South Shore Coastal Infrastructure Inventory and Assessment Demonstration Project
Coastal Hazards Commission

Town of Plymouth

Prepared for:
Office of Coastal Zone Management
Boston, MA

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• Document Table
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Section I

Town of Plymouth

Coastal Hazards Infrastructure and Assessment Program
Section I – Coastal Hazards Infrastructure and Assessment Program

INTRODUCTION

The Project and Client

The Commonwealth of Massachusetts has initiated a Coastal Hazards Commission (CHC) to identify the vulnerability of the state to coastal hazards. As one of five working groups working under the CHC, the 20-Yr Infrastructure Plan was to establish a prioritization for the repair of coastal structures. The focus areas of the Working Group include:

- Publicly owned infrastructure
- Infrastructure for which State is responsible
- Inventory of public hazards infrastructure
- Evaluation on conditions
- Development for a prioritization of work
- Estimation of capital and maintenance costs

The 20-Yr Infrastructure Working Group is led by Representative Frank Hynes with CZM as the lead State Agency overseeing the management of the project. The region included in the demonstration project was identified as the South Shore and included the eight communities of Hingham, Hull, Cohasset, Scituate, Marshfield, Duxbury, Kingston and Plymouth.

Consultant Team

The consultant team that performed the demonstration project was led by Bourne Consulting Engineering (BCE) of Franklin, MA who was responsible for overall project management, research and field assessments. Assisting BCE was Applied Coastal Research and Engineering, Inc. of Mashpee, MA who was responsible for field assessments and GIS data conversion. Alpha Land Surveying and Engineering of Middleboro, MA also supported the Team with field GPS survey.

PURPOSE

Study Purpose

CZM seeks to identify the capacity of Massachusetts coastal structures to resist major coastal storms and prevent storm damage. In working toward this goal, CZM has initiated a program to perform an assessment of Commonwealth owned and/or maintained coastal structures. The first phase of this program is the performance of a demonstration project for coastal structures located on the South Shore. The demonstration project will identify existing structures, their general conditions, ability to provide coastal protection and the probable cost for repairs. The information collected and developed will be incorporated into the MassGIS system to allow use for developing a 20 Year Coastal Infrastructure Plan.

As this is a demonstration project, it will serve as the basis for development of a statewide inventory and assessment of all Commonwealth coastal structures and the needs for their maintenance and/or repair. Incorporated into this project will be the identification of issues and limitations of the investigation and
assessment to achieve the overall goals and what should be included in future investigations/assessments of coastal structures for the other regions.

Goals of Study

The goals of the South Shore Coastal Infrastructure Inventory and Assessment Project include:

- To be used as the model to go forward for assessment of coastal structures for the remainder of the coastal regions
- To identify areas of research and/or assessment that need to be modified for future phases that were not included within the demonstration project
- Complete the study with the final report by November 15, 2006 for submission to the Coastal Hazards Commission
- To identify all the coastal structures the state either owns or has responsibility to maintain for the eight communities included within the study
- Of the structures identified, determine the structure location and characteristics, the structure condition relative to providing coastal protection and the structure importance in relation to what it is protecting.
- To the degree possible, identify the structure elevation and the FIRM mapping flood elevation and category.
- To the degree possible, identify structure owner and available documents from local, state and federal agencies.
- To establish an estimated cost to rehabilitate the coastal structures to provide the level of project established in the structure’s original design.
- Provide the information in a format compatible for incorporation into the MassGIS system

Limit of Study

Due to the time constraints and the amount of effort necessary to collect, process and compile the information, the following are identified as limitations of the information presented:

- All property ownership was taken as presumed. No legal investigation of ownership was performed during the project. Property ownership is based on town assessor maps. Where structures were located outshore of assessor map defined property lines, it was assumed to be Town land unless other information indicated otherwise. Where structures were located outshore of Mean Low Water, property is assumed to be State owned.

- The structure ownership was based on assessor maps and research at the local, state and federal levels. Where there was indication of public work on a structure on Town land or on private property, the structure was presumed to be Town owned. Where the structure was on state property, the structure was presumed to be state owned. Where ownership of the structure was not clear but was located on private property, the structure ownership was defined as unknown.

- The study included town and state owned structures as it was assumed that most town owned structures received state funding at some level for construction and/or maintenance.
  - Federal structures were identified but no assessment of conditions or priority was performed.
  - Structures that were determined to be private were not included.
  - Undocumented structures considered to be on private land, but having the potential to have been publicly built and/or maintained, were identified as having an “unknown ownership”.

Town of Plymouth
The prioritizing of structures was based primarily on risk to general infrastructure and density of housing. Infrastructure included was buildings. The study did not consider all infrastructure issues including:
- No consideration on utility impacts – water, electrical, sewer, gas
- No consideration of roadway and bridge protection
- Evacuation routes were not considered within the investigation
- Location of Emergency Shelters were not included in priority assessments

Research was performed at the local, state and federal levels. The local research was limited to location and documenting available coastal structure contract drawings. Research at DCR was restricted to available historic construction plans for coastal structures at the MA-DCR Waterways office in Hingham, MA. No investigation of state archives was performed. Research at MA DEP Chp 91 and USACE was limited to recorded permits and licenses found in their files. No investigation was performed at the Registry of Deeds.

DEVELOPMENT OF MassGIS DATABASE ATTRIBUTES

The specific attributes that would be incorporated into the MassGIS system were developed based on the scope of work and the goals to be achieved. The following was established to standardize the data collection and presentation and to allow total flexibility for sorting by attributes in the final GIS database. The attributes identified below were input into a MS Access database which was used to manage the data from all eight communities within a single file.

Database Attributes
- Attribute Descriptions/Definitions

**Structure Number**: A unique structure number was given to each coastal structure. The number was based on existing numbering systems that include the State Department of Environmental Protection community number followed by the local community assessor’s parcel numbering system. The last three digits of the number represent the structure within the parcel. Where structures extend over several parcels, the structure is referenced to a parcel that is approximately in the center of the structure. Where Town assessor’s references include letters, those are also included within the structure number. Some communities have block numbering within their numbering system and these are included. Communities without block numbering still have the block numbering included but these are illustrated as all zeros for that specific segment.

Structures that are on Town property, which would otherwise not have a parcel number, are referenced to a parcel that is in the immediate vicinity of the coastal structure.

On this basis, the following is the general numbering convention:

**CCC-MMM-PPP-BBB-SSS**

Where:
- **CCC** DEP Community Number
- **MMM** Community Map Number
- **BBB** Block Number (000 if no block numbering system)
- **PPP** Community Parcel Number
- **SSS** Structure Number
Property Ownership: All property ownership was on a "presumed" basis as no legal verification of ownership was performed. The ownership of the property was classified under four basic areas which were private ownership (Private), Town ownership (Local), Commonwealth of Massachusetts ownership (State), federal government ownership (Federal) or unknown. Property ownership was based on Town assessor’s maps. Where the location was located above Mean Low Water, and not within a defined parcel, the property ownership was presumed to be the Town unless documentation was found to indicate otherwise. Where a structure was located offshore of Mean Low Water, the property ownership was presumed to be the state.

Structure Ownership: The ownership of all structures is presumed as no verification of ownership was performed. Ownership of the structure was determined by research into historic state and federal permits and the entity indicated on the permits as the applicant. Where no other information was found, the following was utilized:
- Structures located on private land but appearing to be significant structures were identified as owned by the Town or as “Unknown”. Unknown was used were there was a question of local or private ownership.
- Structures on Town property were assumed to be owned by the Town
- Structures that were located off-shore were presumed to be federally owned
- Structures that were identified as being privately owned were eliminated from the database

Basis of Ownership: The basis of structure ownership was provided to give rationale to the structure ownership and identified the research resource that identified the ownership or the methodology otherwise used. The responses utilized were limited to the following:
- DPW – DPW Employee Interview
- DCR - Contract Drawings
- DEP – Ch 91 License
- USACE – Permits
- Property Ownership
- Offshore Structure

Structure Owner’s Name: Ownership names reflect the presumed owner of publicly owned structures. As this was for public structures only, the ownership was restricted to the community name, the state agency or the federal agency.

Earliest Structure Record: The year of the oldest document located for the structure. The information is determined from the document research performed on the structure from local, state and federal agencies. If no documents could be found than this entry is denoted as ‘Unknown’. Where documentation of the structure could be found, the date from the oldest document was utilized.

Primary Structure / Secondary Structure: Many of the coastal structures consisted of combined structures which were rated separately. It was typically found that one structure was significantly more prominent (Ex. Bulkhead/Seawall) and was therefore identified as the Primary Structure while a smaller structure might exist in front (ex. Revetment) of it. The type, height and material of each structure are identified separately. The condition of each structure was based on the Primary Structure. Where there was no secondary structure, the fields were left blank.

Structure Type: The structure type was categorized into five basic coastal structure categories which were Bulkhead/Seawall, Revetment, Coastal Beach, Coastal Dune, and Jetty/Groin.
Structure Material: The identification of the coastal structure’s material of construction was performed and represents the primary material. Stone structures consisted of both mortared and non-mortared conditions.

Structure Height: Each type of structure was categorized by its visible height in feet which was broken into four specific ranges which are:

- < 5 feet
- 5 to 10 feet
- 10 to 15 feet
- >15 feet

Structure Condition: A preliminary assessment of the condition for each structure was performed by the field teams. This was by visual observation only and no detailed investigation was performed. The condition assessments were based on a predefined five level rating system that ranged from Rating A for Excellent Condition to Rating F for Critical Condition. A detailed listing of the conditions and their definitions can be seen in Exhibit A.

Priority Rating: In order to account for the need for protection at any one site, a five level priority rating system was established. This allowed for consideration of public infrastructure protection, density of residential housing for development of structure overall importance for coastal protection. The ratings range from Level 1 for no infrastructure or residence protection to Level 5 for critical inshore infrastructure protection and/or high density residential. The detailed listing and definitions for the priority categories can be seen in Exhibit B.

Structure Repair / Reconstruction Cost: A preliminary estimation of construction costs to maintain or repair structures was made based on the preliminary field assessment of the structures. A Repair Cost Matrix was developed based on structure type, condition, height and material and can be seen in Exhibit C. Once each structure’s type, height, and material classifications were determined, the cost per foot for the structure was determine from the Repair Cost Matrix and multiplied by the length of the structure to obtain the estimated repair/restoration cost. The cost matrix repair costs include a 20 percent construction cost contingency as well as 10 percent costs for engineering and permitting.

Structure Length: The length of each structure is provided and utilized in the development of the repair/reconstruction costs. The lengths are given to the nearest foot and taken as the linear distance along the structure, as determined by the GPS location, which takes into account structure angles and curvature.

Structure Elevation: The elevation of structures was determined in feet from existing information where available. The datum used is NAVD 88 and elevations are to the nearest foot. From a previous study much of the south shore coastal structures had elevations defined based on LIDAR mapping data. Where available structure documentation with elevations was found, in areas with no LIDAR data, the information was included within the structure information. Where there was no LIDAR information or existing documentation, the item has been left blank.

LIDAR (Light Detection and Ranging) is technology that is currently being used for high-resolution topographic mapping by mounting a LIDAR sensor, integrated with Global Positioning System (GPS) and inertial measurement unit (IMU) technology, to the bottom of aircraft and measuring the pulse return rate to determine surface elevations.

FEMA Zone and Elevation: For each structure the FEMA Flood Insurance Rate Maps (FIRM) were researched for their Flood Zone designation and their Base Flood Elevation from the most recent FIRM maps for the specific Town. The elevations are provided in feet on the same datum as the FIRM maps (NGVD) with no adjustments or conversions.
Structure Comments: The engineering team provided a brief description and comment on the structure at the time of the field assessments which is provided in support of the condition rating that was given for the structure.

Pictures: At the time of the field assessments, digital photographs were taken to provide a general overview of the structure. The number of pictures were limited to a maximum of six. The first photograph for each structure is shown on the Structure Assessment Form. The list of all photographs is provided on the form.

Town Documents: Town documents represent the structure information that could be found in the Town’s DPW/Engineering Department records. Where particular records could be found, a table of document information was developed and included within the database with limited descriptions.

MA - DCR Documents: MA-DCR documents represent the structure information that could be found within DCR – Waterways office in Hingham. Where particular records could be found, a table of document information was developed and included within the database with limited descriptions.

MA - DEP Chp. 91 Licenses: MA-DEP Chapter 91 license documents represent the structure information that could be found within MA-DEP Chp 91 records in Boston. Where particular records could be found, they were scanned as pdf files and attached to the structure through the GIS database information. In addition, a table of license document information was developed and included within the database with limited descriptions.

USACE Permits: USACE Permits represent the structure information that could be found within the Army Corp of Engineers regulatory office in Concord, MA. Where particular records could be found, they were scanned as pdf files and attached to the structure through the GIS database information. In addition, a table of license document information was developed and included within the database with limited descriptions.

DEVELOPMENT OF REPAIR / RECONSTRUCTION COSTS

A matrix to be used within the database has been developed to assess likely rehabilitation/repair costs to restore the coastal structures to their original design condition. No attempt was made to assess the level of exposure and associated level of protection that might be required to meet current design standards for these structures. These costs are only an estimation to bring these structures back to their original design intent based on 2006 construction costs.

The development of the cost matrix is based on the following:

Structure Condition Ratings – The condition of the coastal structures was determined in the field by the survey crew which was led by an engineer with waterfront structure assessment and design experience. The definitions of the rating criteria utilized for the assessments is presented elsewhere.

The cost implications for each rating condition are as follows:

- A Rating Structures not requiring any maintenance, repair or rehabilitation cost and would not be expected to experience damage if subject to a major coastal storm event
- B Rating Structures requiring limited or no repair and would be expected to experience only minor damage if subject to a major coastal storm event. The
value of these maintenance costs is assumed to be 10 percent of the construction cost.

- **C Rating** Structures requiring moderate to significant level of repair or reconstruction and would be expected to experience significant damage if subject to a major coastal storm event. The structure is presumed to be effective under a major storm event. The value of the repair costs is assumed to be 50 percent of the construction cost.

- **D Rating** Structures requiring significant level of rehabilitation or total reconstruction and would be expected to experience significant damage or possibly fail if subject to a major coastal storm event. The value of the repair costs is assumed to be 100 percent of the construction cost.

- **F Rating** Structures requiring complete reconstruction and would expect to provide little or no protection from a major coastal storm event. The value of the repair costs is assumed to be 100 percent of the construction cost plus a cost for removal/disposal of the original structure.

**Height of Structure** — Height of a structure is a major factor in the structure cost and therefore was identified as a significant factor in assessing rehabilitation/repair construction costs. The structures were broken down into four major categories which were:

- \(<5'\) Structures that were less than five feet in height
- \(5'-10'\) Structures five to 10 feet in height
- \(10'-15'\) Structures over 10 feet to 15 feet in height
- \(>15'\) Structures greater than 15 feet in height — assumed 20 feet typical

**Length of Structure** — Length is based on field GPS location with measurements rounded to the nearest foot.

**Bulkhead / Seawall Structures** — These structures are assumed to be constructed out of concrete, steel, stone or wood with each having its own criteria for establishing costs. For each structure type the following was assumed:

- **Concrete Seawalls** — These walls were assumed to be gravity structures with the volume of concrete used based on the bottom width being one-half of the structure height. Costs of construction were based on a per cubic yard estimate that varied from $350 to $630 per cubic yard depending on the structure height. Values for excavation and demolition of existing structure were also included.

- **Stone Seawalls** — These walls were treated the same as concrete seawalls and assumed to be gravity structures with the volume of the structure based on the bottom width being one-half of the structure height. Costs of construction were based on a per cubic yard estimate that varied from $350 to $630 per cubic yard depending on the structure height. Values for excavation and demolition of existing structure were also included.

- **Steel Bulkheads** — Steel bulkheads were presumed to be constructed with steel sheet piling. Tie back systems were presumed for structures 10 feet or greater in height. Shorter walls were assumed to have a cantilever design. The total depth of sheeting was presumed to be two times the exposed height. The cost for construction varied from $40 per square foot to $60 per square foot plus the cost of excavation and demolition.
Timber Bulkheads – Timber bulkheads were presumed to be constructed with timber piles at eight foot on center, horizontal wales and vertical four inch sheathing. The unit costs for installed materials used were $1,500 per pile and $7.50 per bfm.

Revetment Structures – Revetment structures were presumed to be constructed of dry placed (no concrete) stone with a two on one slope and a horizontal toe and crown equal to the thickness layer established for each height condition. The total thickness of the revetment layers varied from six to ten feet with the cost of armor and under-layer stone assumed to be $50 per ton and the crushed stone base to be $15 per ton.

Groins and Jetties – Groins and jetties were assumed to be the same materials and construction as the revetment structures but would have two sides and therefore double the quantities.

Coastal Beaches – Costs for restoration of Coastal beaches presumed the placement of beach renourishment sands at a 1-on-20 slope over the existing beach conditions. The cost for deposition of sand assumed relatively close source of material and utilized $20 per cubic yard for the material installed.

Coastal Dunes – Restoration of coastal dunes assumed a cross section of renourished sand with a one-on-four slope on one side of a 25 foot width at the defined dune height. The cost for deposition of sand assumed relatively close source of material and utilized $20 per cubic yard for the material installed.

Contingency – A contingency of 20 percent was added to all costs to reflect the unknowns associated with this level of rehabilitation/repair estimating.

Engineering and Regulatory Approvals – A ten percent increase to the cost matrix prices was assessed to represent the engineering design and regulatory approval requirements for the restoration of these structures.
## EXHIBIT A

**Structure Condition Table – 5 Level Rating System**

<table>
<thead>
<tr>
<th>Preliminary Condition Assessment</th>
<th>Definition Based Upon Perceived Immediacy of Action and Potential to Cause Damage if Not Corrected</th>
<th>Level of Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong> Excellent</td>
<td>Like new condition. Structure expected to withstand major coastal storm without damage. Stable landform (beach, dune or bank). Adequate system exists to provide protection from major coastal storm</td>
<td>None</td>
</tr>
<tr>
<td><strong>B</strong> Good</td>
<td>Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure</td>
<td>Minor</td>
</tr>
<tr>
<td><strong>C</strong> Fair</td>
<td>Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life</td>
<td>Moderate</td>
</tr>
<tr>
<td><strong>D</strong> Poor</td>
<td>Structure exhibits advanced levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure has strong risk of significant damage and possible failure during a major coastal storm Structure should be monitored until repairs/reconstruction can be initiated. Actions taken to reconstruct structure to regain full capacity to resist a major coastal storm. Landform eroded, stability threatened. Landform not adequate to provide protection during major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.</td>
<td>Major</td>
</tr>
<tr>
<td><strong>F</strong> Critical</td>
<td>Conditions of structure/landform may warrant emergency stabilization as failure may result in potential loss of property and/or life. Landform eroded, loss of integrity Structure exhibits critical levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure provides little or no protection from a major coastal storm. Actions taken to totally reconstruct structure to regain full capacity. Landform stability is severely compromised, rate of erosion/material loss may be increasing, and landform does not provide adequate protection from a major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.</td>
<td>Immediate</td>
</tr>
</tbody>
</table>
EXHIBIT B

Priority Rating System - 5 Level Rating System

<table>
<thead>
<tr>
<th>Preliminary Priority Level Assessment</th>
<th>Level Based Upon Perceived Immediacy of Action and Presence of Potential Risk to Inshore Structures if Not Corrected</th>
<th>Level of Action Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>None No Inshore Structures or Residential Dwelling Units Present</td>
<td>Long Term Planning Considerations</td>
</tr>
<tr>
<td>II</td>
<td>Low Priority Inshore Structures Present with Limited potential for Significant Infrastructure Damage</td>
<td>Future Project Consideration</td>
</tr>
<tr>
<td>III</td>
<td>Moderate Priority Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (&lt;1 dwelling impacted / 100 feet of shoreline)</td>
<td>Consider for Active Project Improvement Listing</td>
</tr>
<tr>
<td>IV</td>
<td>High Priority High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)</td>
<td>Consider for Next Project Construction Listing</td>
</tr>
<tr>
<td>V</td>
<td>Immediate / Highest Priority Critical Inshore Structures Present with Potential for Infrastructure Damage and/or High Density Residential Dwellings Conditions of structure may warrant emergency stabilization as failure may result in potential loss of property and/or life. (&gt;10 dwellings impacted / 100 feet of shoreline)</td>
<td>Consider For Immediate Action Due to Public Safety and Welfare Issues</td>
</tr>
</tbody>
</table>
# REPAIR / REHABILITATION COSTING DATA

Cost per linear foot of structure

<table>
<thead>
<tr>
<th>Structure Type</th>
<th>Structure Material</th>
<th>Height</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulkhead Seawall</td>
<td>Concrete</td>
<td>Under 5 Feet</td>
<td>$0</td>
<td>$84</td>
<td>$425</td>
<td>$850</td>
<td>$982</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 To 10 Feet</td>
<td>$0</td>
<td>$152</td>
<td>$759</td>
<td>$1,518</td>
<td>$1,782</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 To 16 Feet</td>
<td>$0</td>
<td>$251</td>
<td>$1,254</td>
<td>$2,508</td>
<td>$2,970</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td>$0</td>
<td>$396</td>
<td>$1,980</td>
<td>$3,960</td>
<td>$4,752</td>
</tr>
<tr>
<td></td>
<td>Steel</td>
<td>Under 5 Feet</td>
<td>$0</td>
<td>$54</td>
<td>$273</td>
<td>$546</td>
<td>$696</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 To 10 Feet</td>
<td>$0</td>
<td>$165</td>
<td>$825</td>
<td>$1,650</td>
<td>$1,843</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 To 16 Feet</td>
<td>$0</td>
<td>$251</td>
<td>$1,254</td>
<td>$2,508</td>
<td>$2,772</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td>$0</td>
<td>$443</td>
<td>$2,176</td>
<td>$4,342</td>
<td>$3,796</td>
</tr>
<tr>
<td></td>
<td>Stone</td>
<td>Under 5 Feet</td>
<td>$0</td>
<td>$84</td>
<td>$425</td>
<td>$850</td>
<td>$983</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 To 10 Feet</td>
<td>$0</td>
<td>$152</td>
<td>$759</td>
<td>$1,518</td>
<td>$1,782</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 To 16 Feet</td>
<td>$0</td>
<td>$251</td>
<td>$1,254</td>
<td>$2,508</td>
<td>$2,970</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td>$0</td>
<td>$396</td>
<td>$1,980</td>
<td>$3,960</td>
<td>$4,752</td>
</tr>
<tr>
<td></td>
<td>Wood</td>
<td>Under 5 Feet</td>
<td>$0</td>
<td>$88</td>
<td>$431</td>
<td>$892</td>
<td>$994</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 To 10 Feet</td>
<td>$0</td>
<td>$127</td>
<td>$602</td>
<td>$1,285</td>
<td>$1,463</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 To 16 Feet</td>
<td>$0</td>
<td>$151</td>
<td>$904</td>
<td>$1,808</td>
<td>$1,872</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td>$0</td>
<td>$202</td>
<td>$1,008</td>
<td>$2,017</td>
<td>$2,389</td>
</tr>
<tr>
<td>Coastal Beach</td>
<td>Sand</td>
<td>Under 5 Feet</td>
<td>$0</td>
<td>$28</td>
<td>$132</td>
<td>$264</td>
<td>$284</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 To 10 Feet</td>
<td>$0</td>
<td>$127</td>
<td>$634</td>
<td>$1,267</td>
<td>$1,267</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 To 16 Feet</td>
<td>$0</td>
<td>$224</td>
<td>$1,122</td>
<td>$2,244</td>
<td>$2,244</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td>$0</td>
<td>$398</td>
<td>$1,980</td>
<td>$3,980</td>
<td>$3,980</td>
</tr>
<tr>
<td>Coastal Dune</td>
<td>Sand</td>
<td>Under 5 Feet</td>
<td>$0</td>
<td>$18</td>
<td>$93</td>
<td>$188</td>
<td>$188</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 To 10 Feet</td>
<td>$0</td>
<td>$48</td>
<td>$236</td>
<td>$476</td>
<td>$476</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 To 16 Feet</td>
<td>$0</td>
<td>$79</td>
<td>$395</td>
<td>$793</td>
<td>$793</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td>$0</td>
<td>$132</td>
<td>$680</td>
<td>$1,320</td>
<td>$1,320</td>
</tr>
<tr>
<td>Revetment</td>
<td>Stone</td>
<td>Under 5 Feet</td>
<td>$0</td>
<td>$65</td>
<td>$333</td>
<td>$664</td>
<td>$730</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 To 10 Feet</td>
<td>$0</td>
<td>$120</td>
<td>$601</td>
<td>$1,201</td>
<td>$1,300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 To 16 Feet</td>
<td>$0</td>
<td>$157</td>
<td>$781</td>
<td>$1,584</td>
<td>$1,686</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td>$0</td>
<td>$247</td>
<td>$1,234</td>
<td>$2,468</td>
<td>$2,888</td>
</tr>
<tr>
<td>Groin</td>
<td>Stone</td>
<td>Under 5 Feet</td>
<td>$0</td>
<td>$157</td>
<td>$864</td>
<td>$1,328</td>
<td>$1,480</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 To 10 Feet</td>
<td>$0</td>
<td>$157</td>
<td>$1,201</td>
<td>$2,402</td>
<td>$2,802</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 To 16 Feet</td>
<td>$0</td>
<td>$157</td>
<td>$1,584</td>
<td>$3,168</td>
<td>$3,368</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over 15 Feet</td>
<td>$0</td>
<td>$157</td>
<td>$2,488</td>
<td>$4,976</td>
<td>$5,332</td>
</tr>
</tbody>
</table>

NOTE: Repair-Rehabilitation Costs include 10% for engineering and regulatory approvals and 20% construction contingency.
Section II

Town of Plymouth

Community Findings
Section II – Community Findings – Town of Plymouth

COMMUNITY DESCRIPTION

The Town of Plymouth consists of a land area of 96.5 square miles out of a total area of 134 square miles and had a population of 51,701 in the 2000 census. The Town is located on the South Shore of Massachusetts and its location can be seen on this report’s cover. The estimated length of shoreline that is directly exposed to open ocean waves is 19.0 miles with the remaining shoreline semi-protected by offshore structures or landforms. The Town is protected from major coastal storms by both natural and man-made shoreline structures that require maintenance to insure the long term protection of its coastline. The man-made and publicly owned structures that protect the Town were investigated for their ability to provide adequate protection from major coastal storms. Structures have been identified as publicly owned, including coastal dunes and beaches, based on evidence of investment of public funds made to create/enhance/maintain these structures. The assessment did not include floating or pile supported structures as they are assumed not to provide any significant coastal protection from major storm events.

STRUCTURE INVENTORY

Within the Town of Plymouth, there were 43 structures which had public or unknown ownership identified which provide significant coastal protection. The location of the structures can be seen in Sheets 1 through Sheet 11 in Section III of this report. The structures were categorized by their type and by their structural condition based on a preliminary field assessment. The distribution of structures by type and condition can be seen in the following table:

<table>
<thead>
<tr>
<th>Primary Structure (t)</th>
<th>Total Structures</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>F</th>
<th>Total Length (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulkhead / Seawall</td>
<td>4</td>
<td></td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
<td>1835</td>
</tr>
<tr>
<td>Revetment</td>
<td>30</td>
<td>11</td>
<td>16</td>
<td>2</td>
<td>1</td>
<td></td>
<td>32557</td>
</tr>
<tr>
<td>Groin / Jetty</td>
<td>8</td>
<td></td>
<td>1</td>
<td>3</td>
<td>3</td>
<td></td>
<td>5415</td>
</tr>
<tr>
<td>Breakwater</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>2900</td>
</tr>
<tr>
<td>Coastal Dune</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coastal Beach</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>43</td>
<td>12</td>
<td>21</td>
<td>6</td>
<td>4</td>
<td></td>
<td>42717</td>
</tr>
</tbody>
</table>

Within the above table, the total length of each type of structure is also provided. The structures are listed by the type which is providing the primary coastal protection. Many sites have multiple structure types at the same location (i.e. revetment in front of seawall). These secondary structures, although not identified within these tables, are included in the development of repair/rehabilitation costs.

The development of repair costs has been included by structure type and by condition. In the Town of Plymouth’s case there are a total of 43 structures which would require approximately $27.2 million to bring all the coastal structures to “A” Rating. Most critical will be the structures in the “D” and “F” classifications as those are assumed to undergo some level of damage or failure during the next major coastal storm event. To reconstruct these structures, identified in the preliminary survey as being in poor condition, an estimated $11.2 million would be required to upgrade the Town’s coastal protection.

BCE

II - 1

Town of Plymouth
Based on the limited research within the scope of this project research, the presumed ownership of the structures was established on an initial basis and would be subject to more intense review in future tasks. Structures identified as being owned privately were excluded from further consideration. Although ownership of the land on which the structure was located was a factor, the structure ownership was treated as a separate issue from land ownership. For the Town of Plymouth the breakdown of structures by assumed ownership is as follows:

**STRUCTURE OWNERSHIP / REPAIR COST - Town of Plymouth**

<table>
<thead>
<tr>
<th>Primary Structure (f)</th>
<th>Total Structures</th>
<th>Structure Condition Rating</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Town Owned</td>
<td>43</td>
<td>$ 1,056,118</td>
<td>$ 14,861,847</td>
</tr>
<tr>
<td>Commonwealth of Massachusetts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal Government Owned</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown Ownership</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The identification of presumed ownership was not based on the investigation of legal documents but relied on property ownership and from construction and regulatory documents that were found. A more detailed investigation of legal documents and agreements would be required where structure ownership is disputed. A more detailed identification of structure type, length, condition and location can be found in Section III which contains Structure Assessment Reports for each individual structure found.

**SUMMARY**

The enclosed reports and associated documents reflects the Town of Plymouth’s coastal structure information that will eventually be input into a state-wide GIS database and will be accessible through MassGIS. This data, when compiled state-wide, will be critical in the development of both short term and long term planning for maintaining and improving Massachusetts coastal protection.

This database will also provide relatively quick access to identify available documentation for these structures as well as the ability to be updated as coastal structure improvements are made.
Section III

Town of Plymouth

Structure Assessment Reports
COASTAL STRUCTURE LOCATION PLAN

TOWN OF PLYMOUTH
SOUTH SHORE COASTAL INFRASTRUCTURE INVENTORY
AND ASSESSMENT DEMONSTRATION PROJECT
AUGUST 2006

SCALE: 1" = 200'

0 200

Bourne Consulting Engineering
COASTAL STRUCTURE LOCATION PLAN

TOWN OF PLYMOUTH
SOUTH SHORE COASTAL INFRASTRUCTURE INVENTORY
AND ASSESSMENT DEMONSTRATION PROJECT
AUGUST 2006

SCALE: 1" = 200'
COASTAL STRUCTURE LOCATION PLAN

TOWN OF PLYMOUTH
SOUTH SHORE COASTAL INFRASTRUCTURE INVENTORY
AND ASSESSMENT DEMONSTRATION PROJECT
AUGUST 2006
### Structure Assessment Form

**Property Owner:**
- Local

**Presumed Structure Owner:**
- Local

**Owner Name:**
- Plymouth

**Location:**
- High Cliff

**Date:**
- 8/31/2006

**Based On Comment:**
- Property Ownership

**Earliest Structure Record:**
- 0

**Estimated Reconstruction/Repair Cost:**
- $103,904.00

**Length:**
- 173 Feet

**Top Elevation:**
- Feet NAVD 88

**FIRM Map Zone:**
- V4

**FIRM Map Elevation:**
- 15 Feet NGVD

**Primary Type:**
- Revetment

**Primary Material:**
- Stone

**Primary Height:**
- 5 to 10 Feet

**Secondary Type:**

**Secondary Material:**

**Secondary Height:**

- 0

**Structure Summary:**
This structure is a stone revetment fronting a concrete seawall. The stone is weathered and becoming unraveled. The wall is not visible for evaluation.

**Condition Rating**
- C: Fair
- Moderate

**Description**
- Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

**Priority Rating Action**
- III: Moderate Priority

**Description**
- Consider for Active Project Improvement Listing
- Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 130 feet of shoreline)

**Structure Images:***
- [057-001-000-010-100-PHO1A.jpg](057-001-000-010-100-PHO1A.jpg)

**Structure Documents:***
- MA DPW OCT 1956 Proposed Drainage, [057-001-000-010-100-DCR1A](057-001-000-010-100-DCR1A)
- MA DPW OCT 1956 Proposed Drainage, [057-001-000-010-100-TWN1A](057-001-000-010-100-TWN1A)

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth
Location: High Cliff
Based On Comment: Property Ownership
Earliest Structure Record: 0
Estimated Reconstruction/Repair Cost: $63,664.00

Length: 530 Feet
Top Elevation: Feet NAVD 88
FIRM Map Zone: V4
FIRM Map Elevation: Feet NGVD 15

Primary Type: Revetment
Primary Material: Stone
Primary Height: 5 to 10 Feet

Secondary Type: Secondary Material: Secondary Height: 5 to 10 Feet

Structure Summary:
This structure is a stone revetment. The side slopes and crest are in excellent condition. There is minor and isolated cracking and displacement of some armor stones.

Condition Rating Level of Action Description
B Good Minor Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with nc damage. Actions taken to prevent / limit future deterioration and extend life of structure.

Priority Rating Action Description
III Moderate Priority Consider for Active Project Improvement Listing Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings ( <1 dwelling impacted / 100 feet of shoreline)

Structure Images: 057-006-062-019-100-PHO1A.jpg
Structure Documents: MA DPW APR 1967 Proposed Shore 057-006-062-019-100-DCR1A

Prepared By: Bourne Consulting Engineering
**Structure Assessment Form**

**Property Owner:**
- Local

**Presumed Structure Owner:**
- Local

**Owner Name:**
- Plymouth

**Location:**
- Atlantic Ave.

**Based On Comment:**
- DPW - Drawings

**Earliest Structure Record:**
- 1957

**Estimated Reconstruction/Repair Cost:**
- $158,004.00

**Date:**
- 8/31/2006

**FIRM Map Zone:**
- V4

**FIRM Map Elevation:**
- 15 Feet NGVD

**Length:**
- 475 Feet NAVD 88

**Top Elevation:**
- 15 Feet NGVD

**Primary Type:**
- Revetment

**Primary Material:**
- Stone

**Primary Height:**
- Under 5 Feet

**Secondary Type:**
- 

**Secondary Material:**
- 

**Secondary Height:**
- 

**Structure Summary:**
This structure is a stone revetment. There are shifted armor stone and slumping of the side slopes evident, conditions worsens towards the south end of the structure.

**Condition Rating Level of Action Description**
- C
- Fair
- Moderate
- Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

**Priority Rating Action Description**
- IV
- High Priority
- Consider for Next Project Construction Listing
- High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Damage (1-10 dwellings impacted / 100 feet of shoreline)

**Structure Images:**
- [057-007-000-042-100-PHO1A.jpg]

**Structure Documents:**
- MA DPW SEP 1957 Proposed Shore 057-007-000-042-100-DCR1A
- MA DPW SEP 1957 Proposed Shore 057-007-000-042-100-TWN1A
CZM South Shore Coastal Infrastructure Inventory and Assessment
Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth
Location: Caswell Lane
Based On Comment: USACE - Permits
Earliest Structure Record: 1974
Estimated Reconstruction/Repair Cost: $360,360.00

Date: 8/31/2006

Length: 600 Feet
Top Elevation: Feet NAVD 88
FIRM Map Zone: V4
FIRM Map Elevation: 14 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: 5 to 10 Feet
Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
This structure is a stone revetment. The side slopes are very steep and also vertical in some sections. The northern corner is grouted. There are many areas of shifted and displaced armor stones. The oversteepened side slopes are a stability concern.

Condition Rating
C Fair
Level of Action Description
Moderate
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

Priority Rating
IV High Priority
Action Description
Consider for Next Project Construction Listing
High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Damage (1-10 dwellings impacted / 100 feet of shoreline)

Structure Images:
[057-012-000-046A-100-PHO1A.jpg]
[057-012-000-046A-100-PHO1B.jpg]

Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: Caswell Lane
Based On Comment: DEP - Ch 91 License
Earliest Structure Record: 1983

Date: 8/31/2006
Estimated Reconstruction/Repair Cost: $116,424.00

Length: 350 Feet
Top Elevation: 14 Feet NAVD 88
FIRM Map Zone: V4
FIRM Map Elevation: 14 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: Under 5 Feet
Secondary Type: Secondary Material: Secondary Height:

This structure is a small stone revetment fronting a parking lot. The stone is weathered and the side slopes have slumped along most of the section.

Condition Rating Level of Action Description
C Fair Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating Action Description
II Low Priority Future Project Consideration Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images:
057-014A-000-001A-100-PH01A.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: Town Wharf
Based On Comment: USACE - Permits
Earliest Structure Record: 1959

Date: 8/31/2006
Estimated Reconstruction/Repair Cost: $175,824.00

Length: 225 Feet
Top Elevation: 12 Feet NAVD 88
FIRM Map Zone: A5
FIRM Map Elevation: 12 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: 10 to 15 Feet

Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This structure is a stone revetment beneath a wooden quay wall supported by timber piles. There is no access to evaluate the structure. Even visual assessment is difficult.

Condition Rating Level of Action Description
C Fair Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

Priority Rating Action Description
III Moderate Priority Consider for Active Project Improvement Listing Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:
[057-014A-000-007-100-PHO1A.jpg]

Structure Documents:
MA DEQE FEB 1971 Proposed Harbor 057-014A-000-007-100-DCR1A
USACE JUN 1935 Proposed Fill in 057-014A-000-007-100-COE1A
MADPW FEB 1959 Proposed Town 057-014A-000-007-100-COE1B

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: Town Wharf
Based On Comment: USACE - Permits
Earliest Structure Record: 1935
Estimated Reconstruction/Repair Cost: $136,752.00

Date: 8/31/2006

Length: 175 Feet
Top Elevation: 12 Feet NGVD
FIRM Map Zone: A5
FIRM Map Elevation: 12 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: 10 to 15 Feet
Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
This structure is a stone revetment with a wave return face concrete cap. The cap is weathered and shows some spalling. Certain sections appear tilted forward somewhat. The stone sideslopes have slumped in some sections, appearing to create a gap between the top of the stone armor and the bottom of the concrete cap.

Condition Rating
C Fair
Level of Action Description
Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating Action Description
IV High Priority Consider for Next Project Construction Listing High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Damage (1-10 dwellings impacted / 100 feet of shoreline)

Structure Images:
057-014A-000-010A-100-PH01A.jpg

Structure Documents:
USACE JUN 1935 Proposed Fill in 057-014A-000-010A-100-COE1A
MADPW FEB 1959 Proposed Town 057-014A-000-010A-100-COE1B

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: Water St.
Based On Comment: USACE - Permits

Earliest Structure Record: 1935
Estimated Reconstruction/Repair Cost: $33,772.00

Length: 215 Feet
Top Elevation: 12 Feet NAVD 88
FIRM Map Zone: A5
FIRM Map Elevation: 12 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: 10 to 15 Feet

Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This structure is a stone revetment. The sideslopes show some weathering but are generally in good condition.

Condition Rating Level of Action Description
B Good Minor Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

Priority Rating Action Description
III Moderate Priority Consider for Active Project Improvement Listing Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:
057-014A-000-014-100-PHO1A.jpg

Structure Documents:
USACE JUN 1935 Proposed Fill in 057-014A-000-014-100-COE1A
USACE SEP 1952 Proposed Fill and 057-014A-000-014-100-COE1B

Prepared By: Bourne Consulting Engineering
### CZM South Shore Coastal Infrastructure Inventory and Assessment

#### Structure Assessment Form

**Town:** Plymouth  
**Structure ID:** 057-014A-000-021A-100  
**Key:** community-map-block-parcel-structure  

<table>
<thead>
<tr>
<th>Property Owner:</th>
<th>Location:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>Caswell Lane</td>
<td>8/31/2006</td>
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</table>

<table>
<thead>
<tr>
<th>Presumed Structure Owner:</th>
<th>Based On Comment:</th>
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</thead>
<tbody>
<tr>
<td>Local</td>
<td>Property Ownership</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Owner Name:</th>
<th>Estimated Reconstruction/Repair Cost:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plymouth</td>
<td>$59,459.00</td>
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</table>

<table>
<thead>
<tr>
<th>Earliest Structure Record:</th>
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<tbody>
<tr>
<td>0</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Length:</th>
<th>Top Elevation:</th>
<th>FIRM Map Zone:</th>
<th>FIRM Map Elevation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>495 Feet</td>
<td>Feet NAVD 88</td>
<td>V4</td>
<td>15 Feet NGVD</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary Type:</th>
<th>Primary Material:</th>
<th>Primary Height:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revetment</td>
<td>Stone</td>
<td>5 to 10 Feet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary Type:</th>
<th>Secondary Material:</th>
<th>Secondary Height:</th>
</tr>
</thead>
</table>

**Structure Summary:**
This structure is a stone revetment along the northwest corner of Plymouth Harbor Town boat ramp parking lot. The side slopes and crest are in good condition. The armor stone shows minor weathering.

**Condition Rating**

- **Rating:** B  
- **Level of Action:** Good  
- **Description:** Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

**Priority Rating**

- **Rating:** IV  
- **Action Description:** High Priority  
- **Description:** Consider for Next Project Construction Listing  
- **Description:** High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)

**Structure Images:**

![Structure Image](057-014A-000-021A-100-PHO1A.jpg)

**Structure Documents:**

Prepared By: Bourne Consulting Engineering
### CZM South Shore Coastal Infrastructure Inventory and Assessment

**Structure Assessment Form**

**Location:** Plymouth Harbor  
**Date:** 8/31/2006

**Property Owner:** Local  
**Presumed Structure Owner:** Local  
**Owner Name:** Plymouth

<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plymouth</td>
<td>8/31/2006</td>
</tr>
</tbody>
</table>

| Estimated Reconstruction/Repair Cost: $4,536,180.00 |

<table>
<thead>
<tr>
<th>Length: 2900 Feet NAVD 88</th>
<th>Top Elevation: 14 Feet NGVD</th>
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</thead>
<tbody>
<tr>
<td>Primary Type: Breakwater</td>
<td>Primary Material: Stone</td>
</tr>
<tr>
<td>Secondary Type:</td>
<td>Secondary Material:</td>
</tr>
</tbody>
</table>

**Structure Summary:**
This structure is a rubble mound breakwater around the northern side of Plymouth Harbor. There is a scour apron along the inside and outside toe for the outer 175 yards of the structure. Overall the crest and sideslopes appear in good condition. However there are many small regions of slumped crest elevation and displaced armor stone.

**Condition Rating**
- **C** Fair

**Level of Action Description**
- Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

**Priority Rating Action Description**
- IV High Priority
- Consider for Next Project Construction Listing
- High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)

**Structure Images:**
- [057-014A-000-021A-200-PHO2A.jpg](#)
- [057-014A-000-021A-200-PHO2B.jpg](#)

**Structure Documents:**

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local

Presumed Structure Owner: Local

Owner Name: Plymouth

Location: Town Wharf

Based On Comment: USACE – Permits

Earliest Structure Record: 1974

Estimated Reconstruction/Repair Cost: $36,036.00

Date: 8/31/2006

Length: 300 Feet

Top Elevation: Feet NAVD 88

FIRM Map Zone: A5

FIRM Map Elevation: 12 Feet NGVD

Primary Type: Revetment

Primary Material: Stone

Primary Height: 5 to 10 Feet

Secondary Type: Concrete

Secondary Material: 

Secondary Height: 

Structure Summary:
This structure is a stone revetment topped with wave return face concrete sections. The concrete cap shows minor cracking. The stone side slopes are in good condition and the stone itself shows some weathering.

Condition Rating Level of Action Description
B Good Minor Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

Priority Rating Action Description
III Moderate Priority Consider for Active Project Improvement Listing Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings ( <1 dwelling impacted / 100 feet of shoreline)

Structure Images:
[057-014A-000-021A-300-PH03A.jpg]

Structure Documents:
[MA DEQE SEP 1970 Proposed Shore 057-014A-000-021A-300-DCR3A]
[USACE OCT 1974 Proposed Public 057-014A-000-021A-300-COE3A]

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment
Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: Town Wharf
Based On Comment: USACE - Permits
Earliest Structure Record: 1974

Date: 8/31/2006
Estimated Reconstruction/Repair Cost: $9,610.00

Length: 80 Feet NAVD 88
Top Elevation: 12 Feet NGVD
FIRM Map Zone: A5
FIRM Map Elevation: 12

Primary Type: Revetment
Primary Material: Concrete
Primary Height: 5 to 10 Feet

Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This structure is a concrete boat ramp for the town. There is some cracking along the surface of the ramp. It is generally in good condition.

Condition Rating Level of Action Description
B Good Minor Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

Priority Rating Action Description
III Moderate Priority Consider for Active Project Improvement Listing Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:
057-014A-000-021A-400-PHQ4A.jpg

Structure Documents:
MA DEQE SEP 1970 Proposed Shore 057-014A-000-021A-400-DCR4B
USACE OCT 1974 Proposed Public 057-014A-000-021A-400-COE4A

Prepared By: Bourne Consulting Engineering
## CZM South Shore Coastal Infrastructure Inventory and Assessment

### Structure Assessment Form

**Property Owner:**
- Local

**Presumed Structure Owner:**
- Local

**Owner Name:**
- Plymouth

**Location:**
- Town Wharf

**Based On Comment:**
- USACE - Permits

**Earliest Structure Record:**
- 1974

**Date:**
- 8/31/2006

**Estimated Reconstruction/Repair Cost:**
- $27,489.00

### Structure Summary:
This structure is a stone revetment with a wave return face concrete cap. The concrete cap shows spalling and discoloration. The stone is weathered but in good condition. The side slopes remain entirely intact.

### Condition
- **Rating:**
  - Good
- **Level of Action:**
  - Minor
- **Description:**
  - Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landfill is present. Structure / landfill adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

### Priority
- **Rating:**
  - Moderate Priority
- **Action:**
  - Consider for Active Project Improvement Listing

### Structure Images:
- 057-014A-000-021A-500-PHO5A.jpg

### Structure Documents:
- MA DEQE SEP 1970 Proposed Shore 057-014A-000-021A-500-DCR5A
- USACE OCT 1974 Proposed Public 057-014A-000-021A-500-COE5A

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: Water St.
Based On Comment: DCR – Contract Drawings

Earliest Structure Record: 1948
Estimated Reconstruction/Repair Cost: $371,184.00

Date: 8/31/2006

Length: 475 Feet
Top Elevation: 13 Feet
FIRM Map Zone: A5
FIRM Map Elevation: 13 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: 10 to 15 Feet
Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This structure is a stone revetment fronting a small park. The bottom half of the armor stone is grouted. The top and bottom sections are not well connected, with the top being slumped in sections.

Condition
C
Rating
Fair
Level of Action
Moderate
Description
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

Priority
III
Rating
Moderate Priority
Action
Consider for Active Project Improvement Listing
Description
Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:
057-017-000-161-100-PHO1A.jpg
057-017-000-161-100-PHO1B.jpg

Structure Documents:
MA DPW JUL 1948 Proposed Bank 057-017-000-161-100-DCR1A
MA DPW JUL 1948 Proposed Bank 057-017-000-161-100-TWN1A
DEP CH.9I SEP 1935 PLAN 057-017-000-161-100-LIC1A
USACE JUN 1935 Proposed Fill in 057-017-000-161-100-COE1A

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth
Location: Water St.
Based On Comment: Property Ownership
Earliest Structure Record: 0
Estimated Reconstruction/Repair Cost: $583,110.00

Length: 465 Feet
Top Elevation: 13 Feet NAVD 88
FIRM Map Zone: A5
FIRM Map Elevation: Feet NGVD

Primary Type: Bulkhead/Seawall
Primary Material: Stone
Primary Height: 10 to 15 Feet

Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
This structure is a grouted stone seawall with rip rap along the toe. The stone along the toe is slumped and unraveled to the point where it no longer protects the base of the wall. The base of the wall shows some missing grout between stones and other damage.

Condition Rating
C Fair
Moderate

Level of Action Description
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating Action Description
III Moderate Priority Consider for Active Project Improvement Listing Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:

Structure Documents:

Prepared By: Bourne Consulting Engineering
**Structure Assessment Form**

**Property Owner:** Local

**Location:** Water St.

**Date:** 8/31/2006

**Presumed Structure Owner:** Local

**Based On Comment:** USACE - Permits

**Earliest Structure Record:** 1935

**Estimated Reconstruction/Repair Cost:** $189,750.00

**Length:** 250 Feet NAVD 88

**Top Elevation:** AS 13 Feet NGVD

**FIRM Map Zone:** AS

**FIRM Map Elevation:** 13

**Primary Type:** Bulkhead/Seawall

**Primary Material:** Stone

**Primary Height:** 5 to 10 Feet

**Secondary Type:**

**Secondary Material:**

**Secondary Height:**

**Structure Summary:**
This structure is a seawall of grouted stone. The stone is stacked at the bottom and has a cap of random placed grouted stone. There is grout missing and/or broken along the base of the wall.

**Condition**
- C
  - Fair
  - Moderate

**Rating**
- **Level of Action**
  - **Description**
    - Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

**Priority**
- III
  - Moderate Priority

**Rating**
- Consider for Active Project Improvement

**Action**
- Listing

**Description**
- Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

**Structure Images:**
- [057-020-000-042-100-PHO1A.jpg]

**Structure Documents:**
- USACE
  - JUN 1935
  - Proposed Fill in
  - [057-020-000-042-100-COE1A]

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

<table>
<thead>
<tr>
<th>Property Owner:</th>
<th>Location:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>State Pier</td>
<td>8/31/2006</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Presumed Structure Owner:</th>
<th>Based On Comment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>USACE - Permits</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Owner Name:</th>
<th>Earliest Structure Record:</th>
<th>Estimated Reconstruction/Repair Cost:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plymouth</td>
<td>1954</td>
<td>$333,960.00</td>
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<table>
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<tr>
<th>Length:</th>
<th>Top Elevation:</th>
<th>FIRM Map Zone:</th>
<th>FIRM Map Elevation:</th>
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</thead>
<tbody>
<tr>
<td>220 Feet</td>
<td>Feet NAVD 88</td>
<td>V4</td>
<td>14 Feet NGVD</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary Type:</th>
<th>Primary Material:</th>
<th>Primary Height:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulkhead/ Seawall</td>
<td>Concrete</td>
<td>5 to 10 Feet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary Type:</th>
<th>Secondary Material:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Structure Summary:</th>
</tr>
</thead>
<tbody>
<tr>
<td>This structure is a short concrete seawall with a wave return face cap and small armor stone strung along the base. The wall shows severe cracking and spalling along the face. The northern end is slumped.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rating</th>
<th>Level of Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Poor</td>
<td>Major</td>
<td>Structure exhibits advanced levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure has strong risk of significant damage and possible failure during a major coastal storm. Structure should be monitored until repairs/reconstruction can be initiated. Actions taken to reconstruct structure to regain full capacity to resist a major coastal storm. Landform eroded, stability threatened. Landform not adequate to provide protection during major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Priority</th>
<th>Rating</th>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Moderate Priority</td>
<td>Consider for Active Project Improvement Listing</td>
<td>Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (&lt;1 dwelling impacted / 100 feet of shoreline)</td>
</tr>
</tbody>
</table>

Structure Images:
057-020-000-182-100-PHO1A.jpg

Structure Documents:
<table>
<thead>
<tr>
<th>Structure Documents:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA DPW</td>
</tr>
<tr>
<td>Nov 1945</td>
</tr>
<tr>
<td>Concrete Retaining</td>
</tr>
<tr>
<td>057-020-000-182-100-DCR1A</td>
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<tr>
<td>MA DPW</td>
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<tr>
<td>MAY 1956</td>
</tr>
<tr>
<td>Proposed Shore</td>
</tr>
<tr>
<td>057-020-000-182-100-TWN1A</td>
</tr>
<tr>
<td>MADPW</td>
</tr>
<tr>
<td>JUL 1954</td>
</tr>
<tr>
<td>Proposed Seawall</td>
</tr>
<tr>
<td>057-020-000-182-100-COE1A</td>
</tr>
</tbody>
</table>

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local

Presumed Structure Owner: Local

Owner Name: Plymouth

Location: State Pier

Based On Comment: USACE - Permits

Earliest Structure Record: 1954

Estimated Reconstruction/Repair Cost: $1,173,572.00

Length: 1954 Feet

Top Elevation: V4 Feet NAVD 88

FIRM Map Zone: 14 Feet NGVD

FIRM Map Elevation: 14 Feet NGVD

Primary Type: Revetment

Primary Material: Stone

Primary Height: 5 to 10 Feet

Secondary Type:

Secondary Material:

Secondary Height:

Structure Summary:

This structure is a stone revetment fronting a park. Some armor stone along the crest has slumped. Minor cracking of the armor stone evident.

Condition Rating

C Fair

Moderate

Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating Action Description

III Moderate Priority Consider for Active Project Improvement Listing Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:

057-020-000-182-200-PHO02A.jpg

057-020-000-182-200-PHO02B.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: 
Local

Presumed Structure Owner: 
Local

Owner Name: 
Plymouth

Location: 
State Pier

Based On Comment: 
USACE – Permits

Earliest Structure Record: 
1954

Estimated Reconstruction/Repair Cost: 
$461,050.00

Length: 
590 Feet

Top Elevation: 
FIRM Map Zone: V4

FIRM Map Elevation: 
14 Feet NAVD 88

Primary Type: 
Revetment

Primary Material: 
Stone

Primary Height: 
10 to 15 Feet

Secondary Type: 

Secondary Material: 

Secondary Height: 

Structure Summary:
This structure is a stone revetment fronting a park. The sideslopes have slumped in some sections and the armor stone has shifted.

Condition Rating

C Fair

Level of Action Description

Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or occur. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating Action Description

III Moderate Priority

Consider for Active Project Improvement Listing

Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:
057-020-000-182-300-PHO3A.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering
Property Owner: Local

Presumed Structure Owner: Local

Owner Name: Plymouth

Location: Pilgrim Memorial State Park

Based On Comment: USACE - Permits

Earliest Structure Record: 1954

Estimated Reconstruction/Repair Cost: $742,368.00

Length: 950 Feet
Top Elevation: 14 Feet NAVD 88
FIRM Map Zone: V4
FIRM Map Elevation: 14 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: 10 to 15 Feet
Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
The structure is a stone revetment fronting a park. The stone is weathered and slumped. A backing of granite stone has become exposed. There is no defined side slope.

Condition Rating
C Fair

Level of Action Description
Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating Action Description
III Moderate Priority Consider for Active Project Improvement Listing Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:
057-020-000-182-400-PHO4A.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: Stephens Field
Based On Comment: DEP – Ch 91 License
Earliest Structure Record: 1998

Date: 8/31/2006
Estimated Reconstruction/Repair Cost: $49,896.00

Length: 150 Feet
Top Elevation: 14 Feet NGVD
FIRM Map Zone: V4
FIRM Map Elevation: 14 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: Under 5 Feet

Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This structure is a small stone revetment fronting tennis courts. The crest is failed in one area and has slumped down.

Condition Rating Level of Action Description
C Fair Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scoul. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating Action Description
III Moderate Priority Consider for Active Project Improvement Listing Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:
057-023-000-026-100-PHO1A.jpg

Structure Documents:
DEP CH.91 JAN 15 1996 PLANS 057-023-000-026-100-LIC1A

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: Stephens Field
Based On Comment: DEP - Ch 91 License
Earliest Structure Record: 1998

Length: 460 Feet
Top Elevation: 14 Feet NGVD
FIRM Map Zone: V4
FIRM Map Elevation: 14 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: Under 5 Feet

Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
This structure is line of strewn rubble and stone lying parallel to the shoreline. The is no slope or interlocking of stones/debris.

Condition Rating Level of Action Description: F Critical Immediate Conditions of structure/landform may warrant emergency stabilization as failure may result in potential loss of property and/or life. Landform eroded, loss of integrity. Structure exhibits critical levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure provides little or no protection from a major coastal storm. Actions taken to totally reconstruct structure to regain full capacity. Landform stability is severely compromised, rate of erosion/material loss may be increasing, and landform does not provide adequate protection from a major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.

Priority Rating Action Description: II Low Priority Future Project Consideration Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images:
057-023-000-026-200-PHO2A.png
057-023-000-026-200-PHO2B.png

Structure Documents:

Prepared By: Bourne Consulting Engineering
## CZM South Shore Coastal Infrastructure Inventory and Assessment
### Structure Assessment Form

**Town:** Plymouth  
**Structure ID:** 057-037A-000-156-100  
**Key:** community-map-block-parcel-structure

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<thead>
<tr>
<th>Property Owner:</th>
<th>Location:</th>
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<tbody>
<tr>
<td>Local</td>
<td>Plymouth Beach</td>
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<table>
<thead>
<tr>
<th>Presumed Structure Owner:</th>
<th>Date:</th>
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<tbody>
<tr>
<td>Local</td>
<td>9/1/2006</td>
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<table>
<thead>
<tr>
<th>Owner Name:</th>
<th>Estimated Reconstruction/Repair Cost:</th>
</tr>
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<tbody>
<tr>
<td>Plymouth</td>
<td>$4,780,512.00</td>
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<table>
<thead>
<tr>
<th>Earliest Structure Record:</th>
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<table>
<thead>
<tr>
<th>Length:</th>
<th>Top Elevation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>7200 Feet</td>
<td>Feet NAVD 88</td>
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</table>

<table>
<thead>
<tr>
<th>FIRM Map Zone:</th>
<th>FIRM Map Elevation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2</td>
<td>19 Feet NGVD</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary Type:</th>
<th>Primary Material:</th>
<th>Primary Height:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revetment</td>
<td>Stone</td>
<td>Under 5 Feet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary Type:</th>
<th>Secondary Material:</th>
<th>Secondary Height:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Structure Summary:
This structure is a stone dike that lies along the eastern edge of Plymouth Long Beach. The southern end of the dike is in fair condition but deteriorates to the north. There are multiple sections of failure with evidence of overwash events behind the dike.

### Condition Rating Level of Action Description
- **Condition Rating**
  - D: Poor
  - Major

- **Level of Action Description**
  - Structure exhibits advanced levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure has strong risk of significant damage and possible failure during a major coastal storm. Structure should be monitored until repairs/reconstruction can be initiated. Actions taken to reconstruct structure to regain full capacity to resist a major coastal storm. Landform eroded, stability threatened. Landform not adequate to provide protection during major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.

### Priority Rating Action Description
- **Priority Rating Action**
  - III: Moderate Priority
  - Consider for Active Project Improvement Listing
  - Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings ( <1 dwelling impacted / 100 feet of shoreline)

### Structure Images:
- [057-037A-000-156-100-PHO1A.jpg](#)
- [057-037A-000-156-100-PHO1B.jpg](#)

### Structure Documents:

---

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner:
Local

Presumed Structure Owner:
Local

Owner Name:
Plymouth

Location:
Plymouth Beach

Date:
9/1/2006

Based On Comment:
DPW - Drawings

Earliest Structure Record:
1970

Estimated Reconstruction/Repair Cost:
$401,500.00

Length: 275 Feet
Top Elevation: 19 Feet NAVD 88
FIRM Map Zone: V2
FIRM Map Elevation: 19 Feet NGVD

Primary Type: Groin/ Jetty
Primary Material: Concrete
Primary Height: Under 5 Feet

Secondary Type: 
Secondary Material: 
Secondary Height: 

Structure Summary:
This structure is the remains of an adjustable groin. All that remains are the concrete posts. All evidence of the insert panels is removed. The structure has completely failed and is non-functional.

Condition
F
Rating
Critical
Level of Action
Immediate
Description
Conditions of structure/landform may warrant emergency stabilization as failure may result in potential loss of property and/or life. Landform eroded, loss of integrity. Structure exhibits critical levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure provides little or no protection from a major coastal storm. Actions taken to totally reconstruct structure to regain full capacity. Landform stability is severely compromised, rate of erosion/material loss may be increasing, and landform does not provide adequate protection from a major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.

Priority
I
Rating
None
Action
Long Term Planning Considerations
Description
No Inshore Structures or Residential Dwelling Units Present

Structure Images:
057-037A-000-359-100-PHO1A.png

Structure Documents:
COE APR 1970 Plymouth Harbor MA, 057-037A-000-339-100-TWN1A

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment  

Structure Assessment Form  

Property Owner: Local  
Presumed Structure Owner: Local  
Owner Name: Plymouth  
Location: Eel River  
Based On Comment:  
Estimated Reconstruction/Repair Cost: $382,536.00  
Date: 9/1/2006  

Length: 900 Feet  
Top Elevation: Feet NAVD 88  
FIRM Map Zone: V2  
FIRM Map Elevation: 19 Feet NGVD  
Primary Type: Bulkhead/Seawall  
Primary Material: Concrete  
Primary Height: Under 5 Feet  
Secondary Type:  
Secondary Material:  
Secondary Height:  

Structure Summary:  
This structure is a concrete seawall fronting a dirt parking lot. The wall shows minor cracking and spalling. The toe of the wall is becoming exposed at the southern end. Each groin is approximately 75 to 180 feet long.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rating</th>
<th>Level of Action</th>
<th>Description</th>
<th>Priority</th>
<th>Rating</th>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Fair</td>
<td>Moderate</td>
<td>Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.</td>
<td>II</td>
<td>Low Priority</td>
<td>Future Project Consideration</td>
<td>Inshore Structures Present with Limited potential for Significant Infrastructure Damage</td>
</tr>
</tbody>
</table>

Structure Images:  
[057-039-000-010B-100-PHO1A.jpg]  
[057-039-000-010B-100-PHO1B.jpg]  

Structure Documents:  
| MA DPW | MAR 1940 | Proposed Shore | 057-039-003-010B-100-DCR1A  
| MA DPW | SEP 1940 | Proposed Shore | 057-039-003-010B-100-DCR1B  
| MA DPW | JUL 1946 | Proposed Repairs | 057-039-003-010B-100-DCR1C  
| MA DPW | OCT 1954 | Proposed Shore | 057-039-003-010B-100-DCR1D  
| MA DPW | SEP 1955 | Proposed Shore | 057-039-003-010B-100-DCR1E  
| MA DPW | SEP 1957 | Proposed Shore | 057-039-003-010B-100-DCR1F  
| MA DPW | MAY 1960 | Proposed Shore | 057-039-003-010B-100-DCR1G  
| MA DPW | MAR 1968 | Proposed Shore | 057-039-003-010B-100-DCR1H  
| MA DPW | MAY 1952 | Proposed Shore | 057-039-003-010B-100-DCR1I  
| MA DPW | APR 1965 | Proposed Shore | 057-039-003-010B-100-DCR1J  
| MA DPW | MAY 1952 | Proposed Shore | 057-039-003-010B-100-TWN1A  

Prepared By: Bourne Consulting Engineering
<table>
<thead>
<tr>
<th>Agency</th>
<th>Date</th>
<th>Description</th>
<th>Structure ID</th>
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</thead>
<tbody>
<tr>
<td>MA DPW</td>
<td>SEP 1957</td>
<td>Proposed Shore</td>
<td>057-039-000-010B-100-TWN1B</td>
</tr>
<tr>
<td>MA DPW</td>
<td>APR 1965</td>
<td>Proposed Shore</td>
<td>057-039-000-010B-100-TWN1C</td>
</tr>
<tr>
<td>MA DPW</td>
<td>MAR 1968</td>
<td>Proposed Shore</td>
<td>057-039-000-010B-100-TWN1D</td>
</tr>
<tr>
<td>COE</td>
<td>DEC 1956</td>
<td>Plymouth Harbor,</td>
<td>057-039-000-010B-100-TWN1E</td>
</tr>
<tr>
<td>PLY DPW</td>
<td>OCT 1978</td>
<td>Contract 2851,</td>
<td>057-039-000-010B-100-TWN1F</td>
</tr>
</tbody>
</table>

Key: community-map-block-parcel-structure
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: Plymouth
Structure ID: 057-039-000-010B-200
Key: community-map-block-parcel-structure

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth
Location: Eel River
Date: 9/1/2006
Based On Comment:
Property Ownership

Earliest Structure Record: 0
Estimated Reconstruction/Repair Cost: $3,054,216.00

Length: 2300 Feet
Top Elevation: 19 Feet NGVD
FIRM Map Zone: V2
FIRM Map Elevation: 0 Feet NAVD 88

Primary Type: Groin / Jetty
Primary Material: Stone
Primary Height: Under 5 Feet
Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This is a field of 5 stone groins. The stones have become largely unraveled so that no crest or side slopes are discernable. The groins are not serving much purpose.

Condition Rating Description
D Poor Structure exhibits advanced levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure has strong risk of significant damage and possible failure during a major coastal storm. Structure should be monitored until repairs/reconstruction can be initiated. Actions taken to reconstruct structure to regain full capacity to resist a major coastal storm. Landform eroded, stability threatened. Landform not adequate to provide protection during major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.

Priority Rating Action Description
I Low Priority Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images: 057-039-000-010B-200-PHO2A.jpg
Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment
Structure Assessment Form

Property Owner: 
Local

Presumed Structure Owner: 
Local

Owner Name: 
Plymouth

Location: 
Warren Cove

Based On Comment: 
DPW - Drawings

Earliest Structure Record: 
1956

Estimated Reconstruction/Repair Cost: 
$2,162,160.00

Length: 
3600 Feet

Top Elevation: 
Feet NAVD 88

FIRM Map Zone: 
V2

FIRM Map Elevation: 
19 Feet NGVD

Primary Type: 
Revetment

Primary Material: 
Stone

Primary Height: 
5 to 10 Feet

Secondary Type: 
Bulkhead/Seawall

Secondary Material: 
Concrete

Secondary Height: 

Structure Summary:
This structure is a stone revetment. It fronts a concrete seawall and has a wave return face in some sections. Along the center of the structure there are armor stone along the toe which have become displaced. This has resulted in some areas of a slumping crest.

Condition
Rating
Level of Action
Description
C
Fair
Moderate
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority
Rating
Action
Description
IV
High Priority
Consider for Next Project Construction Listing
High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)

Structure Images:
057-041-000-029-100-PHO1A.jpg
057-041-000-029-100-PHO1B.jpg

Structure Documents:
MA DPW
JUL 1946
Proposed Repairs to
057-041-000-029-100-DCR1A

MA DPW
OCT 1932
Proposed Rip Rap
057-041-000-029-100-DCR1B

MA DPW
MAR 1940
Proposed Shore
057-041-000-029-100-DCR1C

MA DPW
SEP 1940
Proposed Shore
057-041-000-029-100-DCR1D

MA DPW
OCT 1956
Proposed Shore
057-041-000-029-100-DCR1E

MA DPW
FEB 1960
Proposed Shore
057-041-000-029-100-DCR1F

MA DPW
MAR 1964
Proposed Shore
057-041-000-029-100-DCR1G

DEP CH.91
JAN 30 1980
PLANS
057-041-000-029-100-LIC1A

MA DPW
OCT 1956
Proposed Shore
057-041-000-029-100-TWN1A

MA DPW
FEB 1960
Proposed Shore
057-041-000-029-100-TWN1B

MA DPW
MAR 1964
Proposed Shore
057-041-000-029-100-TWN1C

Prepared By: Bourne Consulting Engineering
## CZM South Shore Coastal Infrastructure Inventory and Assessment

### Structure Assessment Form

<table>
<thead>
<tr>
<th>MADPW</th>
<th>OCT 1956</th>
<th>Proposed Stone</th>
<th>057-041-000-029-100-COE1A</th>
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</thead>
<tbody>
<tr>
<td>TOWN</td>
<td>SEP 2001</td>
<td>Town of Plymouth for</td>
<td>057-041-000-029-100-COE1B</td>
</tr>
</tbody>
</table>

**Town:** Plymouth  
**Structure ID:** 057-041-000-029-100  
**Key:** community-map-block-parcel-structure

Prepared By: Bourne Consulting Engineering
**Structure Assessment Form**

**Property Owner:** Local

**Location:** White Horse Beach

**Date:** 8/31/2006

**Presumed Structure Owner:** Local

**Based On Comment:** DCR - Contract Drawings

**Owner Name:** Plymouth

**Earliest Structure Record:** 1957

**Estimated Reconstruction/Repair Cost:** $20,420.00

**Length:** 130 Feet NAVD 88

**Top Elevation:** 24 Feet NGVD

**FIRM Map Zone:** V2

**FIRM Map Elevation:** 24 Feet NGVD

**Primary Type:** Revetment

**Primary Material:** Stone

**Primary Height:** 10 to 15 Feet

**Secondary Type:** Secondary Material:

**Secondary Height:**

**Structure Summary:**
This structure is a rubble mound revetment. The sideslope is in good condition. There are single armor stones which are cracked.

**Condition** B

**Rating** Good

**Level of Action** Minor

**Description** Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

**Priority** IV

**Rating** High Priority

**Action** Consider for Next Project Construction Listing

**Description** High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)

**Structure Images:**

- [057-044-000-025-100-PHO1A.jpg](#)

**Structure Documents:**

- MA DPW [JUN 1957](#) Proposed Shore [057-044-000-025-100-DCR1A](#)

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth
Location: White Horse Beach
Based On Comment: Property Ownership
Earliest Structure Record: 0
Estimated Reconstruction/Repair Cost: $86,486.00

Length: 720 Feet
Top Elevation: 88 Feet NAVD
FIRM Map Zone: V2
FIRM Map Elevation: 24 Feet NGVD
Primary Type: Revetment
Primary Material: Store
Primary Height: 5 to 10 Feet
Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
This structure is a stone revetment. The sideslopes are in good condition. There are some armor stones along the bottom which have cracked.

Condition B
Rating Good
Level of Action Minor
Description Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

Priority IV
Rating High Priority
Action Consider for Next Project Construction Listing
Description High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)

Structure Images:
057-045A-000-100-100-PHO1A.png

Structure Documents:

Prepared By: Bourne Consulting Engineering
### Structure Assessment Form

**Property Owner:**
Local

**Presumed Structure Owner:**
Local

**Owner Name:**
Plymouth

**Location:**
White Horse Beach

**Date:**
8/31/2006

**Based On Comment:**
DCR – Contract Drawings

**Earliest Structure Record:**
1952

**Estimated Reconstruction/Repair Cost:**
$796,752.00

**Length:**
600 Feet

**Top Elevation:**
72 Feet NAVD 88

**FIRM Map Zone:**
V2

**FIRM Map Elevation:**
24 Feet NGVD

**Primary Type:**
Groin Jetty

**Primary Material:**
Stone

**Primary Height:**
Under 5 Feet

**Secondary Type:**

**Secondary Material:**

**Secondary Height:**

**Structure Summary:**
This is a field of 6 stone groins, with approximately 200 foot spacing between them. The groins show no crest or side slopes and appear instead to be a linear pile of large stone. A majority of the length of each groin is above mean low water, so they have little to no impact on sediment transport along the beach. Each groin is approximately 100 feet long.

**Condition Rating**
D Poor

**Level of Action**
Major

**Description**
Structure exhibits advanced levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure has strong risk of significant damage and possible failure during a major coastal storm. Structure should be monitored until repairs/reconstruction can be initiated. Actions taken to reconstruct structure to regain full capacity to resist a major coastal storm. Landform eroded, stability threatened. Landform not adequate to provide protection during major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.

**Priority Rating Action Description**
I None No Inshore Structures or Residential Dwelling Units Present

**Structure Images:**
057-045A-000-100-200-PH02A.jpg

**Structure Documents:**
MA DPW JAN 1952 Proposed Stone 057-045A-000-100-200-DCR1A

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth
Location: White Horse Beach
Date: 8/31/2006
Based On Comment: Property Ownership
Estimated Reconstruction/Repair Cost: $33,772.00

Earliest Structure Record:

Length: 215 Feet
Top Elevation: 24 Feet NAVD 88
FIRM Map Zone: V2
FIRM Map Elevation: 24 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: 10 to 15 Feet

Secondary Type: Secondary Material:
Secondary Height:

Structure Summary: This structure is a stone revetment. The side slope is in good condition. Some armor stone is cracked.

Condition Rating
Good

Level of Action Rating
Minor

Description Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure/landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent/limit future deterioration and extend life of structure.

Priority Rating
High Priority

Action Description
Consider for Next Project Construction Listing

High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Densities Residential Dwellings (1-10 dwellings impacted/100 feet of shoreline)

Structure Images:
057-045A-000-113-100-PHO1A.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Town: 
Plymouth
Structure ID: 057-045B-000-014A-100
Key: community-map-block-parcel-structure

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: White Horse Beach
Based On Comment:

Property Ownership

Earliest Structure Record: 0
Estimated Reconstruction/Repair Cost: $283,800.00

<table>
<thead>
<tr>
<th>Length:</th>
<th>Top Elevation:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feet NAVD 88</td>
</tr>
<tr>
<td>4300</td>
<td>Feet</td>
</tr>
</tbody>
</table>

FIRM Map Zone: V4
FIRM Map Elevation: 15 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: Under 5 Feet

Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
This structure is the western reveted side slope of a small channel which connects Barlett’s Pond to Cape Cod Bay. The side slope and crest are in good condition with some minor loss of crest elevation.

Condition Rating
B Good
Level of Action Description
Minor Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure.

Priority Rating Action Description
II Low Priority Future Project Consideration Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images:
057-045B-000-014A-100-PHO1A.jpg

Structure Documents:

Prepared By: Bourne Consulting Engineering
## CZM South Shore Coastal Infrastructure Inventory and Assessment

### Structure Assessment Form

**Property Owner:** Local  
**Location:** White Horse Beach  
**Date:** 8/31/2006

**Presumed Structure Owner:**  
**Based On Comment:**  
**Property Ownership:**  
**Owner Name:** Plymouth  
**Earliest Structure Record:**  
**Estimated Reconstruction/Repair Cost:** $283,800.00

<table>
<thead>
<tr>
<th>Length</th>
<th>Top Elevation</th>
<th>FIRM Map Zone</th>
<th>FIRM Map Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>4300 Feet</td>
<td>Feet NAVD 88</td>
<td>V4</td>
<td>15 Feet NGVD</td>
</tr>
</tbody>
</table>

**Primary Type:** Revetment  
**Primary Material:** Stone  
**Primary Height:** Under 5 Feet  
**Secondary Type:**  
**Secondary Material:**  
**Secondary Height:**

### Structure Summary:

This structure is the eastern reveted side slope of a small channel which connects Barlett’s Pond to Cape Cod Bay. The side slope and crest are in good condition with some minor loss of crest elevation.

### Condition Rating

**Priority Rating**

**Level of Action**

**Description**

Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure/landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent/limit future deterioration and extend life of structure.

**Priority**

Low Priority  
**Future Project Consideration**

Inshore Structures Present with Limited potential for Significant Infrastructure Damage

### Structure Images:

057-045B-000-014A-200-PHO2A.jpg

### Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: Manomet Point
Date: 9/1/2006

Based On Comment: Property Ownership
Earliest Structure Record: 0
Estimated Reconstruction/Repair Cost: $1,049,070.00

Length: 850 Feet
Top Elevation: V2 Feet NAVD 88
FIRM Map Zone: 28 Feet NGVD
FIRM Map Elevation:

Primary Type: Revetment
Primary Material: Stone
Primary Height: Over 15 Feet

Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
This structure is a grouted stone revetment along the base of the bluff between Stage Point and Manomet Point. There are many areas of shifted and failing armor along the base of the structure.

Condition Rating:
Level of Action Description: Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating Action Description:
IV High Priority
Consider for Next Project Construction Listing
High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)

Structure Images: Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: Manomet Point
Based On Comment: DEP – Ch 91 License
Earliest Structure Record: 1999

Estimated Reconstruction/Repair Cost: $60,060.00

Date: 9/1/2006

Length: 50 Feet
Top Elevation: 11 Feet NAVD 88
FIRM Map Zone: V2
FIRM Map Elevation: 28 Feet NGVD

Primary Type: Revetment
Primary Material: Concrete
Primary Height: 5 to 10 Feet

Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This is a stone/dirt/concrete ramp from street level down to the eastern end of White Horse Beach. There is some shifting and cracking of the concrete. The ramp is still functional, but poor condition.

Condition Rating Level of Action Description
D Poor Major Structure exhibits advanced levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure has strong risk of significant damage and possible failure during a major coastal storm. Structure should be monitored until repairs/reconstruction can be initiated. Actions taken to reconstruct structure to regain full capacity to resist a major coastal storm. Landform eroded, stability threatened. Landform not adequate to provide protection during major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.

Priority Rating Action Description
III Moderate Priority Consider for Active Project Improvement Listing Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (<1 dwelling impacted / 100 feet of shoreline)

Structure Images:
057-046-000-003-100-PHO1A.jpg

Structure Documents:
MA DPW AUG 1952 Proposed Shore 057-046-000-003-100-DCR1A
DEP CH.91 JUNE 15 19 PLANS 057-046-000-003-100-LIC1A
MA DPW AUG 1934 Proposed Shore 057-046-000-003-100-TWN1A
MADPW Proposed Stone 057-046-000-003-100-COE1A

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: Manomet Point
Based On Comment: Property Ownership
Earliest Structure Record: 0

Date: 9/1/2006
Estimated Reconstruction/Repair Cost: $324,298.00

Length: 415 Feet
Top Elevation: NAVD 88 Feet
FIRM Map Zone: V2
FIRM Map Elevation: 28 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: 10 to 15 Feet

Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
The structure is a stone revetment along the base of the northern face of Manomet Point. The stone appears to have been dumped rather than placed and thus the interlocking of the armor layer is poor. There is some shifting and cracking of armor stone evident.

Condition Rating
C Fair
Level of Action Description
Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating Action Description
IV High Priority Consider for Next Project Construction Listing
High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)

Structure Images: 057-046-000-083-100-PH01A.jpg
Structure Documents: MA DPW JAN 1954 Proposed Stone 057-046-000-083-100-TWN1A

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: White Horse Beach
Property Ownership

Earliest Structure Record: 0
Estimated Reconstruction/Repair Cost: $591,591.00

Length: 985 Feet
Top Elevation: 88 Feet NAVD 88
FIRM Map Zone: V2
FIRM Map Elevation: 17 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: 5 to 10 Feet

Secondary Type: Secondary Material:
Secondary Height:

Structure Summary:
This structure is an almost vertical stone revetment. There are areas of displaced armor stone and slumped crest.

Condition Rating
Level of Action Description
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating Action Description
IV
High Priority
Consider for Next Project Construction Listing
High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)

Structure Images:
[Image 0x0 to 792x612]

Structure Documents:

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth
Location: Manomet Bluffs
Based On Comment: Property Ownership
Earliest Structure Record: 0
Estimated Reconstruction/Repair Cost: $1,254,722.00

Date: 9/1/2006

Length: 975 Feet NAVD 88
Top Elevation: 28 Feet NGVD
FIRM Map Zone: V2
FIRM Map Elevation: 0

Primary Type: Groin/Jetty
Primary Material: Stone
Primary Height: Under 5 Feet
Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This is a field of 13 stone groins. The tips extend approximately to mean low water. A majority of the groins are unraveled and not trapping sand. Each groin is about 75 to 100 feet long.

Condition Rating
Level of Action Description
D Poor Structure exhibits advanced levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure has strong risk of significant damage and possible failure during a major coastal storm. Structure should be monitored until repairs/reconstruction can be initiated. Actions taken to reconstruct structure to regain full capacity to resist a major coastal storm. Landform eroded, stability threatened. Landform not adequate to provide protection during major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.

Priority Rating Action Description
II Low Priority Future Project Consideration Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images:
057-048-000-197-100-PHO1A.jpg

Structure Documents:
MA DPW MAR 1955 Proposed Shore 057-048-000-197-100-CCR1A
MA DPW JUN 1955 Proposed Shore 057-048-000-197-100-CCR1B
MA DPW DEC 1963 Proposed Shore 057-048-000-197-100-CCR1C
MA DPW AUG 1966 Proposed Shore 057-048-000-197-100-CCR1D
MA DPW JUN 1955 Proposed Shore 057-048-000-197-100-TWN1A
PLY DPW AUG 1979 Town of Plymouth 057-048-000-197-100-TWN1B
PLY DPW MAY 1941 Shore protection 057-048-000-197-100-TWN1C

Prepared By: Bourne Consulting Engineering
Property Owner: Local  
Presumed Structure Owner: Unknown  
Owner Name:  

Location: Fisherman's Lane  
Based On Comment:  

Earliest Structure Record:  
Estimated Reconstruction/Repair Cost: $72,996.00  

Length: 50 Feet  
Top Elevation: Feet NAVD 88  
FIRM Map Zone: V2  
FIRM Map Elevation: 20 Feet NGVD  

Primary Type: Groin/ Jetty  
Primary Material: Stone  
Primary Height: Under 5 Feet  
Secondary Type:  
Secondary Material:  
Secondary Height:  

Structure Summary: This structure is a pile of stone at a small bend in the beach. This could either be a very old groin or simply natural armoring of a small promontory.

Condition Rating
Critical  
Immediate

Priority Rating
None  
Long Term Planning Considerations

Action Description
No Inshore Structures or Residential Dwelling Units Present

Condition Level of Action Description
Conditions of structure/landform may warrant emergency stabilization as failure may result in potential loss of property and/or life. Landform eroded, loss of integrity. Structure exhibits critical levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure provides little or no protection from a major coastal storm. Actions taken to totally reconstruct structure to regain full capacity. Landform stability is severely compromised, rate of erosion/material loss may be increasing, and landform does not provide adequate protection from a major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.

Structure Images:  
Structure Documents:  

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: Harlow's Landing
Based On Comment: DPW - Drawings
Earliest Structure Record: 1959

Date: 9/1/2006
Estimated Reconstruction/Repair Cost: $1,117,459.00

Length: 1430 Feet NAVD 88
Top Elevation: V2 Feet NAVD 88
FIRM Map Zone: 19 Feet NGVD

Primary Type: Revetment
Primary Material: Stone
Primary Height: 10 to 15 Feet

Secondary Type: Secondary Material: Secondary Height:

Structure Summary:
This structure is a stone revetment. It is grouted at the southern end and not grouted at the northern end. There are areas of slumped armor and voids between the stones. An old concrete seawall is visible behind some sections of the structure.

Condition Rating
C Fair

Level of Action Description
Moderate Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life.

Priority Rating Action Description
IV High Priority Consider for Next Project Construction Listing High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)

Structure Images:
057-052-000-025-100-PHO1A.jpg

Structure Documents:

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Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment

Structure Assessment Form

Property Owner:
Local

Presumed Structure Owner:
Local

Owner Name:
Plymouth

Location:
Harlow's Landing

Based On Comment:
DPW - Drawings

Earliest Structure Record:
1953

Estimated Reconstruction/Repair Cost:
$510,972.00

Length: 350 Feet
Top Elevation: NAVD 88 Feet
FIRM Map Zone: V2
FIRM Map Elevation: 19 Feet NGVD

Primary Type: Groin/Jetty
Primary Material: Stone
Primary Height: Under 5 Feet

Secondary Type: 
Secondary Material: 
Secondary Height:

Structure Summary:
This is a field of 7 stone groins. A majority of each groin is unraveled. The tips of the groins extend approximately to mean low water. The groins are essentially non-functional. Each groin is approximately 50 feet long.

Condition Rating
Immediate

Level of Action Description
Conditions of structure/landform may warrant emergency stabilization as failure may result in potential loss of property and/or life. Landform eroded, loss of integrity. Structure exhibits critical levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure provides little or no protection from a major coastal storm. Actions taken to totally reconstruct structure to regain full capacity. Landform stability is severely compromised, rate of erosion/material loss may be increasing, and landform does not provide adequate protection from a major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.

Priority Rating
Moderate Priority

Action Description
Consider for Active Project Improvement Listing

Inshore Structures with potential for Infrastructure Damage and/or Limited Residential Dwellings (< 1 dwelling impacted / 100 feet of shoreline)

Structure Images:
057-052-000-025-200-PHO2A.jpg

Structure Documents:
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Prepared By: Bourne Consulting Engineering
**Property Owner:** Local

**Presumed Structure Owner:** Local

**Owner Name:** Plymouth

**Location:** Lookout Point

**Based On Comment:** USACE - Permits

**Earliest Structure Record:** 1992

**Estimated Reconstruction/Repair Cost:** $117,810.00

**Length:** 750 Feet

**Top Elevation:** NAVD 88 Feet

**FIRM Map Zone:** V2

**FIRM Map Elevation:** 21 Feet NGVD

**Primary Type:** Groin/Jetty

**Primary Material:** Stone

**Primary Height:** Under 5 Feet

**Secondary Type:**

**Secondary Material:**

**Secondary Height:**

**Structure Summary:**
This is a field of 5 stone groins south of the entrance to Ellisville Harbor. The crests and sideslopes are in good condition. Outer head and toe of structures was not evaluated due to high tide. Each groin is approximately 150 feet long.

**Condition Rating Level of Action Description**
Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present. Structure/landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent/limit future deterioration and extend life of structure.

**Priority Rating Action Description**
IV  High Priority  Consider for Next Project Construction Listing  High Value Inshore Structures with Potential for Infrastructure Damage and/or Moderate Density Residential Dwellings (1-10 dwellings impacted / 100 feet of shoreline)

**Structure Images:**
057-053-021-019-100-PHO1A.jpg

**Structure Documents:**
MA DPW  DEC 1951  Proposed Stone  057-053-021-019-100-DCR1A
MADPW  JAN 1952  Proposed Stone  057-053-021-019-100-COE1A

Prepared By: Bourne Consulting Engineering
CZM South Shore Coastal Infrastructure Inventory and Assessment
 Structure Assessment Form

Property Owner: Local
Presumed Structure Owner: Local
Owner Name: Plymouth

Location: Ellisville Harbor
Based On Comment: USACE - Permits

Earliest Structure Record: 1960
Estimated Reconstruction/Repair Cost: $76,355.00

Date: 8/31/2006

Length: 115 Feet NAVD 88
Top Elevation: 21 Feet NGVD
FIRM Map Zone: V2
FIRM Map Elevation: 21

Primary Type: Groin/ Jetty
Primary Material: Stone
Primary Height: Under 5 Feet

Secondary Type: Secondary Material: Secondary Height:

Structure Summary: This structure is a stone groin on the open beach just north of the entrance to Ellisville Harbor. The sideslopes and crest of the trunk are generally in good condition. The head of the groin has become unraveled.

Condition Rating
Level of Action Description
C Fair
Moderate
Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure. Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide addition material for full protection and extended life.

Priority Rating Action Description
II Low Priority Future Project Consideration Inshore Structures Present with Limited potential for Significant Infrastructure Damage

Structure Images: 057-053-021-059-100-PH01A.jpg

Structure Documents:
MA DPW DEC 1939 Proposed Excavation 057-053-021-059-100-DCR1A
MA DPW APR 1960 Proposed Harbor 057-053-021-059-100-DCR1B
MA DPW DEC 1939 Proposed Excavation 057-053-021-059-100-TWN1A
MA DPW APR 1960 Proposed Harbor 057-053-021-059-100-TWN1B
MADPW JUN 160 Proposed Stone 057-053-021-059-100-COE1A

Prepared By: Bourne Consulting Engineering
Section IV

Town of Plymouth

Structure Photographs
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Section V

Town of Plymouth

Structure Research

TOWN DOCUMENT LIST

MA DCR - DOCUMENT LIST

MA DEP – Chp 91 DOCUMENT LIST

- Copies of License Documents

USACE – PERMIT DOCUMENT LIST

- Copies of Permit Documents
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<td>WATER STREET, JUST SOUTHEAST OF LATHROP STREET</td>
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<td>PLANS ACCOMPANYING PETITION OF TOWN OF PLYMOUTH, MA FOR BOAT HOUSE LANE BOAT RAMP IMPROVEMENT</td>
<td>3</td>
<td>BOAT HOUSE LANE</td>
<td>1ST SHEET MISSING</td>
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<tr>
<td>057-050-023-001-100</td>
<td>057-050-023-001-100-01C1A</td>
<td>812</td>
<td>DEP CH.01</td>
<td>PLYMOUTH</td>
<td>NOV 28 1979</td>
<td>PLAN ACCOMPANYING PETITION OF TOWN OF PLYMOUTH TO CONSTRUCT AND MAINTAIN A STORM DRAIN OUTFALL FOR SHIP POND IN CAPE COD BAY, TOWN OF PLYMOUTH</td>
<td>1</td>
<td>TERMINUS OF SHORE DRIVE ADJACENT TO SHIP'S POND</td>
<td>CONSTRUCT AND MAINTAIN JETTY, GROIN, RIP-RAP</td>
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<tr>
<td>057-059-000-010B-100</td>
<td>057-059-000-010B-100-01C1A</td>
<td>9215</td>
<td>DEP CH.01</td>
<td>PLYMOUTH</td>
<td>FEB 21 2002</td>
<td>PLAN ACCOMPANYING PETITION OF THE TOWN OF PLYMOUTH FOR CONSTRUCTION AND MAINTAINING A STONE REVETMENT AT 140 AND 150 WARREN AVENUE IN WARREN'S COVE, PLYMOUTH BAY</td>
<td>7</td>
<td>140 AND 150 WARREN AVENUE</td>
<td></td>
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</tbody>
</table>
PLAN ACCOMPANYING PETITION OF THE TOWN OF PLYMOUTH

TO REPAIR AND MAINTAIN EXISTING DRAINAGE OUTFALL AND CONSTRUCT AND MAINTAIN SUPPLEMENTAL OUTFALL IN PLYMOUTH HARBOR TOWN OF PLYMOUTH, COUNTY OF PLYMOUTH
TYPICAL SECTION A-A STONE SEAWALL
STA. 1+25+ TO STA. 3+05+

SCALE IN FEET

NOTES:
1. ALL ELEVATIONS ARE BASED ON U.S.G.S. MEAN SEA LEVEL BENCH MARK "EAS 1978".
2. M.L.W. EL. -4.92 CANNOT BE SHOWN WITHIN THE LIMITS OF SECTIONS A AND B.

LIST OF ABUTTERS

LUCY M. HOLMES
140 SANDWICH STREET
PLYMOUTH, MA 02301
LOT: 7B

JANE L. & JOHN D. SHAW
R 156 SANDWICH STREET
PLYMOUTH, MA 02301
LOT: 10B

CHRISTINE & GRETA MARINOS
27 FREMONT STREET
PLYMOUTH, MA 02360
LOT: 37A

ALICE PAINE/BRENN BREWER
77 FOREST STREET
NEW BEDFORD, MA 02740
LOTS: 58C & 64

TOWN OF PLYMOUTH
2 LINCOLN STREET
PLYMOUTH, MA 02360
LOTS: 1A, 1B, 1C, 1D, & 1E

CLARE BOVIN
26 FREMONT STREET
PLYMOUTH, MA 02360
LOT: 49

JOAN R. THOMAS
4319 GLADDEN COURT
JACKSONVILLE, FL 32207
LOT: 23B

DORA L. & WILLIAM MELLO
27-1/2 FREMONT STREET
PLYMOUTH, MA 02360
LOT: 37B

DOLORES G. SAPPANNARI
8 N. MAIN STREET
ATTLEBORO, MA 02703
LOT: 388

ADM LAND COMPANY
17 LEYDEN STREET
PLYMOUTH, MA 02360
LOT: 60A

*PLANS ACCOMPANYING PETITION OF TOWN OF PLYMOUTH
DEPARTMENT OF PUBLIC WORKS, PARKS DIVISION,
REHABILITATION OF STEPHEN'S FIELD SEAWALL AND
APPURTENANT WORK, PLYMOUTH HARBOR, PLYMOUTH, MA.

PREPARED BY: AMORY ENGINEERS, P.C. DUXBURY, MA
DATE: DECEMBER 1994

LICENSE PLAN NO. 7004
Approved by Department of Environmental Protection
Date: JAN 15 1999
TYPICAL SECTION
STA. 0+00 to STA. 7+77

- TOLERANCE 5'2-
- TOLERANCE 6'2-
- DISPLACED STONE TO BE REPLACED, AS DIRECTED, TO MEET THESE DIMENSIONS.
- EXISTING CONCRETE SEAWALL
- REPLACE STONE CHIPS AS NECESSARY

TYPICAL SECTION
STA. 7+77 to STA. 10+00

- TOLERANCE 5'2-
- TOLERANCE 6'2-
- FACE OF STONE MOUND EL. 20.02
- NOMINAL THICKNESS TOP LAYER OF STONE (TH)
- REPLACE STONE CHIPS AS NECESSARY
- DISPLACED STONE TO BE REPLACED, AS DIRECTED, TO MEET THESE DIMENSIONS.

QUANTITIES
- stone chips 149 cu.yd.

Prepared by Amory Engineers, P.C.
Date: 6/12/89 Sheet 2 of 3

LICENSE PLAN NO. 225
Approved by Department of Environmental Protection
Date: JAN 30 1990
Plan Accompanying Petition
of the
Town of Plymouth
for Construction & Maintaining
A Stone Revetment
at 140 & 150 Warren Avenue
Warren's Cove, Plymouth Bay
September 19, 2001

Sullivan Engineering, Inc.
Osterville, Mass.

LICENCE PLAN NO. 9216
Approved by Department of Environmental Protection of Massachusetts

FEB 21 2002
Plan View
Scale: 1"=50'

Town of Plymouth
Warren's Cove, Plymouth Bay
September 19, 2001

Sullivan Engineering, Inc.
Osterville, Mass.

Sheet 2 of 7
For Proposed Repair
See Typical Sections "A" & "B"
Whichever Applies (sheet 6)

4' Recurve Wall Section
Typical (NTS)

2' Recurve Wall Section
Typical (NTS)

Profile View
Scale: 1' = 10'

Town of Plymouth
Warren's Cove, Plymouth Bay
September 19, 2001

Sullivan Engineering, Inc.
Sheet 5 of 7
Typical Section A
For the Case were the bottom of the existing retaining wall is at elevation 0' MLW.

Typical Section B
For the Case were the bottom of the existing retaining wall is above elevation 0' MLW.
General Notes on Specification Requirements for Construction:

1. General.
   Each stone will be placed by equipment suitable for lifting, manipulating, and placing stones of the size and shape specified.
   Each stone shall be placed with its longest axis perpendicular to the armor slope.
   Placing efforts shall assure that each stone is firmly set and supported by underlying materials and adjacent stones.
   Loose stones shall be reset or replaced.
   Elevation of the toe stone must be witnessed and confirmed.

   Armor stone should meet the following requirements:
   Stones with their largest dimension greater than three times the least dimension should be rejected.
   The stones should have high specific gravity and low absorption.
   Materials should be able to withstand the design impact conditions.

3. Secondary Layer:
   Stones with their largest dimension greater than three times the least dimension should not make up more than 10% of the total.
   All material should have adequate freezing and thawing resistance for the range of anticipated weather conditions.

4. Bedding Layer
   Stones should be within the size range specified and the material should be well blended.
   Stones with the largest dimension greater than three times the least dimension should not constitute more than 10% of the total.

5. Mapping
   The topographic information shown was obtained by conventional survey methods on or between January 8, and February 15, 2001.
   The datum used is Mean Low Water obtained from the USACE.
   The property lines shown are from the Town of Plymouth Assessors' records and do not represent an actual survey on the ground.

Datum Relationship:

Tidal Bench Mark "BM NO 10 1954"
PID LW1544

Tidal Bench Mark #10

Highest Observed Water

MHHW

MHW

9.69' Elevated by NGS

NAVD 1988

MTL

NGVD 1929

MLW

MLLW

-1.83

Lowest Observed Water

15.54

12.49

10.25

9.82

4.91

NAV 1988

0.34

5.26'

-0.34

MLW by USACE Data

-2.17

This relationship is based on the following:

Length of series 3 Months
Time period June - August 1990
Tidal Epoch 1960-1978
Control Tide Station Boston (844 3970)

Town of Plymouth
Warren's Cove, Plymouth Bay
September 19, 2001
Sullivan Engineering, Inc.
Osterville, Mass.

LICENSE PLAN NO. 9216
Approved by Department of Environmental Protection
Date: FEB 21
<table>
<thead>
<tr>
<th>BCE Structure No</th>
<th>Document No</th>
<th>Contract/ Drawing Number</th>
<th>Entity</th>
<th>Municipality</th>
<th>Date</th>
<th>Title</th>
<th>Sheets</th>
<th>Location</th>
<th>Description</th>
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<tr>
<td>057-014A-000-007-100-CDE1A</td>
<td>057-014A-000-007-100-CDE1B</td>
<td>Real 335 Frame 0525</td>
<td>USACE</td>
<td>PLYMOUTH</td>
<td>JUN 1935</td>
<td>Proposed Fill in Plymouth Harbor</td>
<td>2</td>
<td>Town Pier and Western Shoreline</td>
<td>Timber Bulkhead and Gravel Fill</td>
</tr>
<tr>
<td>057-014A-000-007-100-CDE1A</td>
<td>057-014A-000-007-100-CDE1B</td>
<td>M&amp;DPW</td>
<td>PLYMOUTH</td>
<td>FEB 1959</td>
<td>Proposed Town Wharf Construction, Plymouth Harbor</td>
<td>3</td>
<td>Town Pier Adjacent to T-Wharf</td>
<td>Includes Pipe Cap, Rip Rap &amp; Fill</td>
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<tr>
<td>057-014A-000-010A-100-CDE1A</td>
<td>057-014A-000-010A-100-CDE1B</td>
<td>Real 335 Frame 0525</td>
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<td>Real 335 Frame 0525</td>
<td>USACE</td>
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<td>057-014A-000-014A-100-CDE1A</td>
<td>M&amp;DPW</td>
<td>PLYMOUTH</td>
<td>FEB 1959</td>
<td>Proposed Town Wharf Construction, Plymouth Harbor</td>
<td>3</td>
<td>Town Pier Adjacent to T-Wharf</td>
<td>Includes Pipe Cap, Rip Rap &amp; Fill</td>
<td></td>
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<tr>
<td>057-014A-000-001A-300-CDE1A</td>
<td>057-014A-000-001A-300-CDE1B</td>
<td>CENED-CHR-22 1975001190 MA- 76-2204</td>
<td>USACE</td>
<td>PLYMOUTH</td>
<td>OCT 1974</td>
<td>Proposed Public Access Facility, Boat Ramp and Parking Area</td>
<td>3</td>
<td>Boat Ramp at Town Pier</td>
<td>Includes Stone Mound at Shoreline</td>
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<tr>
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<td>CENED-CHR-22 1975001190 MA- 76-2204</td>
<td>USACE</td>
<td>PLYMOUTH</td>
<td>OCT 1974</td>
<td>Proposed Public Access Facility, Boat Ramp and Parking Area</td>
<td>3</td>
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<td>Includes Stone Mound at Shoreline</td>
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<tr>
<td>057-014A-000-001A-500-CDE1A</td>
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<td>CENED-CHR-22 1975001190 MA- 76-2204</td>
<td>USACE</td>
<td>PLYMOUTH</td>
<td>OCT 1974</td>
<td>Proposed Public Access Facility, Boat Ramp and Parking Area</td>
<td>3</td>
<td>Boat Ramp at Town Pier</td>
<td>Includes Stone Mound at Shoreline</td>
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<td>Real 335 Frame 0525</td>
<td>USACE</td>
<td>PLYMOUTH</td>
<td>JUN 1935</td>
<td>Proposed Fill in Plymouth Harbor</td>
<td>2</td>
<td>Town Pier and Western Shoreline</td>
<td>Stone Seawall and Gravel Fill</td>
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<td>057-017-000-001A-100</td>
<td>057-017-000-001A-100-CDE1A</td>
<td>M&amp;DPW</td>
<td>PLYMOUTH</td>
<td>JUN 1935</td>
<td>Proposed Fill in Plymouth Harbor</td>
<td>2</td>
<td>Town Pier and Western Shoreline</td>
<td>Stone Seawall and Gravel Fill</td>
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<tr>
<td>057-020-000-002A-100-CDE1A</td>
<td>057-020-000-002A-100-CDE1B</td>
<td>Real 335 Frame 0525</td>
<td>USACE</td>
<td>PLYMOUTH</td>
<td>JUN 1935</td>
<td>Proposed Fill in Plymouth Harbor</td>
<td>2</td>
<td>Town Pier and Western Shoreline</td>
<td>Stone Seawall and Gravel Fill</td>
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<td>057-020-000-002A-100-CDE1A</td>
<td>057-020-000-002A-100-CDE1B</td>
<td>M&amp;DPW</td>
<td>PLYMOUTH</td>
<td>JUL 1954</td>
<td>Proposed Seawall Plymouth Harbor</td>
<td>3</td>
<td>Fill adjacent to State Pier</td>
<td>Bullethead, Rip Rap</td>
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<td>CENAS-R- 20012744</td>
<td>TOWN</td>
<td>PLYMOUTH</td>
<td>SEP 2001</td>
<td>Town of Plymouth for Construction and Maintaining Stone Revetment at 140 &amp; 150 Warren Ave</td>
<td>8</td>
<td>Warren Cove</td>
<td>Warren Cove</td>
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<td>M&amp;DPW</td>
<td>PLYMOUTH</td>
<td>SEP 2001</td>
<td>Proposed Stone Jetties in Cape Code Bay, Marion Point</td>
<td>1</td>
<td>Northeast of the Intersection of Taylor Road and Marion Point Drive</td>
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<td>M&amp;DPW</td>
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<td>Proposed Stone Jetties, Lookout Point</td>
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<td>Warren Cove</td>
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<td>057-053-011-010A-100</td>
<td>057-053-011-010A-100-CDE1A</td>
<td>M&amp;DPW</td>
<td>PLYMOUTH</td>
<td>JUN 1960</td>
<td>Proposed Stone Jetties, Lookout Point</td>
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<td>057-059-000-010A-100-CDE1B</td>
<td>M&amp;DPW</td>
<td>PLYMOUTH</td>
<td>APR 1969</td>
<td>Proposed Stone Gravel, Plymouth Beach</td>
<td>1</td>
<td>Warren Cove</td>
<td>Extension of Gravel Field</td>
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<td>CENAS-R- 20012744</td>
<td>TOWN</td>
<td>PLYMOUTH</td>
<td>SEP 2001</td>
<td>Town of Plymouth for Construction and Maintaining Stone Revetment at 140 &amp; 150 Warren Ave</td>
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<td>Warren Cove</td>
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<td>057-37A-C00-015A-100</td>
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<td>USACE</td>
<td>PLYMOUTH</td>
<td>AUG 1953</td>
<td>Proposed Fill in Plymouth Harbor</td>
<td>1</td>
<td>Outshore End of Long Beach</td>
<td>Sand Fill from Hydraulic Dredging of Federal Channel</td>
<td></td>
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</table>
NOTE

ELEVATIONS ARE IN FEET AND TENTHS
AND REFER TO PLAN OR MEAN LOW
WATER.

AHLGREN AND WATERS ARE TO BE RUST RESISTANT AND TIMBERS
WEATHER PROOF. CONSTRUCTION METHODS TO
BE IN ACCORDANCE WITH CURRENT STANDARD
PRACTICE.

LOCATION OF WORK TO BE DONE SHOWN IN
RED.

PROPOSED
TOWN WHARF CONSTRUCTION
PLYMOUTH HARBOR
PLYMOUTH - MASS.
APPLICATION BY
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS
FEBRUARY 1959

Karl R. Haugen
Chief, Waterways Engineer

ACC.03974-A
TYPICAL CROSS SECTION

PLAN - PRE-CAST SLABS AND WALL

PILE LAYOUT

NOTE:
ELEVATIONS ARE IN FEET AND TENTHS
AND REFER TO PLANE OF MEAN LOW
WATER.

PROPOSED
TOWN WHARF CONSTRUCTION
PLYMOUTH HARBOR
PLYMOUTH, MASS.

DEPARTMENT OF PUBLIC WORKS, MASSACHUSETTS
DIVISION OF WATERWAYS
FEBRUARY 1959

ALFRED O. MCMAHAN
CHIEF WATERWAYS ENGINEER

ACC. 03974-B
NOTE

ELEVATIONS IN FEET AND TENTH INCHES TO PLANE OF M-6 IN LOW WATER.
HARDWARE TO BE RUST RESISTANT AND TIMBER TO WEATHER PROOF.
CONSTRUCTION METHODS TO BE IN ACCORDANCE WITH CURRENT STANDARD PRACTICE.

PROPOSED
TOWN WHARF CONSTRUCTION
PLYMOUTH HARBOR
PLYMOUTH, MASS.
APPLICATION BY
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS
FEBRUARY 1959

Robert A. Neiman
Chief Waterways Engineer
ACC.03974-C
Note: Proposed work shown in red. Soundings are in feet and tenths and show depths below the plane of Mean Low Water. Minus figures show elevations above the same plane.

PLANNED IMPROVEMENTS:
- Installation of a timber bulkhead
- Construction of a wharf

PROPOSED TIMBER BULKHEAD TOWN WHARF
PLYMOUTH HARBOR
PLYMOUTH-MASS.

APPLICATION BY
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS
SEPTEMBER 1952

DISTRICT WATERWAYS ENGINEER

ACC.03016
PROPOSED PUBLIC ACCESS FACILITY
BOAT RAMP AND PARKING AREA
PLYMOUTH HARBOR
PLYMOUTH MASSACHUSETTS
APPLICATION BY
DEPARTMENT OF PUBLIC WORKS OF MASS.
DIVISION OF WATERWAYS
OCTOBER 1974

NOTE:
1. Elevations in feet and tenths
2. Elevation figures denote depth below MLI.
3. CONTRACT NO. 88-D-4
4. LOCATION OF PROPOSED WORK SHOWN IN RED
5. WORK TO BE DONE UNDER EACH CONCEAL SHOWN IN RED
PHASE II
PLAN
SCALE 1' = 100'

SECTION C-C

PROPOSED PUBLIC ACCESS FACILITY
BOAT RAMP AND PARKING AREA
PLYMOUTH HARBOR
PLYMOUTH MASSACHUSETTS

APPLICATION BY:

Department of Public Works of Massachusetts
PROPOSED WALL AND FILL IN PLYMOUTH HARBOR AT PLYMOUTH MASS.

APPLICATION BY THE TOWN OF PLYMOUTH

June 1935

A.E. Blackmer, Town Engineer
PLYMOUTH HARBOR
PROPOSED FILLING AND RIPRAP
APPLICATION BY
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS AND PUBLIC LANDS
OCTOBER 1925

Francis L. Collier
Engineer
PROFILE VIEW
Scale: 1" = 20'

Proposed Sleeve for Fence Post
Proposed 2" Vibration Pad & Area for Drain Scuppers

4' Recurve Wall Section
Typical (NTS)

Proposed Sleeve for Fence Post
Proposed 2" Vibration Pad & Area for Drain Scuppers

2' Recurve Wall Section
Typical (NTS)

SHEET 6 of 8

Town of Plymouth for Construction & Maintaining A Stone Revetment at 140 & 150 Warren Avenue on Warrens Cove, Plymouth Bay September 19, 2001

Sullivan Engineering, Inc.
Osterville, Mass.
Typical Section B

For the Case where the bottom of the existing retaining wall is above elevation 0' MLW.

Typical Section A

For the Case where the bottom of the existing retaining wall is at elevation 0' MLW.

PROFILE VIEW
Scale: 1" = 10'

SHEET 7 of 8
Town of Plymouth
for Construction & Maintaining
A Stone Revetment
at 140 & 150 Warren Avenue
on Warrens Cove, Plymouth Bay
September 19, 2001

Sullivan Engineering, Inc.
Osterville, Mass.
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   The datum used is Mean Low Water obtained from the USACE.
   The property lines shown are from the Town of Plymouth Assessors' records and do not represent
   an actual survey on the ground.

Datum Relationship:

Tidal Bench Mark "BM NO 10 1954" PIG NWSW

Tidal Bench Mark #10

Highest Observed Water

MHW
MHW

NAVD 1988 MTL
NAVD 1929

MLW
MLW

Lowest Observed Water

-1.83

This relationship is based on the following:

Length of series 3 Months
Time period June – August 1990
Tidal Epoch 1960-1978
Control Tide Station Boston (444 3970)

SHEET 8 of 8
Town of Plymouth
for Construction & Maintaining
A Stone Revetment
at 140 & 150 Warren Avenue
on Warrens Cove, Plymouth Bay
September 19, 2001

Sullivan Engineering, Inc.
Osterville, Mass.
PROPOSED STONE JETTIES
LOCKOUT POINT
PLYMOUTH, MASS.

DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS
JANUARY 1952
SCALES AS SHOWN

NOTE:
ELEVATIONS ARE IN FEET AND FEET ABOVE
THE GENERIC OF MEAN LLOW WATER
DISTANCE ARE SHOWN BETWEEN THE
SAME EATH.

PROPOSED WORK SHOWN IN RED

ACC. 05922
NOTE
ELEVATIONS ARE IN FEET AND TENTHS
AND TRUE HEIGHTS ABOVE PLANE OF
M.A. TWO WATER MINUS FIGURES
MARKED GEODES BELOW THE SAME PLANE.
SHOWN AS ELEVATION DEDUCTING THIS,
SIDE END EASEMENT FOR JETTY LOTS TO
PROPERTY OWNERS NAMES UNKNOWN.
ELEVATIONS MARKED AT 2'-8" 20'-200'-8".
DEPOSITED ON SHEET SHOWN.
EASING TO THIS 60 EAST OF PROPOSED JETTY
LOCATION ON PROPOSED WORK IS SHOWN
IN PLAN.

PROPOSED
EXCAVATION FOR STONE JETTY
ELLISVILLE HARBOR
PLYMOUTH - MASS.
APPLICATION BY
DEPARTMENT OF PUBLIC WORKS, MASSACHUSETTS
DIVISION OF WATERWAYS
JUNE 1960

Robert R. Skenes
Chief Waterways Engineer

ACC. C-3/20
NOTES
Elevations are in feet and tenths and refer to the plane of mean low water.
Sides and apertures of Groins are 1½ to 1

PROPOSED STONE GROINS
PLYMOUTH BEACH
PLYMOUTH, MASS.
APPLICATION BY
DEPARTMENT OF PUBLIC WORKS OF MASSACHUSETTS
DIVISION OF WATERWAYS
APRIL 1969