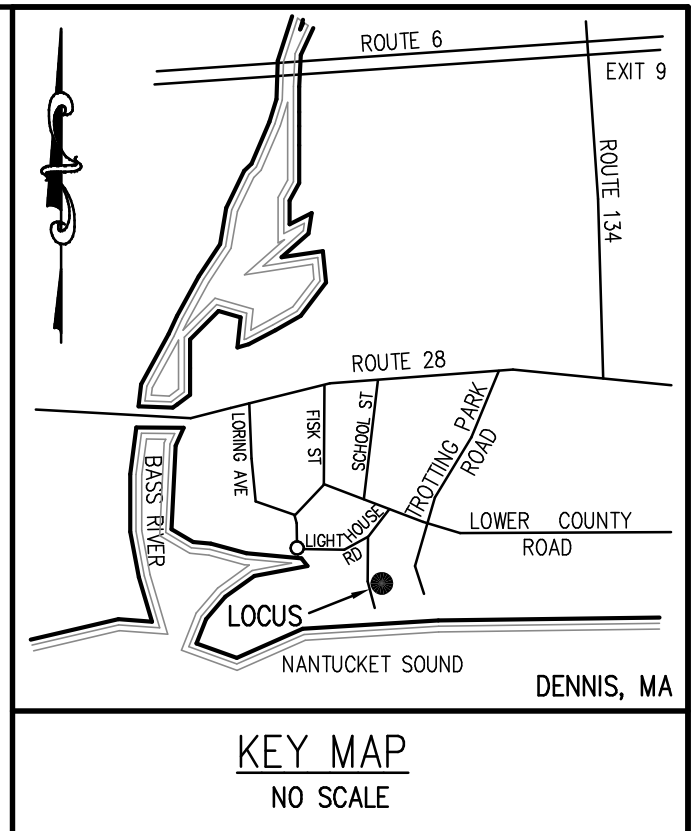
Please feel free to contact me directly should you have questions about this evaluation.

Sincerely,

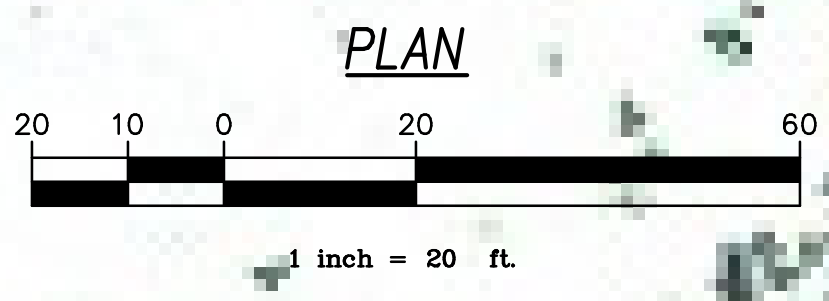
Cape Cod Engineering, Inc.


Robert M. Perry, P.E.

Cc: Greg Stone

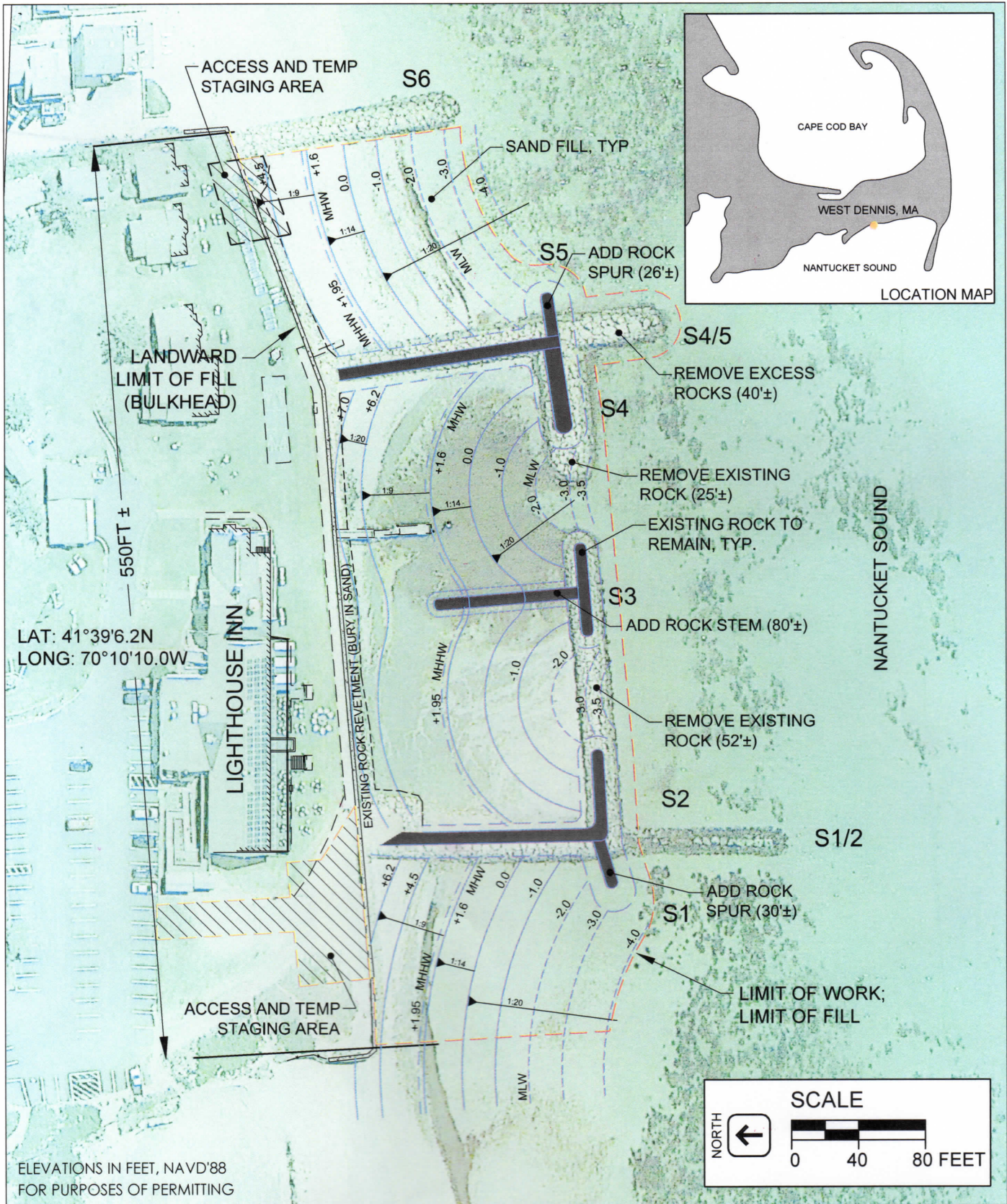


- AQUATIC VEGETATION OBSERVATION NOTES**
1. THE PHOTO-OVERLAY SHOWS THE DARKER DISCREET PATCHES OF AQUATIC VEGETATION IN THE VICINITY OF THE STONE GROIN FORMATIONS. THESE AREAS ARE THE OBSERVED AND SAMPLED LOCATIONS OF ISOLATED AQUATIC BEDS CONTAINING THE LISTED SPECIES BELOW.
 2. THE BROADER, DARK AREAS LACKING DEFINITION, NEARER TO SHORE ARE ABUNDANT DEPOSITS OF COLLECTED WRACK MATERIAL OVERLYING A SAND SUBSTRATE.
 3. THE DISCREET PATCHES PREDOMINANTLY SEAWARD OF THE (-)4 ELEVATION CONTOUR ARE OBSERVED TO BE MARINE, SUBTIDAL, AQUATIC BEDS PREDOMINANTLY CONTAINING A THIN DENSITY OF FIRMLY ROOTED RHIZOMES OF EEL GRASS (*Zostera marina*); RED (*G. americanum*) AND GREEN (*Codium*) MACRO ALGAE AFFIXED TO ATLANTIC SLIPPER SHELLS (*Credulka fornicata*)
 4. GRANITE STONE GROINS IN THE SUBTIDAL ZONE WERE POPULATED WITH BROWN ALGAE, E.G. ROCKWEED (FUCACEAE FAMILY)
 5. SURROUNDING BOTTOM CONSISTS OF UNCONSOLIDATED SAND
- NOTES**
1. ELEVATIONS REFER TO NAVD88.
 2. THE DATA CONTAINED HEARON WAS GENERATED BY AN ON - THE - GROUND OPTICAL FIELD SURVEY EFFORT BY ROBERT FREEMAN, PLS DURING SEPTEMBER 2016
 3. PROPERTY LINES SHOWN ARE APPROXIMATE DUE TO LACK OF MONUMENTATION. ADDITIONAL LOT LINE RESEARCH IS ADVISED.
 4. THE BEACH AND SEAWALL PORTION OF LOCUS IS WITH FEMA FLOOD ZONE VE WITH FLOOD ELEV. = 13 NAVD88; MAIN INN BUILDING IS LOCATED WITHIN ZONE AE W/ BFE 11



HYDROGRAPHIC PLAN
 OF
 EXISTING SHOREFRONT CONDITIONS
 AT
 1 LIGHTHOUSE INN ROAD, WEST DENNIS, MA
 ASSESSORS' MAP 12, PARCEL 7
 PREPARED FOR
 LHI, INC.
 P.O. BOX 128, WEST DENNIS, MA 02670
 MARCH 13, 2017 SCALE - AS NOTED

PREPARED BY
CAPE COD ENGINEERING, INC.
 ROBERT M. PERRY, P.E.
 P.O. BOX 1517
 EAST DENNIS, MA 02641
 TEL: 508-385-1445



ELEVATIONS IN FEET, NAVD'88
FOR PURPOSES OF PERMITTING

LIGHTHOUSE INN; WEST DENNIS, MA
BEACH PROJECT
PROPOSED IMPROVEMENTS

01/30/17
DRAWN BY:
ML
SHEET
1 of 7

Appendix G

MASSACHUSETTS HISTORICAL COMMISSION

PROJECT NOTIFICATION FORM – NOVEMBER 1, 2016

MASSACHUSETTS HISTORICAL COMMISSION RESPONSE LETTER – NOVEMBER 4, 2016

November 1, 2016

Massachusetts Historical Commission
220 Morrissey Boulevard
Boston, MA 02125

RE: Project Notification Form
Lighthouse Inn Groin Improvements
West Dennis, Massachusetts

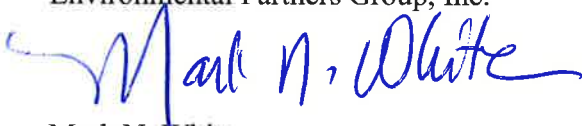
To Whom It May Concern:

On behalf of the LHI Inc., please find enclosed a completed Project Notification Form (PNF) for the proposed Lighthouse Inn Groin Improvements. This form is being submitted in advance of several other environmental permitting submittals (i.e., Massachusetts Environmental Protection Act Environmental Notification Form, and US Army Corps of Engineers Individual Permit).

The site is located in West Dennis, Massachusetts along the Lighthouse Inn shorefront. The proposed project will reconfigure the existing three rock groins along the Lighthouse Inn shorefront such that they are more conducive to maintaining shore protection and a sand beach, while improving natural tidal flow and flushing between the two western groins. These shoreline improvements will therefore provide better protection to the Inn, and will also preserve and protect a light house constructed in 1855 that is on the property and continues to this day to be permitted by the Coast Guard as a private aid to navigation. A Site Locus Map and conceptual project plans are attached.

If you should have any questions or require additional information, please do not hesitate to contact me at (617) 657-0200. I can also be reached via e-mail at mnw@envpartners.com.

Very Truly Yours,
Environmental Partners Group, Inc.



Mark N. White
Sr. Project Manager

Attachments: MHC Project Notification Form
Project Description
Site Locus
Project Plans

CC: Gregory Stone, LHI Inc.
File

950 CMR: OFFICE OF THE SECRETARY OF THE COMMONWEALTH

APPENDIX A

MASSACHUSETTS HISTORICAL COMMISSION
220 MORRISSEY BOULEVARD
BOSTON, MASS. 02125
617-727-8470, FAX: 617-727-5128

PROJECT NOTIFICATION FORM

Project Name: Lighthouse Inn Groin Rehabilitation

Location / Address: 1 Lighthouse Road

City / Town: West Dennis

Project Proponent

Name: Gregory Stone

Address: P.O Box 128

City/Town/Zip/Telephone: West Dennis, Massachusetts 02670 (508) 398-2244

Agency license or funding for the project (list all licenses, permits, approvals, grants or other entitlements being sought from state and federal agencies).

Agency Name

Type of License or funding (specify)

- | | |
|---|--|
| 1. Executive Office of Environmental Affairs | Environmental Notification Form (ENF) |
| 2. National Heritage & Endangered Species Program | Massachusetts Endangered Species Act (MESA) Review |
| 3. US Army Corp of Engineers | Individual Permit |

Project Description (narrative):

Please refer to the attached project description.

Does the project include demolition? If so, specify nature of demolition and describe the building(s) which are proposed for demolition.

No.

Does the project include rehabilitation of any existing buildings? If so, specify nature of rehabilitation and describe the building(s) which are proposed for rehabilitation.

No.

Does the project include new construction? If so, describe (attach plans and elevations if necessary).

Yes. Please refer to the attached plans.

950 CMR: OFFICE OF THE SECRETARY OF THE COMMONWEALTH

APPENDIX A (continued)

To the best of your knowledge, are any historic or archaeological properties known to exist within the project's area of potential impact? If so, specify.

What is the total acreage of the project area?

Woodland _____	acres	Productive Resources:	
Wetland _____	acres	Agriculture _____	acres
Floodplain _____	acres	Forestry _____	acres
Open space _____	acres	Mining/Extraction _____	acres
Developed _____	acres	Total Project Acreage _____	acres

What is the acreage of the proposed new construction? _____ acres

What is the present land use of the project area?

Please attach a copy of the section of the USGS quadrangle map which clearly marks the project location.

This Project Notification Form has been submitted to the MHC in compliance with 950 CMR 71.00.

Signature of Person submitting this form: *Gregory Stone / Pres.* Date: *11/1/16*
Name: *LHI, Inc - Gregory Stone / President*
Address: *1 Lighthouse Inn Rd.*
City/Town/Zip: *W. Dennis Ma 02670*
Telephone: *508-398-2244*

REGULATORY AUTHORITY

950 CMR 71.00: M.G.L. c. 9, §§ 26-27C as amended by St. 1988, c. 254.

PROJECT DESCRIPTION

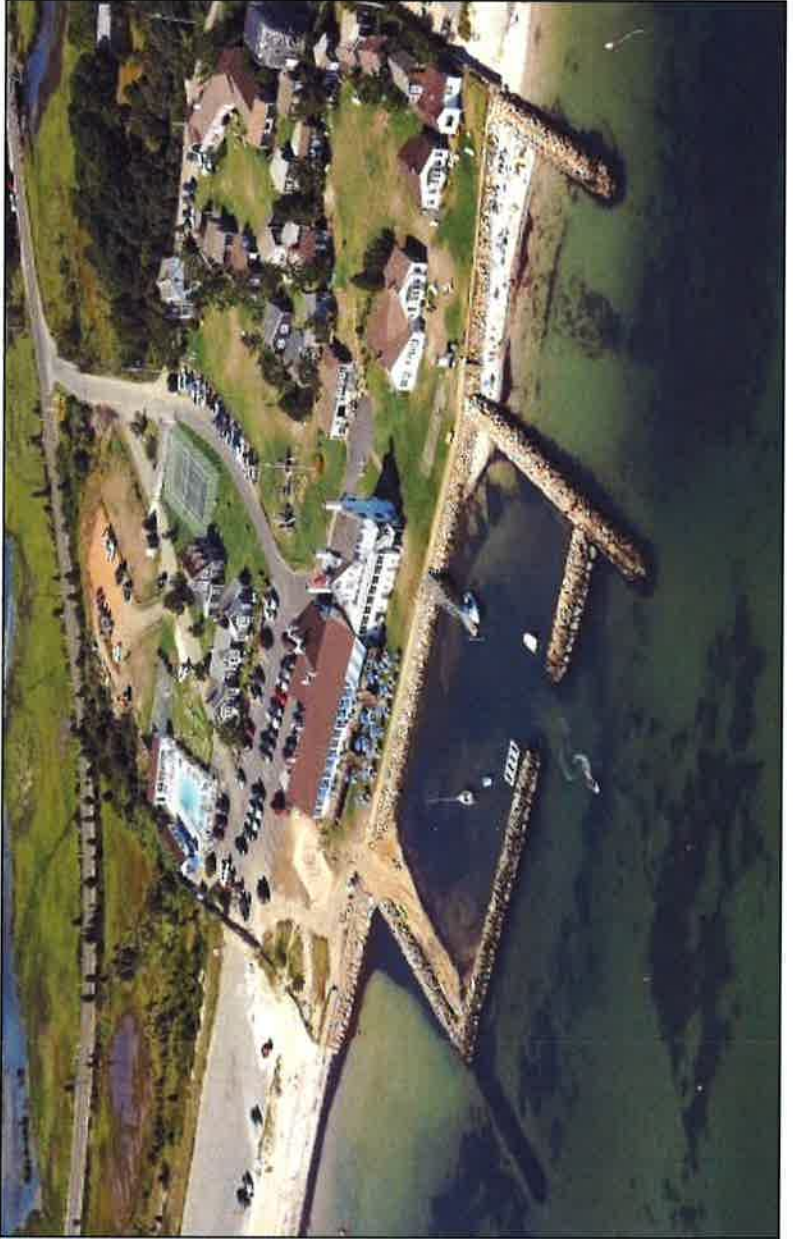
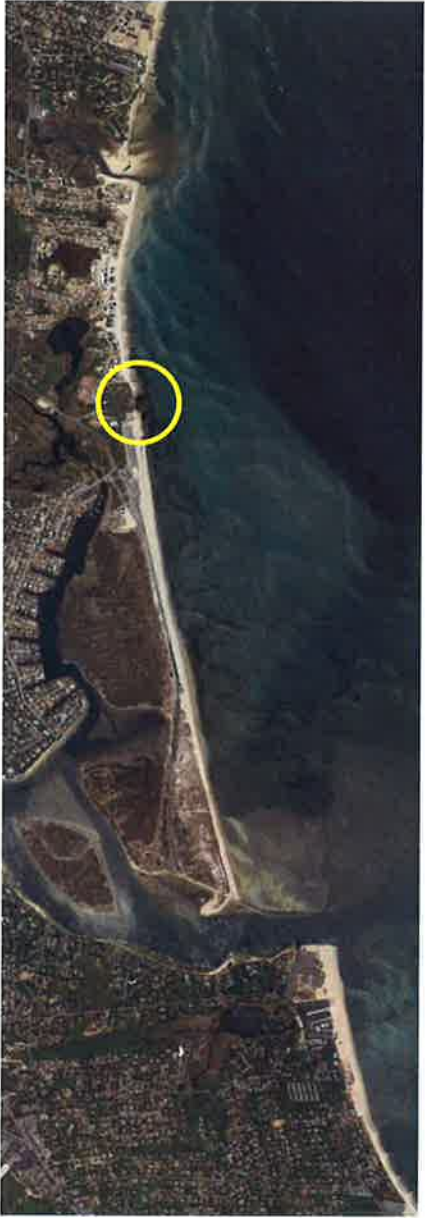
LHI Inc. is located in West Dennis, Massachusetts and owns the Lighthouse Inn (see the attached USGS Locus Plan). The proposed project will reconfigure the a rock groin system along the Lighthouse Inn shorefront such that they are more conducive to maintaining shore protection and a sand beach, while improving natural tidal flow and flushing between the two western groins. These shoreline improvements will provide better protection to the Inn, and will also preserve and protect a light house constructed in 1855 that is on the property and continues to this day to be permitted by the Coast Guard as a private aid to navigation.

The proposed project area comprises approximately 600-ft of ocean shorefront along the Lighthouse Inn shoreline. The shorefront, shown in the attached survey plan of existing conditions and site photographs, includes three rock groins which are the westernmost of a broader field of ten groins. The groins extend between 130 and 240-ft in length from the upland. A shore parallel breakwater spans between the two center groins with a gap opening of about 25-ft. The small size of this gap does not allow sufficient wave energy into the embayment, behind the breakwater, to maintain a natural sand beach and it acts to trap detritus within the embayment.

The proposed shorefront improvements, shown in the attached proposed conditions plan, would reconfigure the existing groins to a design that is more conducive to maintaining shore protection and a sand beach while improving natural tidal flow and flushing between the two western groins. These improvements would remove most of the breakwater and shorten the length of the two western groins. It would reconfigure the rock to a geometry that is more effective in stabilizing the beach, reducing detrital accumulation, and restoring more natural sand beach conditions along the shorefront. The proposed plan entails removal of about 200-ft of existing groin and breakwater structures and relocation to a more effective geometry as shown on the plans. The proposed plan likewise requires placement of beach compatible sand fill after reconfiguration of the rock structures, in order to establish and improve the sand beaches.

Specifically, the plan would decrease the length of the two existing groins at Lighthouse Inn, from 240-ft to 150-ft and from 200-ft to 150-ft, respectively, and it would remove about 125-ft of the existing breakwater between these two groins. Portions of the two groins would be lowered to improve alongshore flow. The plan would reconfigure the removed rock to construct a T-head groin between the 1st and 2nd groins and construct heads at the ends of each of the existing groins, to create four crenulate embayments, commonly referred to as pocket beaches. The resultant gap-openings between the groin structures, between 65- and 95-ft in length, are sufficient to develop and maintain a stable, predictable beach geometry within each pocket beach, while simultaneously reducing the seaward length of the groins along the shoreline.

An important principle of the proposed project is that it seeks to beneficially reconfigure the shoreline's existing structures. The existing groin structures have acted to promote and partly maintain shore protection and a sand beach since the adjacent inlets and shoreline were modified. The proposed plan improves and optimizes these structures through incorporation of contemporary advances and experience in the use of coastal structures; viz., these structures' ability to maintain a stable sand beach of predictable geometry, particularly where subject to the erosion stress from adjacent coastal inlets.





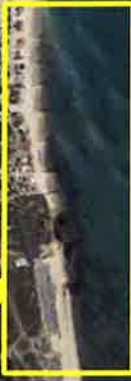
South
Yarmouth

West
Dennis

Bass River

Swan Pond River

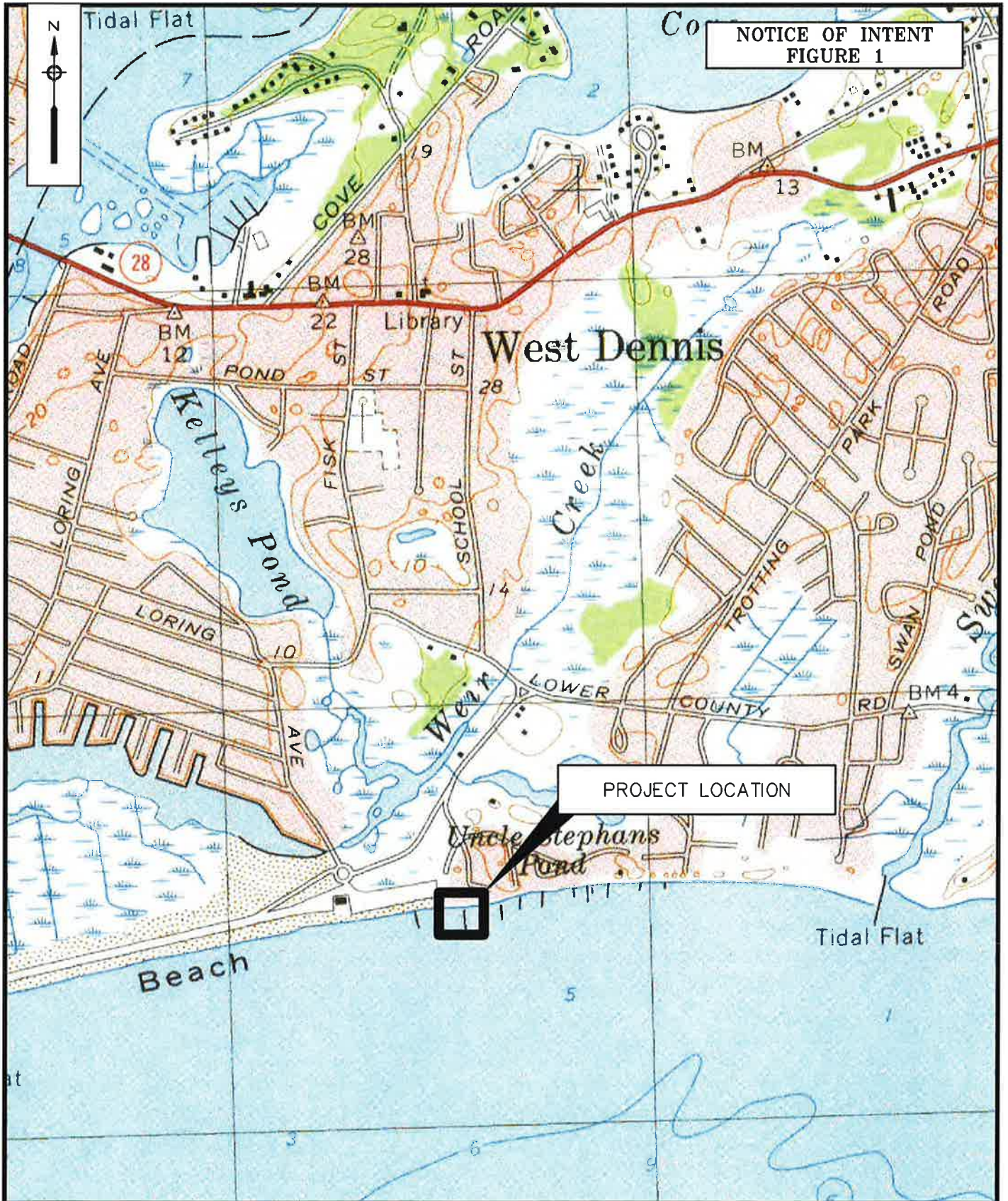
3000 feet



google earth

©2014 U.S. Navy, NGA, GEBCO

3000 ft



NOTICE OF INTENT
FIGURE 1

PROJECT LOCATION

Lighthouse Inn - Dennis, MA MEPA ENVELOPUS MAP LOCUS MAP DWG

Environmental Partners
A partnership for engineering solutions
GROUP
Gloucester, MA | Hyannis, MA | Westport, MA
Tel: 978-455-7100 | www.environmentalpartners.com

NOVEMBER 2016

328-1601

1" = 1,000'

APPLICANT: LIGHTHOUSE INN INC.

LIGHTHOUSE INN GROIN IMPROVEMENTS

USGS QUADS LOCUS MAP



EXISTING CONDITIONS
LIGHTHOUSE INN & DAVID
BEACH RD, MA.
CONCEPT SKETCH
NOT FOR CONSTRUCTION



SCALE
0 100 200 FEET

09-23-2014

NANTUCKET SOUND

IMAGERY: 06-15-2014



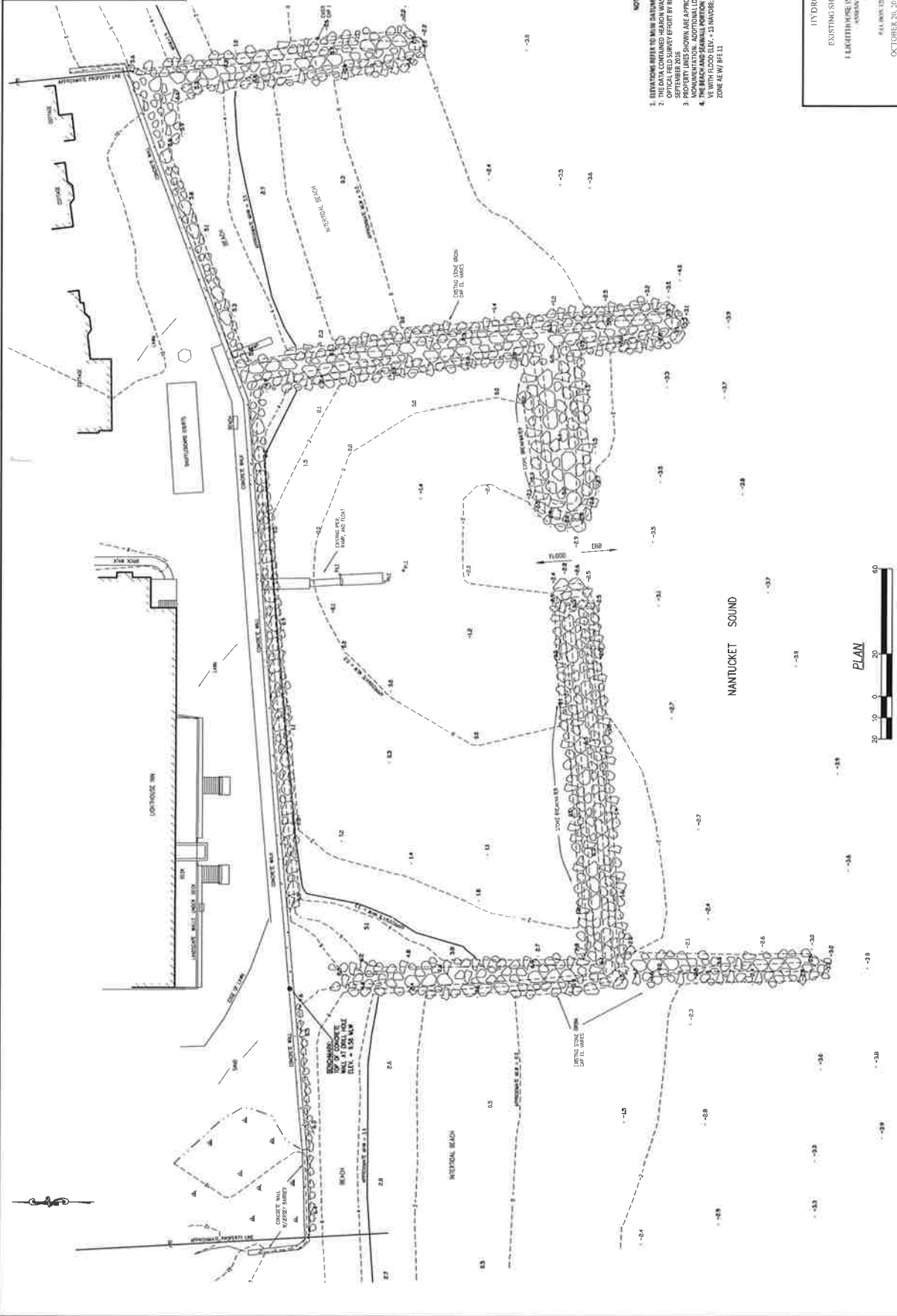
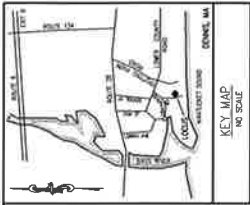
EXISTING CONDITIONS
LIGHTHOUSE INN & DAVID
BEACH RD., MA.
CONCEPT SKETCH
NOT FOR CONSTRUCTION



SCALE
0 30 60 FEET
09-23-2014

NANTUCKET SOUND

IMAGERY: 06-15-2014

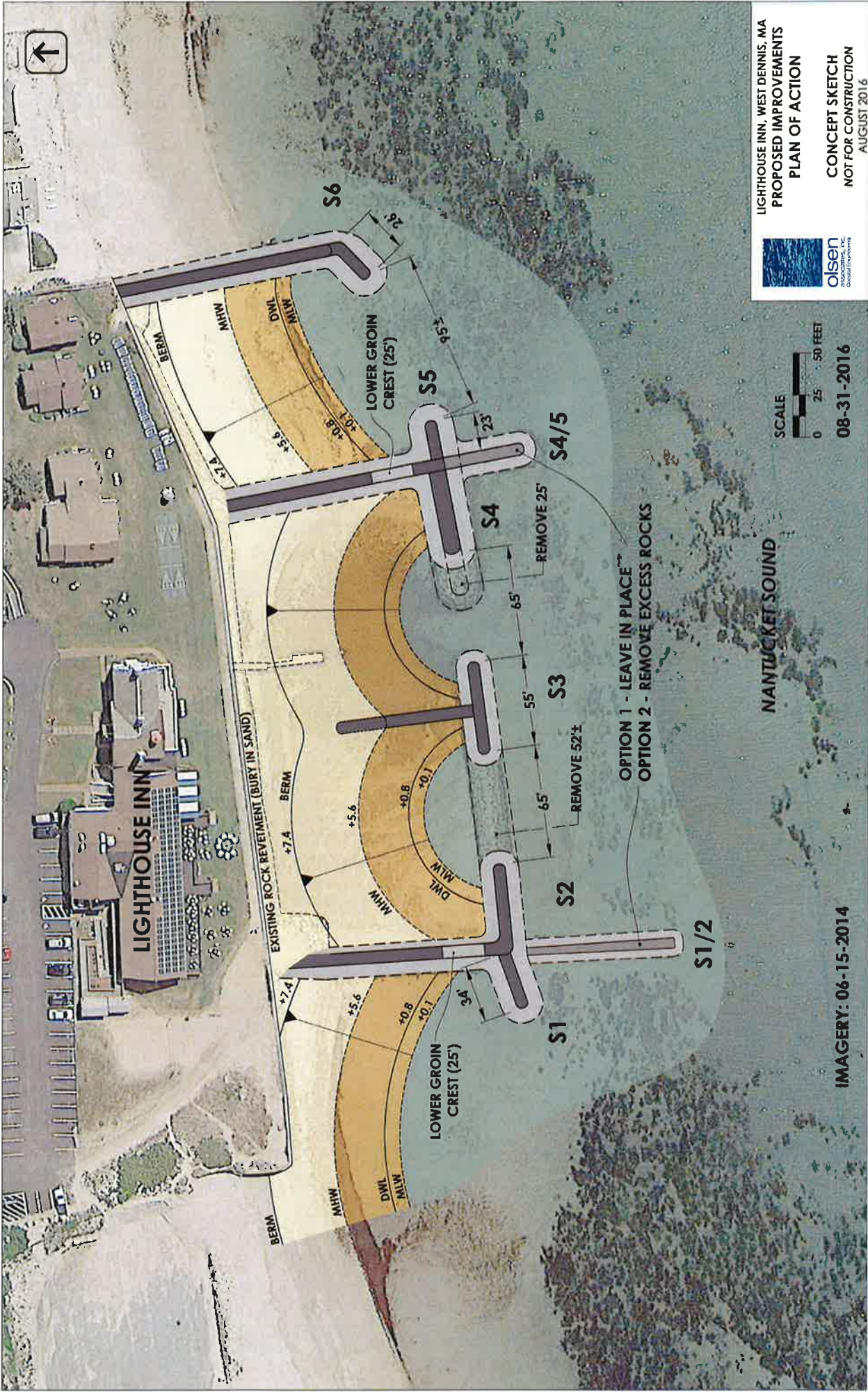


- NOTES
1. EXISTING BATHYMETRY DATA WAS OBTAINED FROM THE DATA COMPANIES RECORDING CONDUCTED BY ANCON - THE - GROUND OPTICAL FIELD SURVEY EFFORT BY ROBERT FREEMAN, P.E. DURING SEPTEMBER 2005.
 2. EXISTING BATHYMETRY DATA WAS OBTAINED FROM THE DATA COMPANIES RECORDING CONDUCTED BY ANCON - THE - GROUND OPTICAL FIELD SURVEY EFFORT BY ROBERT FREEMAN, P.E. DURING SEPTEMBER 2005.
 3. THE BEACH AND BEACHWALL PORTION OF LOCUS IS WITH FEMA FLOOD ZONE 1 AND FLOOD ZONE 2 - 23 IN THESE MAIN AREAS IS LOCATED WITHIN ZONE 1E AND 1F.
 4. THE BEACH AND BEACHWALL PORTION OF LOCUS IS WITH FEMA FLOOD ZONE 1 AND FLOOD ZONE 2 - 23 IN THESE MAIN AREAS IS LOCATED WITHIN ZONE 1E AND 1F.

HYDROGRAPHIC PLAN
OF
EXISTING SHOREFRONT CONDITIONS
1 LIGHTHOUSE INN ROAD WEST DENNIS, MA
CONDUCTED BY L.H. INC.
FOR THE CLIENT
L.H. INC.
110 W. MAIN STREET
DENNIS, MA 01913
OCTOBER 30, 2016 SCALE - AS NOTED
PREPARED BY
CAPE COD ENGINEERING, INC.
100 W. MAIN STREET
DENNIS, MA 01913
TEL: 508-325-4444



HYDROGRAPHIC PLAN



LIGHTHOUSE INN, WEST DENNIS, MA
 PROPOSED IMPROVEMENTS
 PLAN OF ACTION
 CONCEPT SKETCH
 NOT FOR CONSTRUCTION
 AUGUST 2016



08-31-2016

IMAGERY: 06-15-2014

RECEIVED

NOV 01 2016

950 CMR: OFFICE OF THE SECRETARY OF THE COMMONWEALTH

MASS. HIST. COMM

RC 61145

APPENDIX A
MASSACHUSETTS HISTORICAL COMMISSION
220 MORRISSEY BOULEVARD
BOSTON, MASS. 02125
617-727-8470, FAX: 617-727-5128

PROJECT NOTIFICATION FORM

Project Name: Lighthouse Inn Groin Rehabilitation

Location / Address: 1 Lighthouse Road

City / Town: West Dennis

Project Proponent


Name: Gregory Stone

Address: P.O Box 128

City/Town/Zip/Telephone: West Dennis, Massachusetts 02670 (508) 398-2244

For review of MHC files and the materials you submitted, it has been determined that this project is unlikely to affect significant historic or archaeological resources.

RC 61145


Jonathan K. Patton
Archaeologist / Preservation Planner
Massachusetts Historical Commission

11/4/16
Date

Agency license or funding for the project (list all licenses, permits, approvals, grants or other entitlements being sought from state and federal agencies).

Agency Name

- 1. Executive Office of Environmental Affairs
- 2. National Heritage & Endangered Species Program
- 3. US Army Corp of Engineers

Type of License or funding (specify)

- Environmental Notification Form (ENF)
- Massachusetts Endangered Species Act (MESA) Review
- Individual Permit

Project Description (narrative):

Please refer to the attached project description.

Does the project include demolition? If so, specify nature of demolition and describe the building(s) which are proposed for demolition.

No.

Does the project include rehabilitation of any existing buildings? If so, specify nature of rehabilitation and describe the building(s) which are proposed for rehabilitation.

No.

Does the project include new construction? If so, describe (attach plans and elevations if necessary).

Yes. Please refer to the attached plans.

Appendix H

***LIST OF AGENCIES AND PERSONS RECEIVING COPIES OF THE LIGHTHOUSE INN
MEPA EIR***

APPENDIX H

List of Agencies and Persons Receiving Copies of the Lighthouse Inn MEPA EIR

Two Full Sized Copies to:

Secretary Matthew A. Beaton
Executive Office of Environmental Affairs Attn:
MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114

One copy to each of the following:

1. Gregory Stone, President
Lighthouse Inn Inc.
P.O. Box 128
West Dennis, MA 02670-0128
2. Department of Environmental Protection
Commissioner's Office
One Winter Street Boston, MA
02108
3. Department of Environmental Protection
Southeast Regional Office
Attn: MEPA Coordinator
20 Riverside Drive
Lakeville, MA 02347
4. Massachusetts Department of Transportation
Public/Private Development Unit
10 Park Plaza
Boston, MA 02116
5. Massachusetts Department of Transportation
District #5
Attn: MEPA Coordinator
1000 County Street
Taunton, MA 02780
6. Massachusetts Historical Commission The
MA Archives Building
220 Morrissey Boulevard
Boston, MA 02125

7. Board of Underwater Archaeological Resources
MA Office of Coastal Zone Management
251 Causeway Street, Suite 800
Boston, MA 02114-2138
8. Stephen McKenna, Coordinator
Massachusetts Coastal Zone
Management – Cape Cod and Islands
PO Box 220
Barnstable, MA 02630-0220
9. Massachusetts Dept. of Fish & Wildlife
Natural Heritage & Endangered Species
Program
Route 135
Westborough, MA 01581
10. Massachusetts Division of Marine
Fisheries (South Shore)
Attn: Environmental Reviewer
1213 Purchase Street – 3rd Floor
New Bedford, MA 02740-6694
11. Metropolitan Area Planning Council
60 Temple Place/6th floor
Boston, MA 02111
12. Dennis Board of Selectmen
685 Route 134 (P.O. Box 2060)
South Dennis, MA 02660
13. Dennis Planning Department
685 Route 134 (P.O. Box 2060)
South Dennis, MA 02660
14. Dennis Conservation Commission
685 Route 134
South Dennis, MA 02660
15. Dennis Board of Health
685 Route 134
South Dennis, MA 02660

16. Department of Public Health (DPH)
Director of Environmental Health
250 Washington Street
Boston, MA 02115

17. Law Offices of Paul R. Tardif, Esq., P.C.
ATTN: Paul R. Tardif
490 Main Street
Yarmouth Port, MA 02675

18. Kevin R. Bodge, Ph.D., P.E.
Olsen Associates, Inc.
2618 Herschel Street
Jacksonville, FL 32204

19. Robert M. Perry, PE
Cape Cod Engineering, Inc.
PO Box 1517
East Dennis, MA 02641

