



## Final Beach Management Plan Town of Falmouth Beaches



**Prepared For:**

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April 2008

**FINAL  
BEACH MANAGEMENT PLAN  
TOWN OF FALMOUTH BEACHES**

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**Prepared for:**  
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1.0 Introduction

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## 1.0 INTRODUCTION

The Town of Falmouth is located in the southwestern corner of Cape Cod, and is bound on the west by Buzzards Bay and on the south by Vineyard Sound. Its unique location on both of these water bodies creates over 68 miles of open coast and estuarine shoreline (Figure 1). This exceptional coastal environment is comprised of a number of important natural resources, including but not limited to, coastal beaches, coastal dunes, barrier beaches, salt marsh areas, shellfish and finfish species, as well as federal and state-listed shorebird habitat.



**Figure 1. Extent of Falmouth coastline formed by the adjacent waters of Buzzards Bay and Vineyard Sound.**

The early formation of Cape Cod began some 12,000 to 15,000 years ago as global temperatures were warming and the large ice sheets that once extended as far south as Martha's Vineyard, Nantucket, the Elizabeth Islands, and Long Island began to retreat. Large glacial moraines were formed at the leading edges of the ice sheet, and as the glaciers retreated northward they left a series of glacial outwash plains, till deposits, kettle holes, and ice contact features. One of the most prominent glacial features in the Town of Falmouth is the Buzzards Bay Moraine, which extends north-northwest from Woods Hole (Strahler, 1966; Oldale, 1982). The moraine essentially follows Route 28, passing east of West Falmouth and North Falmouth. Glacial deposits on the Buzzards Bay side of the moraine, and along the south shore of Falmouth, are therefore primarily outwash plains created as glacial streams washed large quantities of material off the ice face.

Starting around 7,000 years ago, a rapid rise in sea level caused the submergence of Buzzards Bay and Vineyard Sound (FitzGerald et al., 1992). This rapid rise in sea level continued until approximately 3,500 years ago, at which point the rate of relative sea level rise slowed significantly. It was during this early period of rapid sea level rise that most of present day Buzzards Bay and Vineyard Sound was inundated. From this point on, sea levels gradually rose to the location of the present day shoreline, as waves and currents reworked the pre-existing glacial features and sediments into the modern day beaches, spits, dunes, bays and marshes that comprise the shorelines of Falmouth today. Recent projections by the International Panel on Climate Change (IPCC) indicate potential increases in sea level between 0.6 and 2.0 ft over the next century (IPCC, 2007). Such a rise in sea level will accelerate the evolution of Falmouth's shoreline, causing increased vulnerability to low lying coastal areas.

As with any coastal area, the shoreline of Falmouth is a dynamic setting that constantly changes in response to coastal processes such as waves, winds, storms, currents, and sea level rise. The interaction of these processes with the geological framework of the coastline acts to shape the present day shoreline of Falmouth. These dynamic coastal systems serve a number of important natural functions. For example, coastal beaches, dunes, and banks provide storm damage protection and flood control for inland areas by dissipating incoming wave energy and supplying sediment to adjacent resources. Beaches and dunes also provide important wildlife habitat for certain species of shorebirds. In addition to these natural functions, Falmouth's dynamic coastal systems also provide tremendous recreational and economic benefits for beachgoers, fishermen, and local merchants. In fact, the natural beauty of Falmouth's coastal areas is highly valued by the local residents and forms the basis for the major tourism industry in the town. Continued use of the Falmouth shoreline as both a natural protective buffer and a recreational resource is a difficult task. The complex array of variables needed to meet these competing uses requires implementation of coordinated coastal zone management practices and cooperation between the various stakeholders.

The Town of Falmouth is working towards improved coastal zone management through a number of interrelated municipal activities. The Board of Selectmen's Strategic Plan for 2008-2012 states that maintenance and expansion of Falmouth's waterfront amenities is one of the top three drivers of the Strategic Plan. One of the goals under this plan is to "improve the quality of Falmouth Beaches". The following Beach Management Plan has been developed to help meet this goal, and to address a need for coordinated and effective management of the Town's public beach sites. As a service to its residents and the many tourists that visit Falmouth each year, the Town owns, maintains, and operates 10 coastal public beaches and one inland pond beach. Together, these beaches provide over 12 miles of public access to the shoreline. Continued sustainability of these beaches is critically important to the Town of Falmouth, and as such, the need for a coordinated Beach Management Plan was identified. The goals of the Beach Management Plan are to preserve and enhance the natural and recreational functions of the Town of Falmouth public beaches and to guide future coastal zone management decisions by balancing the needs of all stakeholders. To achieve these goals, the following objectives were identified for the Beach Management Plan:

- Develop an inventory of natural and anthropogenic resources, historical evolution, and existing coastal processes at each public beach site that will serve as a reference document for coastal managers.
- Develop a management program that is consistent with federal, state, and local laws and regulations for the various potential uses of the beaches.
- Define short- and long-term components of a beach restoration and management program, including post-storm response activities.
- Develop short- and long-term recommendations for infrastructure maintenance and improvement.
- Identify planning activities that will facilitate improved management of the beaches.
- Provide a document that serves as the basis for a Notice of Intent application to the Falmouth Conservation Commission for ongoing management of wetland resource areas protected by the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00) and the Falmouth Wetlands Regulations (FWR 10.00).

## 2.0 Falmouth Public Beaches Inventory

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## 2.0 FALMOUTH PUBLIC BEACHES INVENTORY

Salt water public beaches operated by the Town of Falmouth are evenly split between the Buzzards Bay and Vineyard Sound shorelines. From north to south the Buzzards Bay beaches include Megansett, Old Silver Reserved, Old Silver Public, Chapoquoit, and Wood Neck (Figure 2). Moving from west to east along the Vineyard Sound shoreline, the public beaches include Surf Drive, Falmouth Heights, Bristol, Menauhant West, and Menauhant East (Figure 2). The only freshwater public beach operated by the Town of Falmouth is located in Goodwill Park along the south shore of Grews Pond (Figure 2). Public beach services are also provided by the Town at Stoney Beach, which is located on the Buzzards Bay side of Woods Hole, although the beach parcel is actually owned and managed by the Marine Biological Laboratory. Countless other coastal and inland pond parcels are owned by the Town of Falmouth, and therefore available to the public; however, amenities and services are only offered at the public beach sites.



Figure 2. Distribution of public beach sites throughout the Town of Falmouth.

To provide a basis for the long-term management of Falmouth's ten saltwater public beaches, an inventory of historical and existing conditions was performed. Historical aerial photographs, town records, and existing reports were reviewed for geomorphologic and anthropogenic changes to the beaches. Modern day conditions were also documented through site visits, beach profiling, sediment sampling and digital photography. In addition, a general understanding of the process response relationships at each beach was developed from the inventory data. This combination of information is critical for the development of effective recommendations to guide future management of Falmouth's natural public beach resources.

Results from the inventory are provided separately for each of the public beach sites. A description of the physical components of the sites such as size, type and extent of resource areas, protected species, sediment characteristics, vegetation, elevation and beach slope are discussed. In addition, information regarding rates of historical shoreline change and sediment transport patterns is provided. Anthropogenic features of the sites such as coastal engineering structures, fencing, parking areas, stormwater drainage structures, and buildings are also identified and described. Finally, a summary of the services provided by the Town of Falmouth at each of the public beaches, including bathing facilities, restrooms, concessions, etc. is discussed.

Existing conditions plans for each of the public beaches are provided in Appendix A. These plans were generated using Geographic Information System (GIS) data layers provided by the Town of Falmouth, as well as new data layers created for the following attributes: catch basins, handicap parking, lifeguard stands, restrooms, showers, beach access points, fencing, wetland resource areas, and beach profile locations. With the exception of the beach profile data, all other mapping was performed using a combination of visual inspection and digital orthophotography (2001 and 2005 available from MassGIS). The delineation of wetland resource areas followed the definitions provided in the Massachusetts Wetlands Regulations (310 CMR 10.0) and the Falmouth Wetlands Regulations (FWR 10.0). Mapping information for Estimated and Priority Habitat was obtained directly from the Massachusetts Division of Fisheries and Wildlife Natural Heritage & Endangered Species Program (NHESP; Mass. Div. of Fisheries and Wildlife, 2008).

Additional information on storm surge elevations and flood zone designations for each beach was obtained from the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS; FEMA, 1986) for the Town of Falmouth, and the Flood Insurance Rate Maps (FIRMs). These documents provide estimates of flood conditions during storms of varying recurrence intervals (10-, 50-, and 100-yr events). Data describing the geomorphic evolution of the beaches and long-term shoreline change was obtained from historical aerial photographs provided by the Town, as well as the Massachusetts Shoreline Change Project (Theiler, O'Connell, Schupp, 2001).

The beach profile data were collected on Nov. 20-21, 2007 at each of the public beach sites using a Trimble RTK Global Positioning System (GPS). A total of 21 profiles were surveyed as indicated in Table 1. The data were collected along shore normal transects starting on the roadway or parking lot areas landward of the beach, and extending to wading depth near mean low water. Elevation (z) and position data (x,y) were collected

with respect to NGVD 1929 and the Massachusetts State Plane Coordinate System NAD 1983. These data provide baseline conditions for each of the beaches, and when monitored over time, will provide the Town of Falmouth with the necessary information on when dune and/or beach restoration activities are warranted. Copies of the raw data file in a .txt format and profile plots are provided in Appendix C and the locations of the profiles are shown on the plans provided in Appendix A.

**Table 1. Summary of Beach Profile Locations**

| <b>Beach Location</b>       | <b>Beach Profile</b> |
|-----------------------------|----------------------|
| Megansett Beach             | MG1                  |
| Old Silver Beach – Reserved | OS1, OS2             |
| Old Silver Beach – Public   | OS3, OS4             |
| Chapoquoit Beach            | CB1, CB2             |
| Wood Neck Beach             | WN1, WN2, WN3        |
| Surf Drive Beach            | SD1, SD2, SD3        |
| Falmouth Heights Beach      | FH1, FH2             |
| Bristol Beach               | BB1, BB2             |
| Menauhant Beach – West      | MH1, MH1D            |
| Menauhant Beach - East      | MH2, MH2D            |

Samples were also collected for grain size analysis from each of the public beach sites. The samples were collected from the foreshore, or intertidal portion of the beach between mean high water and mean low water, and also from the backshore portion of the beach. Grain size analysis on the sand-sized fraction from the intertidal zone was performed using a Beckman-Coulter LS13320™ laser particle-size analyzer (Appendix B). Percentages of gravel, sand, and silt were computed along with mean grain-size statistics. The grain size data provides information on sediment characteristics at each beach. The data will serve as a baseline and help to address sediment compatibility issues for future beach and/or dune restoration.

**2.1 MEGANSETT BEACH**

Megansett Beach is located in the village of North Falmouth at the northern terminus of County Road (Figure 2). The beach is bound to the west by the open waters of Megansett Harbor, and to the north by the mooring basin section of Megansett Harbor that is formed by the protection of a large stone jetty. A private residence abuts the public beach to the south, and the Megansett Yacht Club is located to the east across County Rd. The Town of Falmouth Megansett Harbor boat ramp is located at the end of County Rd., immediately adjacent to the public beach parking lot.

*2.1.1 Natural Features and Coastal Processes*

The public beach parcel is approximately 1.1 acres in size, including both the beach and parking lot areas. The majority of the unimproved section of the parcel is classified as Coastal Beach, with only a small area at the southern boundary containing a Coastal Dune (Appendix A - Map 1). The dune resource is contiguous with a larger Coastal Dune that extends to the south across private properties. The only vegetation on the parcel is beach grass, which is well established in the Coastal Dune (Figure 3).

Sediments on the beach are composed of coarse-grained sand with a mean particle size of 0.85 mm (Appendix B). In general, these coarse-grained beach sands are uniformly distributed across the site. The majority of the beach and adjacent waters of Megansett Harbor are mapped as Estimated and Priority Habitat by the NHESP (12<sup>th</sup> Atlas, 2007). According to the NHESP Common and Roseate Tern species have been found in the vicinity of Megansett Beach (Appendix A – Map 1).



**Figure 3. View of Megansett Beach showing the coastal beach resource in the foreground (left photo) and the coastal dune resource near the southern boundary of the parcel (right photo).**

The average elevation of the parking lot at Megansett Beach is approximately 6.0 ft NGVD. The backshore portion of the beach starts at elevation 6.8 ft NGVD near the edge of the parking lot, and extends seaward at a gradual slope of 0.7% for approximately 150 ft to the edge of the berm (Profile MG1, Appendix C). The seaward portion of the beach within the normal range of tides (foreshore), slopes more steeply at 7.1% from elevation 5.3 ft NGVD near the berm crest, to a point below mean low water. FEMA storm surge predictions for this area of Falmouth indicate flood elevations of 9.2, 12.6 and 14.0 ft NGVD for the 10-, 50-, and 100-yr storm events, respectively. Given the maximum elevation on the parcel of 6.8 ft, it is expected that the property will be inundated during storm events of 10-yr magnitude and greater. For the 100-yr storm event, the FEMA Flood Insurance Rate Maps (FIRMs) indicate that the entire Megansett Beach parcel (beach and parking lot) falls within a mapped velocity-zone with a Base Flood Elevation (BFE) of 19 ft NGVD (Figure 4). As such, the parcel will experience storm surge flooding and wave action during a 100-yr storm event.

Geomorphic evolution of Megansett Beach has been strongly controlled by installation of the Megansett Harbor breakwater and other coastal engineering structures along the northern edge of the beach parcel. Historical shoreline positions from 1845 to 2005 show significant accretion in the area of Megansett Beach (Figure 5). The early 1845 shoreline held a position east of the present day Megansett Yacht Club, and by 1938, the shoreline had accreted approximately 300 ft to a location near the center of the existing beach parking lot (Figure 5). Average accretion rates over this early time period prior to the installation of coastal engineering structures were about +3.5 ft/yr. Construction of the stone breakwater and subsequent armoring along the north side of the Megansett Beach parcel created an anchor point for the shoreline and allowed sediment to build up on the

south side of the structures. Since this time, the beach has been relatively stable, showing no trends of long-term erosion or accretion.

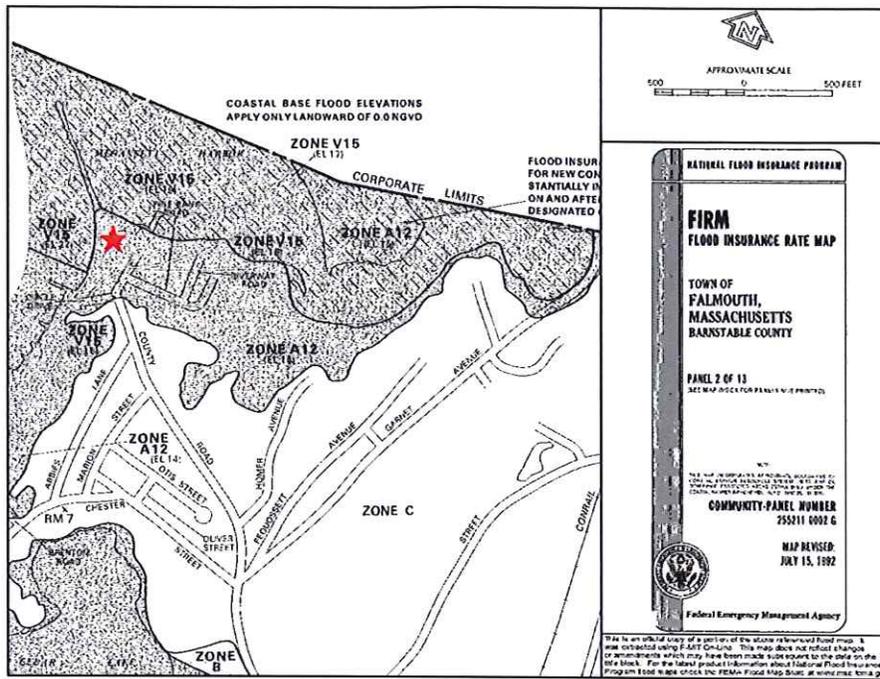


Figure 4. FEMA FIRM showing flood zone designations for Megansett Beach.

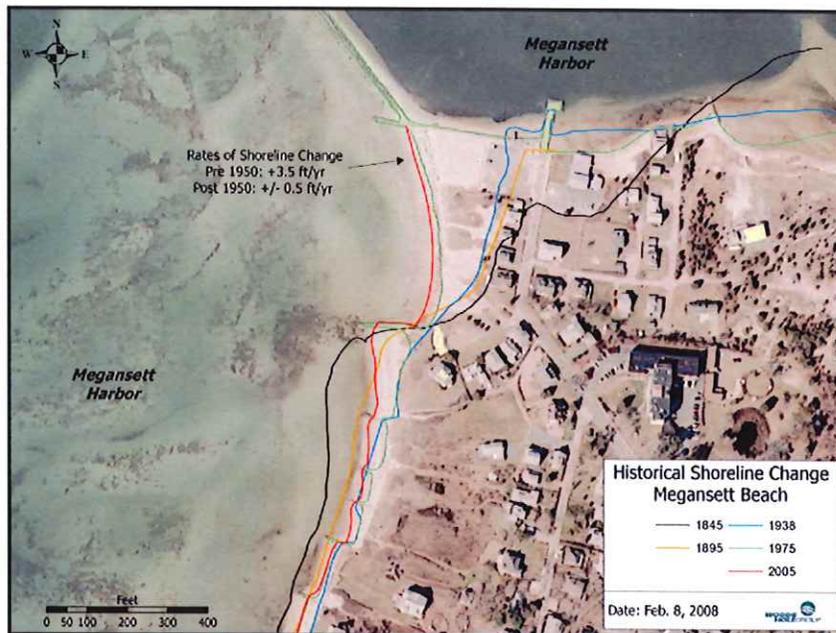


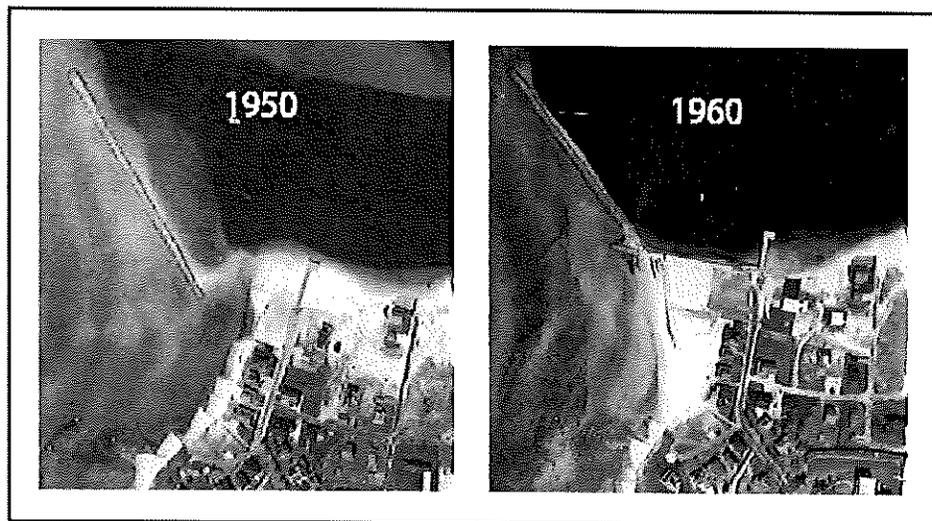
Figure 5. Historical shoreline change from 1845 to 2005 for the Megansett Beach area.

The Megansett Beach shoreline is at the northeastern end of a longshore transport system that stretches from Nyes Neck to the public beach. Although this section of shoreline is

heavily controlled by coastal engineering structures such as revetments and groins which tend to limit and trap available sediment, the net direction of transport along the shoreline is from southwest to northeast. Over the years this has caused sediment to accumulate in a broad shoal outside the Megansett Harbor breakwater (Figure 5). The shoal area acts to dissipate incoming wave energy and thereby protects the beach from higher energy waves that typically cause erosion. The beach area is also protected from northeast and northwest winds and waves by nearby Scraggy Neck, Lawrence Island and the adjacent Megansett Harbor breakwater. The combination of these factors contributes to the relative stability of the shoreline at Megansett Beach.

### *2.1.2 Anthropogenic Features*

Review of historical aerial photographs indicates that the Megansett Harbor breakwater was built sometime between 1938 and 1950 (Figures 5-6). The 620 ft long structure was built by the Commonwealth of Massachusetts as a stone breakwater, and was originally detached from the shoreline. In 1952 the stone revetment and groin that form the northern edge of the beach were installed to connect with the breakwater, and the public beach was widened with sand dredged from the harbor (Mass DPW Contract No. 1230). Shortly afterwards the parking lot was installed (Figure 6). The stone revetment was grouted with concrete and extended the length of the public beach parcel to the dinghy dock area. A small stone and concrete seawall with rip rap toe protection was also installed between the dinghy dock and the public launching ramp. A set of concrete stairs was built across the revetment from the beach to the protected portion of Megansett Harbor behind the breakwater (Figure 7). The only other structure on the beach is a 3 to 4 ft high wooden wind fence near the edge of the parking lot that was installed to minimize wind blown transport to the parking lot (Figure 7). A single catch basin is also located in the parking lot.



**Figure 6. Historical aerial photographs from 1950 and 1960 showing the early development of Megansett Beach.**



**Figure 7. View of stone breakwater, revetment, access stairs, and wind fencing at Megansett Beach.**

### *2.1.3 Public Beach Services*

Megansett Beach is open for use by those with resident beach stickers only. The Town provides a 46 space paved parking lot that is open during the summer (June through August) from 9:00 AM to 9:00 PM. On average, the ratio of beach area to parking spaces provides 696 sq ft of beach per vehicle. During the winter months the parking lot is open 24 hours a day, 7 days a week. Handicap parking areas are clearly marked. The parking lot is staffed by 1 attendant during the summer months, who is responsible for checking beach stickers and directing traffic. The Town also staffs the beach with 2 lifeguards during the summer season from the hours of 9:00 AM to 5:00 PM. Portable restrooms are provided, generally during the period from May through September. Although shower facilities are not available at Megansett Beach, a nearby shower is located on the Town pier at the end of County Rd. immediately adjacent to the beach. A mobile food concession serving ice cream also visits the beach on a regular daily basis during the summer months. Megansett Beach has 1 recycling bin and 2 trash bins that are serviced during the summer; one trash bin remains at the beach during the winter season. A mutt mitt station is also provided.

## **2.2 OLD SILVER BEACH – RESERVED & PUBLIC**

Old Silver Beach – Reserved & Public are located on Quaker Rd. in North Falmouth (Figure 2). Both beaches are bound to the west by the open waters of Buzzards Bay, and separated from each other by the Herring River inlet. Old Silver Beach – Reserved abuts the Sea Crest Resort property to the north, and the salt marsh/tidal creek system of Herring River, across Quaker Rd. to the west. Old Silver Beach – Public is bound to the south by private properties in Falmouth Cliffs, and to the east by a small pond, Quaker Rd., and other private properties located along Jae Rd.

### *2.2.1 Natural Features and Coastal Processes*

The public beach parcel at Old Silver Beach – Reserved is approximately 3.9 acres in size, including both the beach and parking lot areas. The resource areas include Coastal Beach, Coastal Dune, Barrier Beach, and Banks of or Land Under Fish Runs as shown on Map 2 (Appendix A). The Coastal Beach spans the length of the property seaward of the parking lot, while the Coastal Dune is segmented into two distinct features (Figure 8). A

relatively small Coastal Dune is located along the northern edge of the property; this feature extends onto the Sea Crest Resort property to the north. A much larger Coastal Dune is located at the southeast corner of the property, between the Herring River jetty, Quaker Rd., and the concession area. The northern dune is vegetated with beach grass, and the larger dune supports species of both beach grass and beach plum. The larger dune also contains several paths worn by foot traffic. The Barrier Beach resource is made up of both the Coastal Beach and Coastal Dune areas, and the Herring River and associated banks are classified as Banks of or Land Under Fish Runs. Sediments from the intertidal portion of Old Silver Beach - Reserved are composed of coarse-grained sand with a mean particle size of 0.56 mm; material above the mean high water line is composed of medium-grained sand (Appendix B).



**Figure 8. View of Coastal Dune and Coastal Beach resources at Old Silver Beach – Reserved.**

Areas of Buzzards Bay, as well as the Herring River inlet and associated marsh system are mapped as Estimated and Priority Habitat by the NHESP (12<sup>th</sup> Atlas, 2007). According to the NHESP, species of Common and Roseate Tern have been found in the vicinity of Old Silver Beach (Appendix A – Map 1). The inlet and marsh system are likely mapped as foraging habitat for these shorebirds, as the adjacent beaches are not known as nesting sites. The Old Silver Beach areas have also been identified by the Massachusetts Division of Marine Fisheries as Horseshoe Crab spawning sites.

The elevation of the parking lot at Old Silver Beach – Reserved ranges from 10 to 14 ft NGVD. The elevation at the top of the seawall is 15 ft NGVD. The backshore portion of

the beach directly in front of the parking lot starts near elevation 9.0 ft NGVD, and extends seaward at a gradual slope of 2.3% for approximately 130 ft to the edge of the berm (OS1, Appendix C). The Coastal Dune south of the concession area is approximately 130 ft wide, with a maximum crest elevation of 12 ft NGVD (OS2, Appendix C). The backshore beach narrows considerably from north to south along the property, measuring only 36 ft wide in front of the dune. The slope of the foreshore is relatively consistent along the length of Old Silver Beach – Reserved, measuring approximately 11.5% from the berm crest to a point below mean low water. Beyond this point, the slope flattens out across the nearshore shoals.

Old Silver Beach – Public is much larger than the Reserved side, measuring approximately 6.0 acres. This includes a large parking lot, as well as Coastal Beach, Coastal Dune, Barrier Beach, and Banks of or Land Under Fish Runs resources (Map 3, Appendix A). The beach parcel also contains a coastal pond (Land Under Water Bodies and Waterways) with associated Bordering Vegetated Wetland that adds another approximate 3.0 acres to the Old Silver Beach – Public property. Three separate Coastal Dune resources are present; one at the northern end of the beach next to the Herring River jetty, a second smaller dune near the center of the beach at the landward end of the stone groin, and a third much larger dune that encompasses much of the southern end of the property (Figure 9). All of the dunes are well vegetated with beach grass. The larger dune to the south also supports woody species of beach plum, brier, some small cedar and hardwood trees, as well as phragmites. A number of footpaths have been worn in the larger dune, especially in the area between the parking lot and the coastal pond. Sediments from the intertidal portion of Old Silver Beach - Public are composed of coarse-grained sand with a mean particle size of 0.76 mm (Appendix B). Sediment above the mean high water line is composed of medium-grained sand.

The main parking area at Old Silver Beach – Public ranges in elevation from 13 to 14 ft NGVD while the smaller parking lot to the south, known as the “Chute”, slopes gradually down to an elevation of 6 ft NGVD. The elevation at the crest of the stone revetment is 14.2 ft NGVD, with a rather steep slope down to the Coastal Beach (OS3, Appendix C). The beach area seaward of the revetment is relatively narrow, measuring approximately 50 to 55 ft to the mean high water line. The Coastal Dune at the south end of the beach is nearly 70 ft wide and rises to a maximum elevation of 16.5 ft NGVD (OS4, Appendix C). The beach area seaward of the dune ranges from 60 to 130 ft wide and slopes gradually to the offshore tidal flats.

The revetments at Old Silver Beach – Reserved & Public will protect the parking areas and concession buildings from stillwater flooding associated with 10-yr storm events and smaller, although wave overtopping and runup may result in some sheet flow in these areas. For the 100-yr storm event, the FEMA FIRMs show the beach areas to be within a mapped V-zone with a BFE of 19 ft NGVD (Figure 10). The parking lot areas and the concession buildings appear to be in A-zones (BFE 14 and 15 ft NGVD). These designations indicate storm surge flooding at all areas at Old Silver Beach – Reserved & Public during a 100-yr storm event, with increased wave action occurring across the beach areas seaward of the revetments.



Figure 9. View of Coastal Dune and Coastal Beach resources at Old Silver Beach – Public.

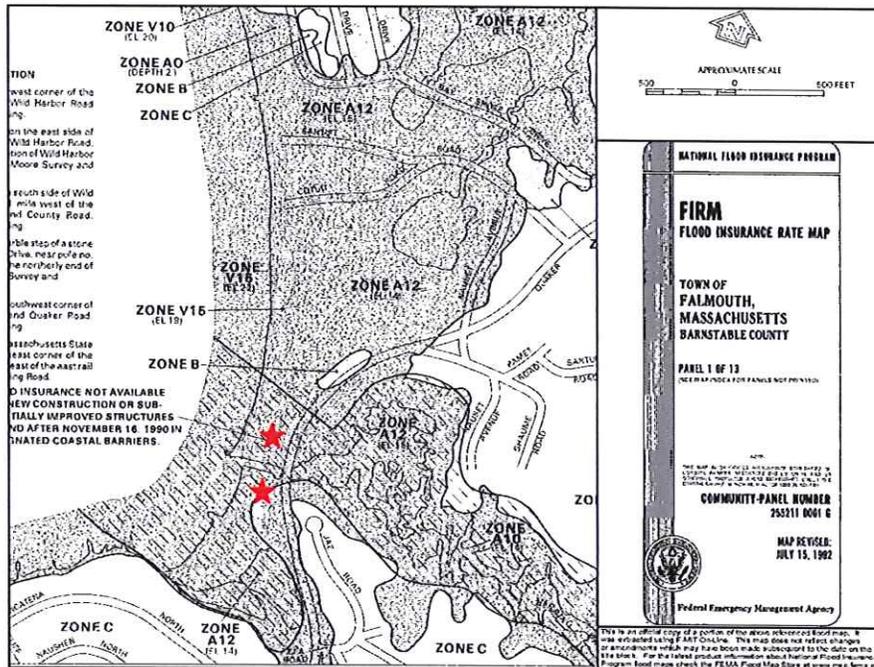


Figure 10. FEMA FIRM showing flood zone designations for Old Silver Beach – Reserved and Public areas.

Historical shoreline positions for the Old Silver public beaches are shown in Figure 11. These data indicate that prior to stabilization, the location of the Herring River inlet migrated north and south of its present position. In 1845 it appears that the inlet may have been closed, but by 1895, the inlet had opened near the center of present day Old Silver Beach – Reserved. By 1938, the Herring River inlet was established in its current location by construction of the northerly jetty. At this time the width of the inlet was considerably wider than present day, resulting in a southerly shift of the adjacent, unprotected shoreline. After the second jetty at the Herring River inlet was constructed the shoreline at Old Silver Beach – Public accreted to a position near the end of the jetty. Since this time, major shoreline fluctuations at both beaches have been reduced; however, data from 1938 to 2005 indicate a trend of net erosion. Rates of shoreline erosion at Old Silver Beach – Reserved are on the order of -0.5 to -0.8 ft/yr, and rates at Old Silver Beach – Public are between -0.4 and -0.6 ft/yr (Figure 11).



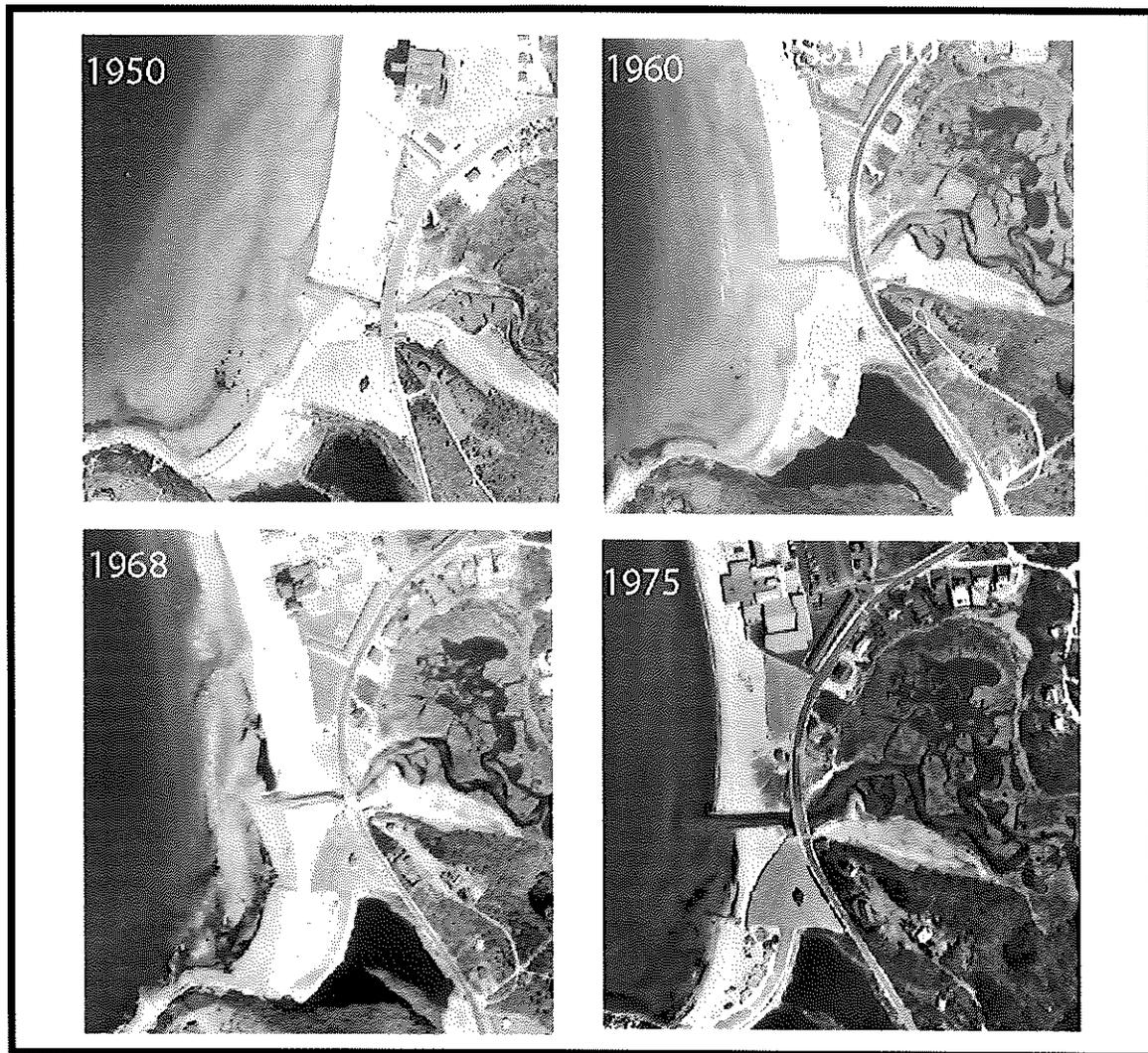
**Figure 11. Historical shoreline change from 1845 to 2005 for Old Silver Beach – Reserved & Public.**

The Old Silver public beaches are located at the southern end of a longshore transport system that stretches from Falmouth Cliffs to Crow Point, near the entrance to Wild Harbor. The dominant direction of sediment transport within this system changes as a function of location. Areas near Crow Point are more dominant to the north, while areas near the Sea Crest Resort and Old Silver public beach more dominant to the south. A significant volume of sand has built up in the shoal areas seaward of Old Silver Beach – Reserved & Public. These shoals act to dissipate wave energy during storms and protect the beach from severe erosional events.

### 2.2.2 Anthropogenic Features

Historical information from aerial photographs, Department of Environmental Protection (DEP) records and CZM shoreline data indicate that the northern jetty protecting the

Herring River inlet was built sometime between 1935 and 1938. By 1950, the parking lot, seawall, and concession building were in place at Old Silver Beach – Reserved, and the main parking lot, revetment, groin, and original concession were in place on the public side (Figure 12). The seawall on the Reserved beach was constructed as a poured concrete wall, while the revetment on the Public beach was built as a steeply sloping rock wall grouted with concrete. By 1960, construction of the southern jetty at the Herring River inlet was underway, and the “Chute” parking area was being created along the inland side of Old Silver Beach – Public. Both of these activities were complete by 1968. The last major change at the beach occurred in 1972 when the concession building on the public side was moved to its current location.



**Figure 12. Historical aerial photographs from 1950 to 1975 showing the early development of Old Silver Beach – Reserved & Public.**

Other anthropogenic features at Old Silver Beach – Reserved include sand fencing and split rail fencing around portions of the dunes, as well as wooden retaining walls around the dunes near the concession building (Figure 8). The edge of the parking lot near the road is also marked with a split rail fence. Two sets of concrete stairs and a ramp provide access from the parking area to the beach. An additional set of stairs and ramp are located near the concession building for access to the road and sidewalk. A concrete storage vault for rescue equipment is located on the beach immediately adjacent to the seawall, and two catch basins are located at the south end of the parking lot. The sanitary waste system associated with the concession building was installed with the original pre-1950 building, and is located in the dune area near the road.

Anthropogenic features at Old Silver Beach – Public include split rail fencing and a wooden walkway along the handicap path to the beach (Figure 9), and a system of wooden retaining walls and split rail fencing around the landward edge of the dunes in the “Chute” parking area. Two sets of concrete stairs and a gently sloping sandy area near the concession building provide access from the parking area to the beach. A permanent lifeguard stand is also located at the edge of the parking lot. Storm water drainage is managed through a system of 6 catch basins located at the western edge of the main parking lot and 1 located near the end of the “Chute” parking lot. The sanitary waste system for the concession was installed in 1972 when the building was relocated, and then upgraded again in 1986. The Town of Falmouth maintains flood insurance policies with the National Flood Insurance Program (NFIP) for both of the Old Silver Beach bathhouse/concession buildings.

### *2.2.3 Public Beach Services*

Old Silver Beach – Reserved is open for those with resident beach stickers only, while Old Silver Beach – Public is open to both residents with beach stickers, as well as the general public on a fee basis. The Reserved beach parking lot provides 90 spaces and the Public beach lot provides 313 parking spaces. Additional parking spaces are available for either beach in the overflow parking area across Quaker Rd. On average, the ratio of beach area to parking spaces provides 803 sq ft of beach per vehicle at Old Silver – Reserved, and only 203 sq ft per vehicle on the Public side. Handicap parking is available and clearly marked at all lots. The parking area gates are open from 9:00 AM to 9:00 PM during the summer season. The gates remain open 24 hours a day during the winter months, with the exception of the overflow area which is permanently closed during the winter. During the summer beach season, the parking lots are staffed with 6 to 7 attendants for checking beach stickers, collecting fees, and directing traffic. Lifeguards are also on duty from 9:00 AM to 5:00 PM during the summer season (6 to 7 lifeguards). The Beach Committee also hires a policeman to help direct traffic near the crosswalk on Quaker Rd. During busy weekends a second policeman is provided by the Town.

The concession/bathhouse buildings at both Old Silver Beach areas have permanent indoor bathrooms. Because of the limited capacity of the bathroom facilities at Old Silver Beach – Reserved, 1-2 portable restrooms are also provided. Shower facilities are located outside both bathhouse buildings. Food concession services are also provided by private vendors at both beaches, operating under seasonal contracts issued by the Beach Committee. Both beaches have 1 recycling bin and 6 trash bins that are serviced during

the summer; one trash bin remains at each beach during the winter season. Mutt mitt stations are also provided at both beaches.

### **2.3 CHAPOQUOIT BEACH**

Chapoquoit Beach is located in the village of West Falmouth on Chapoquoit Road (Figure 2). The beach is bound to the west by the open waters of Buzzards Bay, and to the east by Chapoquoit Road and West Falmouth Harbor. The property to the north of Chapoquoit Beach is owned by Chapoquoit Associates; this undeveloped beach parcel is leased to the Town of Falmouth and used as an extension of the public beach area. Bowerman's Beach Club abuts Chapoquoit Beach to the south.

#### *2.3.1 Natural Features and Coastal Processes*

The town-owned public beach parcel is approximately 2.5 acres in size, including both the beach and parking lot areas. The adjacent Chapoquoit Associates parcel adds another 0.4 acres for use by the public. Resources at Chapoquoit Beach include Coastal Beach, Coastal Dune, and Barrier Beach (Map 4, Appendix A). Chapoquoit Beach is also located within the Town of Falmouth Black Beach/Great Sippewisset Marsh District of Critical Planning Concern (DCPC). The Coastal Beach resource extends the length of the property, while the Coastal Dune is located south and west of the parking lot (Figure 13). The dune resource is contiguous with a larger Coastal Dune that extends to the south onto the Bowerman's Beach Club property. The western portion of the Coastal Dune is vegetated with beach grass, while the eastern part of the dune closest to Chapoquoit Rd. contains woody species of beach plum, bayberry, and poison ivy. The Barrier Beach resource is made up of both the Coastal Beach and Coastal Dune areas. Sediments on the beach are composed of medium-grained sand with a mean particle size of 0.43 mm (Appendix B). Finer-grained sands are found within the dune areas.



**Figure 13. Public beach at Chapoquoit showing Coastal Beach and Coastal Dune resources.**

The elevation of the parking lot at Chapoquoit Beach ranges from 9 to 11 ft NGVD. The elevation at the crest of the seawall/revetment is 11.6 ft NGVD. The backshore portion of the beach in front of the revetment is extremely narrow, averaging only 15 to 20 ft wide (CB2, Appendix C). Seaward of the berm, the foreshore area between mean high water and mean low water slopes steeply at 3 to 4%. Further to south beyond the end of the revetment, the beach is much wider and has a gentler slope (CB1, Appendix C). This



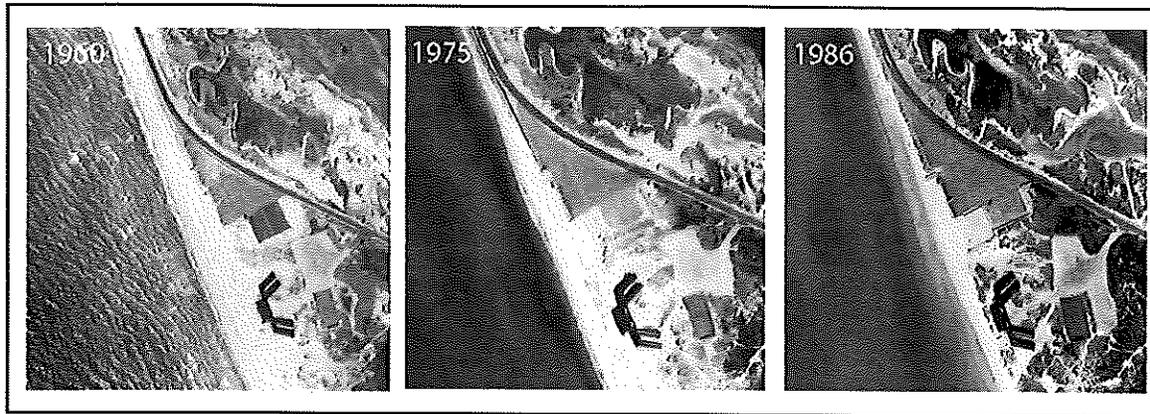


**Figure 15. Historical shoreline change from 1845 to 2005 for Chapoquoit Beach.**

### 2.3.2 Anthropogenic Features

Anthropogenic alterations at Chapoquoit Beach began with installation of the concrete seawall along Chapoquoit Road, sometime prior to 1950. Although early records are not available to determine exactly when the seawall was built, aerial photographs indicate that the wall and a portion of the public beach parking lot were in place by 1950. The seawall design included a poured concrete wall with removable timber slats at the top to control wave runup and overtopping. Use of the timber slats was discontinued many years ago. By 1960, the parking lot had been extended to the south to its present configuration, and the stone revetment that protects the end of the parking area was in place (Figure 16). Since this time, few other anthropogenic alterations have been made to the site. Comparison of the 1960, 1975, and 1986 aerial photographs clearly illustrate the loss of beach in this area (Figure 16).

Other anthropogenic features at Chapoquoit Beach include sand fencing around the Coastal Dunes immediately adjacent to the “L” portion of the beach (Figure 13). Wooden retaining walls have also been installed to contain the dunes along the south side of the parking lot, and a small wooden wind fence is located at the landward edge of the “L”. A concrete storage vault for rescue equipment built in 1992, is located on the beach in the northeast corner of the “L”, and a single catch basin to contain storm water is located at the southern end of the parking lot. Beach access at the northern end of the parcel is provided by a set of wooden stairs that were rebuilt in 2007, along with a set of concrete stairs that have been in place since the 1960s. Access to the “L” portion of the beach is provided by a break in the fencing at the edge of the parking lot. A permanent lifeguard stand is located on the parking lot near the concrete stairway.



**Figure 16. Historical aerial photographs from 1960 to 1986 showing the early development of Chapoquoit Beach.**

### *2.3.3 Public Beach Services*

Chapoquoit Beach is open for those with resident beach stickers only. The Town provides a 108 space paved parking lot that is open during the summer from 9:00 AM to 9:00 PM. On average, the ratio of beach area to parking spaces provides 567 sq ft of beach per vehicle. During the winter months the parking lot is open 24 hours a day, 7 days a week. Handicap parking areas are available and clearly marked. The parking lot is staffed by 1-2 attendants during the summer months, who are responsible for checking beach stickers and directing traffic. The Town also staffs the beach with 3 lifeguards during the summer season from the hours of 9:00 AM to 5:00 PM. Portable restrooms are provided and serviced during the summer months. Shower facilities are not available at Chapoquoit Beach. A mobile food concession serving ice cream also visits the beach on a regular daily basis during the summer months. Chapoquoit Beach has 1 recycling bin and 3 trash bins that are serviced during the summer; one trash bin remains at the beach during the winter season. A mutt mitt station is also provided for dog walkers, who are allowed to use the beach from October 1 through April 30.

## **2.4 WOOD NECK BEACH**

Wood Neck Beach is located in the village of Sippewisset at the end of Wood Neck Road (Figure 2). The beach is bound to the north by the Little Sippewisset tidal creek and the development of Saconneset Hills beyond. Undeveloped properties to the south of Wood Neck Beach are owned by the Sippewisset Highlands Beach Trust and the Salt Pond Bird Sanctuaries; a number of privately developed properties also abut the south side of the Town-owned land at Wood Neck Beach. The Little Sippewisset salt marsh and tidal creek system lie to the west Wood Neck Beach.

### *2.4.1 Natural Features and Coastal Processes*

The Wood Neck Beach area encompasses approximately 5.2 acres, including the beach and parking lot areas. The adjacent Little Sippewisset salt marsh and tidal creek system account for another 13.7 acres of Town-owned land. Wetland resources at Wood Neck Beach include Coastal Beach, Coastal Dune, Barrier Beach, and Salt Marsh (Map 5, Appendix A). The Coastal Beach and Dune resources extend the length of the property

to the west of the parking area (Figure 17). Additional areas of Coastal Dune are located east of the parking area along the edge of the Salt Marsh (Figure 17). Dune vegetation consists of beach grass and woody species such as beach plum and bayberry. The Barrier Beach is made up of both the Coastal Beach and Coastal Dune resources, and also includes the parking area. All of Wood Neck Beach and the associated Little Sippewissett marsh system are mapped as Estimated and Priority Habitat by the NHESP (12<sup>th</sup> Atlas, 2007). According to the NHESP, Roseate Tern and Eastern Box Turtle species have been found in the vicinity of Wood Neck Beach (Map 5, Appendix A).



**Figure 17. Public beach at Wood Neck showing Coastal Beach, Coastal Dune and Salt Marsh resources.**

Sediment characteristics at Wood Neck Beach vary as a function of location. The intertidal portion of the beach contains a mixture of gravel and sand with a few cobbles (Figure 17). The backshore and dune areas contain medium-grained sand with a mean particle size of 0.39 mm (Appendix B). Finer-grained sands are located in the tidal flats offshore and along the marsh side of the barrier.

The elevation of the parking area at Wood Neck Beach is approximately 6 to 7 ft NGVD. The crest of the primary dune at the southern end of the beach reaches a maximum of 14.5 ft NGVD (WN1, Appendix C), while the dune crest to the north is lower with an average elevation of 9.8 ft NGVD (WN2-WN3, Appendix C). The backshore beach above high tide is relatively narrow at Wood Neck Beach, ranging between 30 and 50 ft wide. Beach slopes in this area are between 7.0 and 10.0%. One of the most distinguishing characteristics of Wood Neck Beach is the wide foreshore, or intertidal





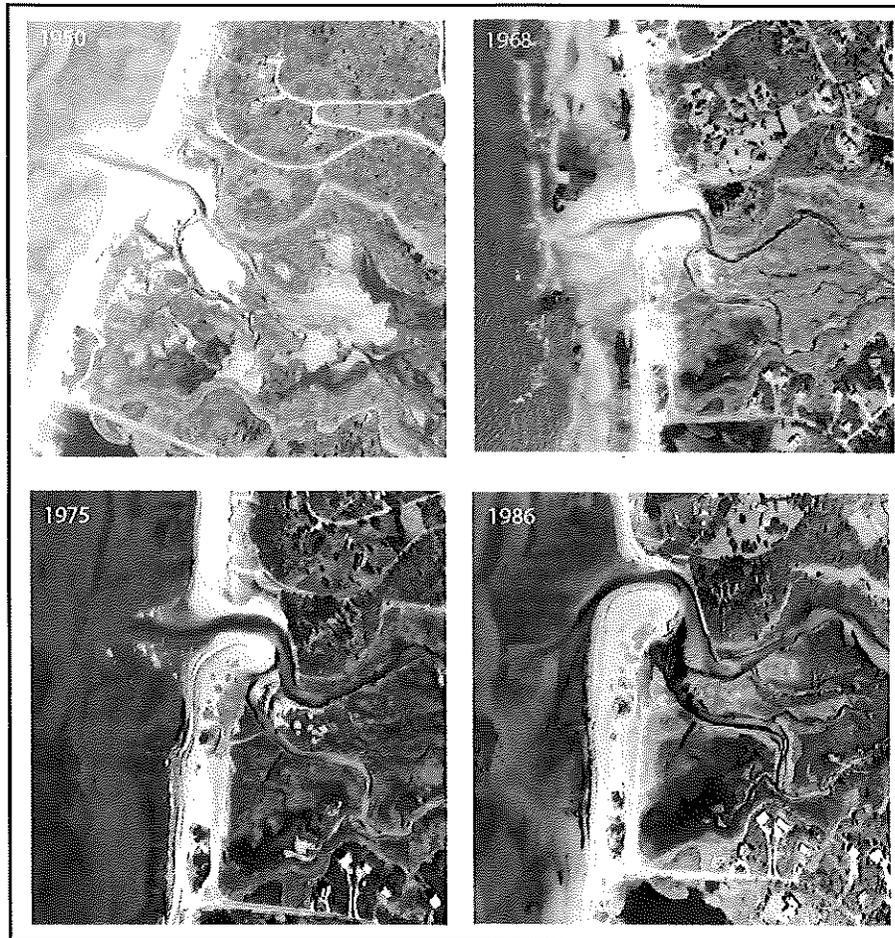
Figure 19. Historical shoreline change from 1845 to 2005 for Wood Neck Beach.

#### 2.4.2 Anthropogenic Features

Anthropogenic alterations to Wood Neck Beach have been limited to formation of the parking area, fencing, and various projects to nourish the beach and restore the dunes. Historical aerial photography suggests that the parking area was constructed sometime between 1960 and 1968 (Figure 20). Prior to 1968, a series of footpaths were used to access the beach from the end of Wood Neck Rd. The original natural surface parking area was constructed on the landward side of the barrier, and has essentially remained in this location for the past 40 to 45 years. Sand fencing to control foot traffic and promote dune growth has been installed at various locations over the years. Currently, sand fencing exists along the edges of the three beach access paths through the dunes. Sand fencing is also located along the landward side of the dune closest to Little Sippewissett Creek and along a portion of the central dune that faces Buzzards Bay (Figure 17). Several programs involving beach and dune restoration have been completed at Wood Neck Beach, generally in response to storm-generated erosion. The two most recent restoration projects were completed in 1992 following Hurricane Bob, 2006 following the storm of Dec. 9, 2005.

#### 2.4.3 Public Beach Services

Wood Neck Beach is open for those with resident beach stickers only. The Town provides a natural surface parking area for approximately 80 vehicles that is open during the summer from 9:00 AM to 9:00 PM. On average, the ratio of beach area to parking spaces provides 990 sq ft of beach per vehicle. During the winter months the parking lot is open 24 hours a day, 7 days a week. Handicap parking areas are available and clearly marked. The parking lot is staffed by 1-2 attendants during the summer months, who are responsible for checking beach stickers and directing traffic. The Town also staffs the beach with 4 lifeguards during the summer season from the hours of 9:00 AM to 5:00 PM. Portable restrooms are provided and serviced during the summer months. Shower



**Figure 20. Historical aerial photographs from 1950 to 1986 showing the early development of Wood Neck Beach.**

facilities are not available at Wood Neck Beach. A mobile food concession serving ice cream also visits the beach on a regular daily basis during the summer months. Wood Neck Beach has 1 recycling bin and 2 trash bins that are serviced during the summer; one trash bin remains at the beach during the winter season. A mutt mitt station is also provided near the entrance to the beach.

## **2.5 SURF DRIVE BEACH**

Surf Drive Beach is the closest public beach to the center of Falmouth, stretching for nearly 0.5 miles along the shoreline of Vineyard Sound (Figure 2). The beach is bound to the north by Surf Drive and a number of privately-owned properties developed primarily as summer residences. The western end of the beach abuts a number of seasonal beach cabanas that lie on the Barrier Beach fronting Salt Pond. Other privately-owned property abuts Surf Drive Beach to the east.

### *2.5.1 Natural Features and Coastal Processes*

The public beach at Surf Drive is approximately 6.9 acres in size, including both the beach and parking lot. The auxiliary parking area at the end of Mill Rd. adds another 1.0 acres of town-owned land to the Surf Drive Beach facility. Wetland resources include

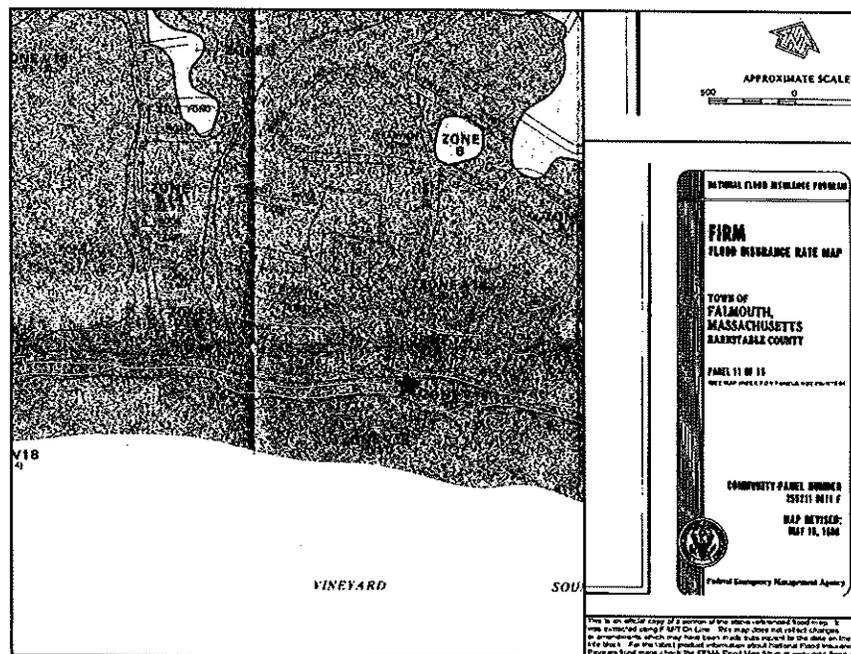
Coastal Beach, Coastal Dune, Barrier Beach, and Banks of or Land Under Fish Runs (Map 6, Appendix A). The Coastal Beach resource extends the length of the public beach, while the Coastal Dune resource is located west of the parking lot and bathhouse/concession building (Figure 21). Vegetation on the seaward side of the dunes is primarily beach grass with woody species of beach plum growing on the landward side of the dunes. Access paths through the dunes have been formed at 5 locations along the beach. The Barrier Beach resource is located at the extreme western end of Surf Drive, beyond the intersection with Mill Rd (Map 6, Appendix A). The small inlet to Fresh River and Siders Pond is a herring run, and therefore is classified as Banks of or Land Under Fish Runs. Sediments from the backshore portion of Surf Drive Beach are composed of coarse-grained sand with a mean particle size of 0.96 mm (Appendix B). Lower on the beach within the intertidal area, the sediments contain a greater percentage of gravel, intermixed with the coarse-grained sand.



**Figure 21. Public beach area at Surf Drive (west to east) showing Coastal Beach and Coastal Dune resources and the bathhouse/concession building.**

The elevation of the roadway along Surf Drive Beach ranges from 5.0 to 6.5 ft NGVD, generally increasing from west to east. The dune and beach areas west of the Fresh River inlet show some important differences from the dune and beach areas east of the inlet. To the west of Fresh River, the dune crest is approximately 2 ft lower than the dune crest east of the inlet. Maximum dune elevations near the end of Mill Rd. are about 7.8 ft NGVD as compared with the 9.4 ft NGVD dune crest elevations east of Fresh River (SD1-SD2, Appendix C). Dune widths also increase from west to east along Surf Drive Beach. The backshore beach above high tide is relatively narrow on both sides of the inlet, and the foreshore beach slopes gradually at 10 to 12%. The area of Surf Drive Beach east of the bathhouse/concession building in the vicinity of the “kiddie pool” is significantly different. The beach starts at the edge of the parking lot near elevation 6.0 ft NGVD, and extends between 50 and 100 ft seaward to the mean high water line (SD3, Appendix C). The two stone groins in the “kiddie pool” area curve towards each other, forming a protected pool along the shoreline where the beach is relatively stable. Further to the east, the beach decreases in width, until it eventually pinches out at the property line, adjacent to a rip rap revetment.

FEMA storm surge predictions for the south shore of Falmouth are lower than the Buzzards Bay shoreline (FEMA, 1986). For the 10-, 50-, and 100-yr storm events, the stillwater elevations given by FEMA are 5.3, 9.0, and 11.0 ft, respectively. Given these elevations, it is expected that much of the Surf Drive Beach area, including the western dunes and the parking lot and bathhouse/concession building will be inundated during a 10-yr storm event and greater. During a 100-yr storm event, the FEMA FIRMs show all of Surf Drive Beach to be located in a V-zone with base flood elevations of 13 to 14 ft NGVD (Figure 22). In fact, the V-zone designation extends nearly 250 ft north of Surf Drive into areas currently developed with seasonal residences. These areas can be expected to sustain severe flooding and storm damage during a 100-yr magnitude storm.



**Figure 22. FEMA FIRM showing flood zone designations for Surf Drive Beach.**

Historical evolution of the shoreline at Surf Drive Beach from 1845 to 2005 is illustrated in Figure 23. At most locations, the data show accretion of the shoreline during the early period from 1845 to 1938. This was a period when the coastline was in a more natural state without coastal engineering structures, and there was an abundance of sediment in the longshore transport system. Since 1938, when armoring of the shoreline became more popular, the shoreline at Surf Drive Beach has been experiencing a steady trend of erosion (Figure 23). Rates of shoreline change from 1938 to 2005 range from -0.5 to -1.6 ft/yr. The highest rates of erosion have occurred in front of the Surf Drive bathhouse/concession building, which is immediately west of the groins that form the “kiddie pool”. Long-term trends of shoreline change have been more variable within the “kiddie pool”, showing both accretion and erosion.

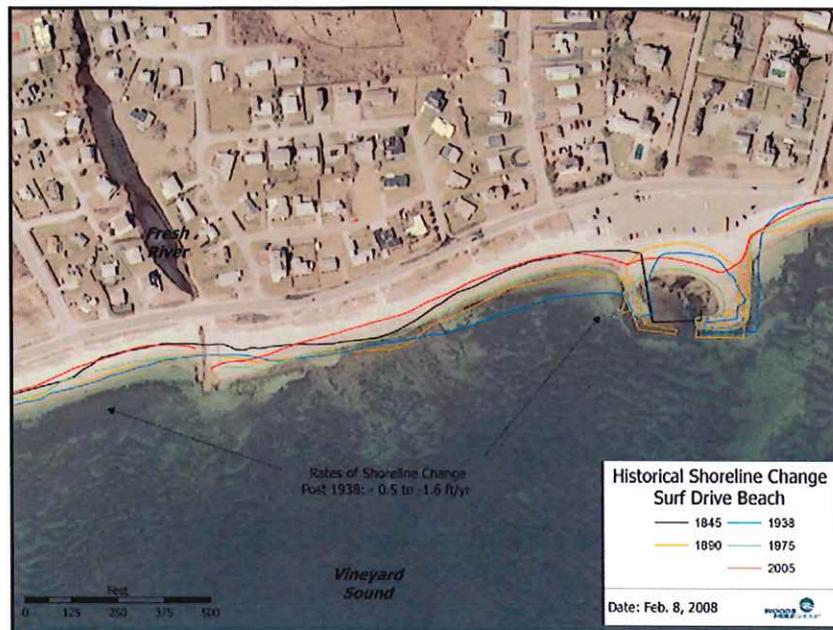


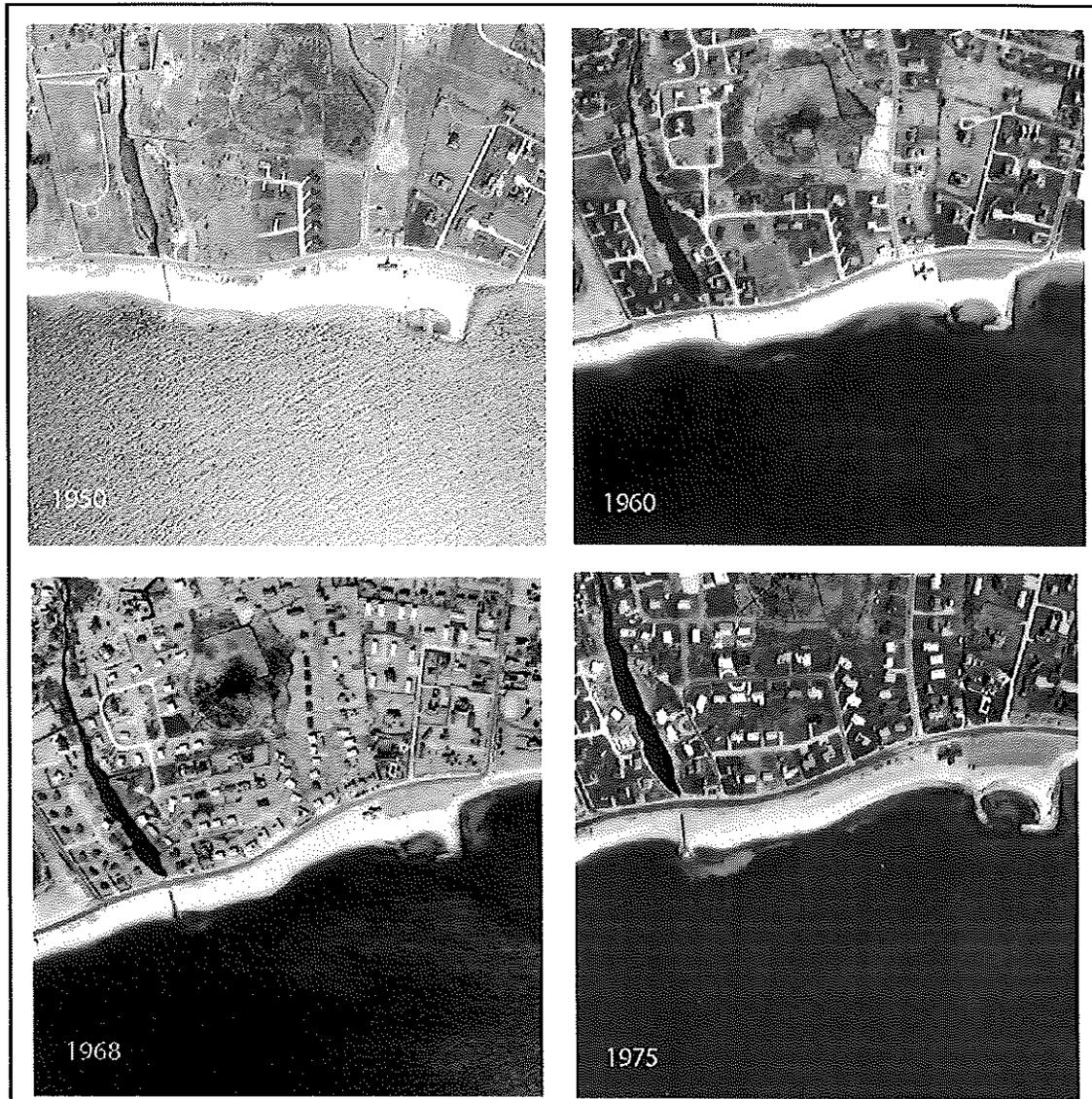
Figure 23. Historical shoreline change from 1845 to 2005 for Surf Drive Beach.

Surf Drive Beach is located within a longshore transport system that stretches for more than 3.5 miles from Nobska Point to Falmouth Heights. Although the dominant direction of sediment transport along the south shore of Falmouth is generally from west to east, the Surf Drive Beach area actually falls within a small reversal zone where net transport is from east to west. One of the strongest indicators of this reversal is the accumulation of sediment on the eastern (updrift) sides of jetties and groins, and erosion on the western sides of the structures. The reversal zone appears to extend from the eastern end of Surf Drive Beach to a point near the Trunk River inlet. On any given day sand moves in both directions along Surf Drive Beach depending on the direction of wave approach; however, the net direction of sediment transport is likely from east to west.

### 2.5.2 Anthropogenic Features

Aerial photographs shown in Figure 24 indicate that the Surf Drive bathhouse/concession building and paved parking lot were in place by 1950. The stone groins that form the “kiddie pool” were also in place by this time, as was the concrete seawall and apron that

protects the eastern end of the beach at the end of Shore St. Fresh River drained through a culvert under Surf Drive and then through a natural channel across the beach. Few changes occurred between 1950 and 1960, although some beach erosion is evident. By 1968, the stone jetties at the entrance to Fresh River were installed (Mass DPW Contract No. 2463), and have remained in place since this time. By 1975, downdrift erosion to the west of the Fresh River jetties is apparent. Several dune restoration projects have been implemented along Surf Drive Beach, beginning in the mid-1960s, and again in 1991 following Hurricane Bob.



**Figure 24. Historical aerial photographs from 1950 to 1975 showing the early development of Surf Drive Beach.**

Other anthropogenic features at Surf Drive Beach include sand fencing along the edges of the 5 dune access paths, along with a wooden retaining wall that contains the dune closest to the bathhouse. A 3 to 4 ft high wooden wind fence has also been erected between the parking lot and the beach area, primarily to minimize wind blown transport to the parking

lot (Figure 21). Several sections of split rail fencing are located at the eastern end of the parking area where Shore St. merges with Surf Drive. The sanitary waste system for the bathhouse/concession building feeds into the Town of Falmouth municipal sewer system, and mechanical components associated with this system are located behind a fenced area along the north edge of the parking lot. A single catch basin is also located in the parking lot between the bathhouse building and the roadway.

### *2.5.3 Public Beach Services*

Surf Drive Beach is open to residents with beach stickers as well as the general public on a fee basis. The main parking lot provides 145 spaces and the natural surface parking area at Mill Rd. provides an additional 100 spaces. When combining the parking areas, the ratio of beach area to parking spaces provides 676 sq ft of beach per vehicle. Handicap parking is available and clearly marked at both lots. The parking area gates are open from 9:00 AM to 9:00 PM during the summer season. The gates remain open 24 hours a day during the winter months. During the summer beach season, the parking lots are staffed with attendants (1 - main lot, 1 - Mill Rd.) for checking beach stickers, collecting fees, and directing traffic. A total of 6 lifeguards are also on duty from 9:00 AM to 5:00 PM during the summer season.

The concession/bathhouse building at Surf Drive Beach houses the administrative offices for the Beach Department; however its use as office space is typically limited to the summer months. The building has permanent indoor bathrooms and shower facilities. Food concession services are provided by a private vendor that operates under a seasonal contract issued by the Beach Committee. Surf Drive Beach has 1 recycling bin and 7 trash bins that are serviced during the summer; one trash bin remains during the winter season. Mutt mitt stations are also provided at both ends of the beach.

## **2.6 FALMOUTH HEIGHTS BEACH**

Falmouth Heights Beach is located on Grand Ave., to the west of Falmouth Inner Harbor (Figure 2). The beach is bound to the south by the open waters of Vineyard Sound and to the west by the Casino Wharf beachfront condominium facility. The Falmouth Heights ballpark and a number of commercial establishments are located across Grand Ave. to the north. Privately developed properties abut Falmouth Heights Beach to the east.

### *2.6.1 Natural Features and Coastal Processes*

The public beach parcel at Falmouth Heights is slightly larger than 5.0 acres, including the beach, parking area, and esplanade area. The only wetland resource on site is a Coastal Beach, which extends the entire length of the property (Map 7, Appendix A; Figure 25). The esplanade area between the beach and Grand Ave., is vegetated with grasses, and a small sitting garden with native shrubs is located near the western end of the esplanade. Sediments on the beach are composed primarily of coarse-grained sand with a mean particle size of 0.83 mm (Appendix B). In general, these coarse-grained sediments are uniformly distributed across the beach.



**Figure 25. Public beach area at Falmouth Heights showing Coastal Beach resource, concrete seawall, and esplanade.**

The elevation of Grand Ave. in the vicinity of Falmouth Heights Beach is between 10 and 11 ft NGVD. The topography of the parking lot, esplanade, and sidewalk slopes down gently towards the concrete seawall. The elevation at the crest of the seawall is 9.0 ft NGVD (FH1-FH2, Appendix C). The beach near the toe of the seawall ranges in elevation from 4.0 to 6.0 ft NGVD, which leaves 3 to 5 ft of the seawall face directly exposed. The backshore portion of the beach between the seawall and the berm is nearly flat and ranges in width from 50 to 60 ft wide. Beyond this, the foreshore extends for another 50 ft at a gradual slope of 12 to 13%.

FEMA's predicted elevation of 5.3 ft NGVD for stillwater flooding during a 10-yr storm indicates that the Falmouth Heights seawall (9.0 ft NGVD) will provide protection from storm surge during a 10-yr event and lower. However, wave runup and overtopping will likely result in water ponding within low areas behind the wall. The crest of the seawall is at or below the predicted elevations for the 50- and 100-yr storm, and as such significant storm surge can be expected with these larger events. The FEMA FIRMs show the beach areas beyond the seawall to be in a V-zone with a base flood elevation of 14 ft NGVD (Figure 26). The esplanade, parking lot, and land areas within the first block of Grand Ave. are within an A-zone with a base flood elevation of 12 ft NGVD.

Historical evolution of the shoreline at Falmouth Heights Beach from 1846 to 2005 is illustrated in Figure 27. The data show significant variations in shoreline position with time, although no clear trends of erosion or accretion. During the late 1800s the beach

appears to have accreted to a position close to the present day shoreline, and then eroded again by 1938. Installation of the stone groins sometime after 1938 allowed the beach to build out as illustrated by the 1975 shoreline. The beach has been nearly stable since 1975, showing minor rates of erosion on the order of -0.2 to -0.5 ft/yr (Figure 27). The Heights Beach is located in a sediment transport system that extends from Falmouth Heights to the entrance of Great Pond. The net direction of transport is from west to east.

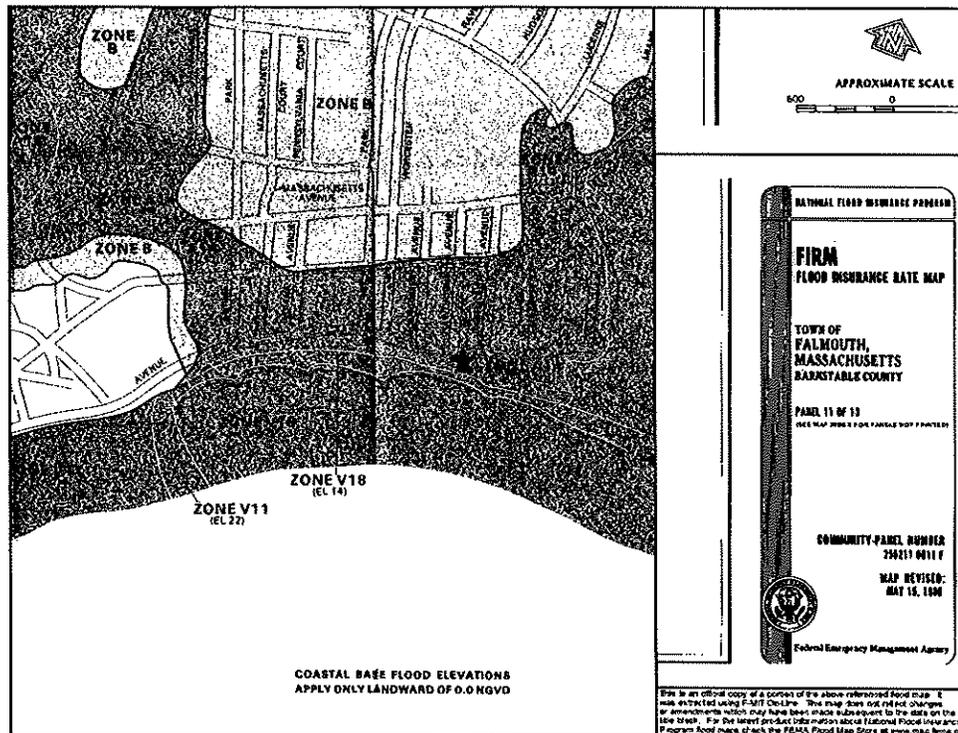


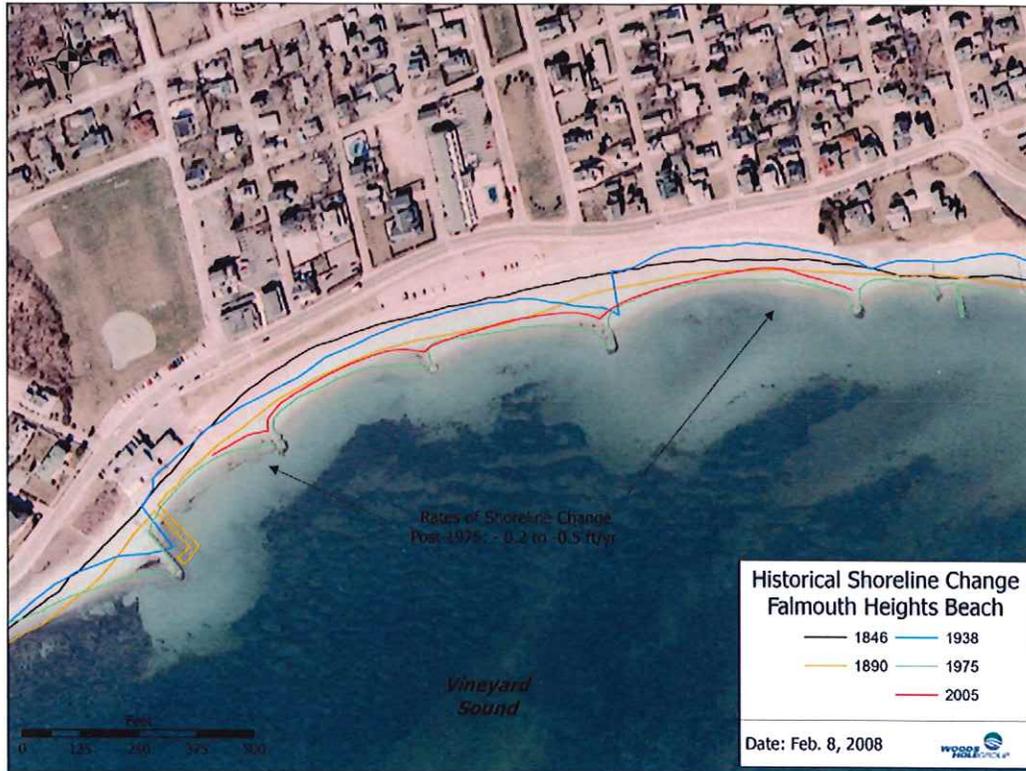
Figure 26. FEMA FIRM showing flood zone designations for Falmouth Heights Beach.

### 2.6.2 Anthropogenic Features

The seawall at Falmouth Heights Beach was built in 1918 as a recurved concrete wall. Approximately 15 to 20 years later, during the mid to late 1930s, the three stone groins were installed. These groins have remained in place since their original installation. Aerial photographs shown in Figure 28 clearly depict the presence of the groins in 1950, along with a severely eroded beach. During the mid to late 1950s dredge material created during the formation of Falmouth Inner Harbor was used to form a beach in front of the bluffs to the west of the public beach. By 1960, easterly transport of this material resulted in the formation of a large beach at Falmouth Heights Beach. The 1960 photograph in Figure 28 illustrates the results of this restoration project. By 1975 the beach had eroded gradually and the existing natural surface parking area was built. Continued erosion of the beach is seen in the 1986 photograph.

Other anthropogenic features at Falmouth Heights Beach include split rail fencing around the edges of the parking area and a concrete sidewalk on the landward side of the seawall. A series of 8 concrete stairways provide access from the parking area and sidewalk to the

beach (Figure 25). The extreme western end of the seawall grades down in elevation to meet the level of the beach, thus providing a gradual ramp for additional beach access. A concrete storage vault built in 1992 and used for rescue equipment is located on the landward edge of the beach adjacent to the seawall.

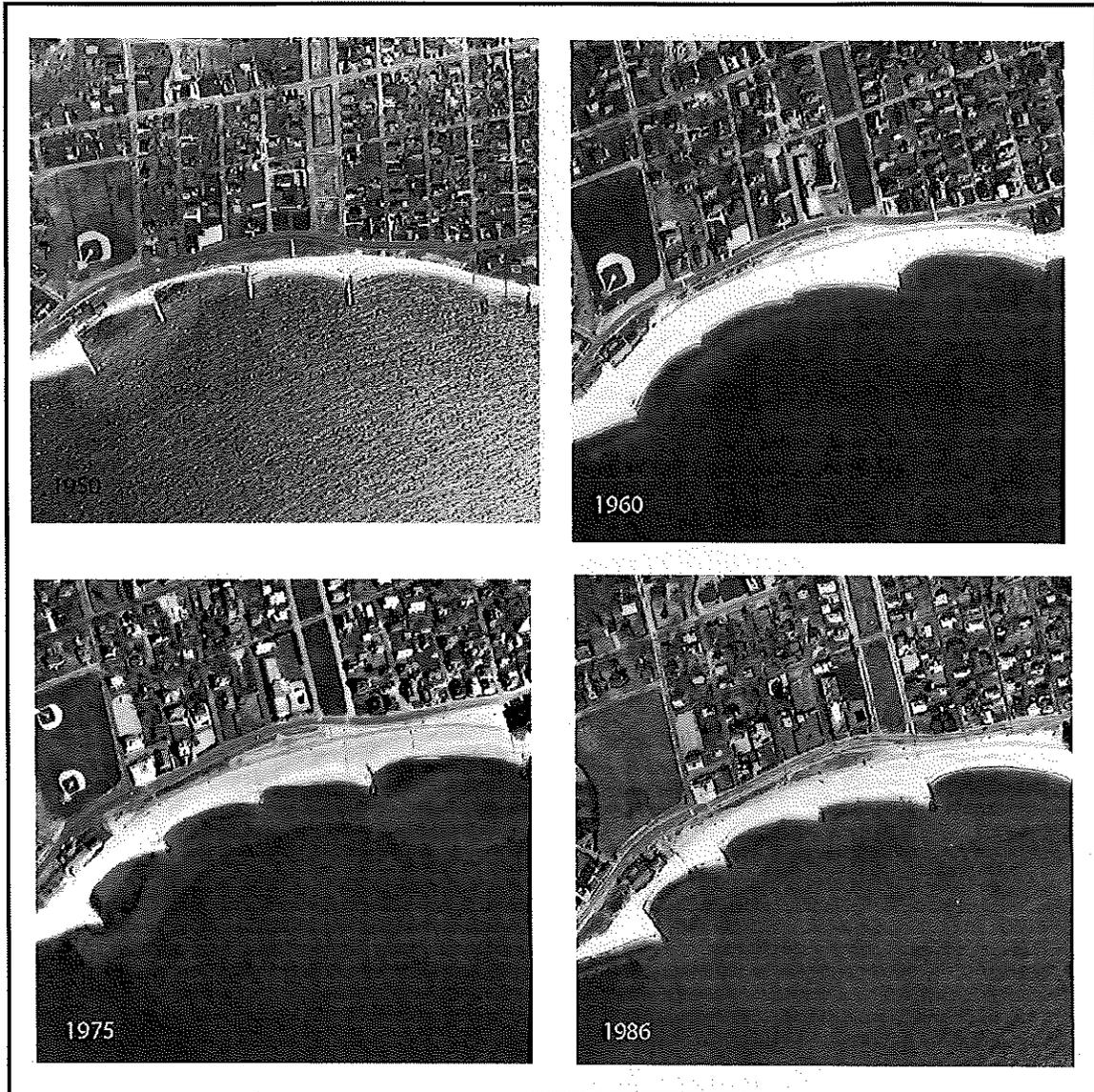


**Figure 27. Historical shoreline change from 1846 to 2005 for Falmouth Heights Beach.**

### 2.6.3 Public Beach Services

Falmouth Heights Beach is open for those with resident beach stickers only. The Town provides a natural surface parking area for approximately 60 vehicles that is open during the summer from 9:00 AM to 9:00 PM. On average, the ratio of beach area to parking spaces provides 2,393 sq ft of beach per vehicle. Because the Heights Beach serves a large population that walks to the beach, the area per visitor is considerably smaller. During the winter months the parking lot is open 24 hours a day, 7 days a week. Handicap parking areas are available and clearly marked. The parking lot is staffed by 1 attendant during the summer months, who is responsible for checking beach stickers and directing traffic. The Town also staffs the beach with 6-7 lifeguards during the summer season from the hours of 9:00 AM to 5:00 PM. Portable restrooms are placed on the beach in front of the seawall and screened with temporary fencing. These facilities are available only during the summer months. A seasonal shower facility is located immediately to the west of the parking area on the edge of the esplanade. A mobile food concession serving lunch and ice cream is also stationed at the beach on a daily basis during the summer. Falmouth Heights Beach has 1 recycling bin and 8 trash bins that are serviced during the summer; one trash bin remains at the beach during the winter season.

Three mutt mitt stations are also provided along the sidewalk area for clean up after dogs, which are allowed on the beach only during the period October 1 through April 30.



**Figure 28. Historical aerial photographs from 1950 to 1986 showing the early development of Falmouth Heights Beach.**

## **2.7 BRISTOL BEACH**

Bristol Beach is located along the south shore of Falmouth on Menauhant Rd (Figure 2). The beach is bound to the south by the open waters of Vineyard Sound and to the north by the Little Pond estuary system. The western and eastern ends of Bristol Beach directly abut privately developed properties.

### *2.7.1 Natural Features and Coastal Processes*

Bristol Beach is approximately 3.7 acres in size, including both the beach and parking lot areas. The public beach is bisected by the tidal inlet to Little Pond, and the two beach

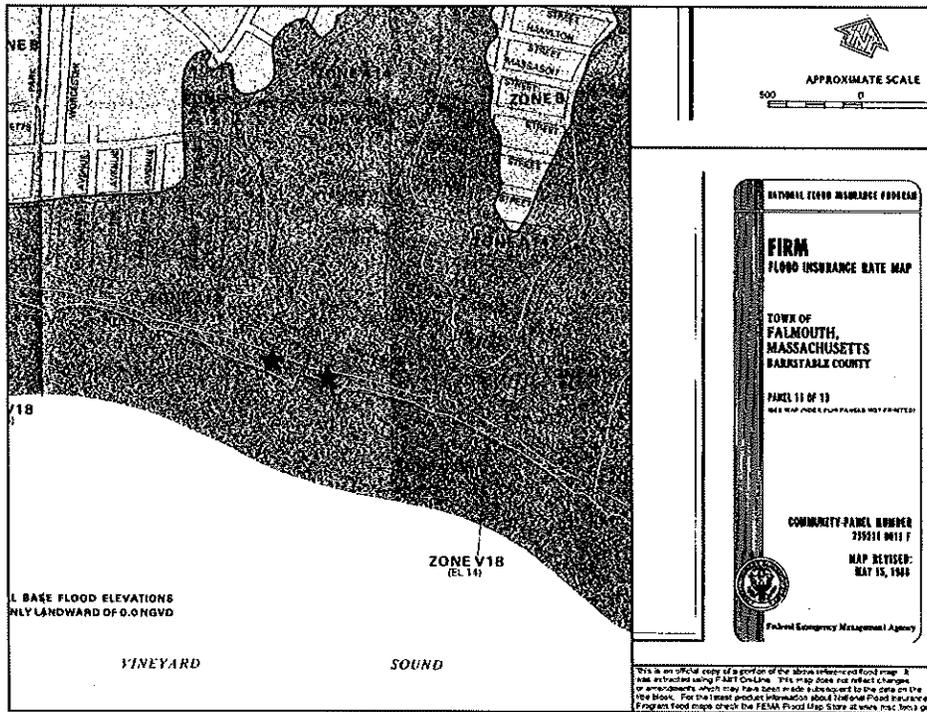
areas and parking lots are connected by a small bridge. Wetland resources include Coastal Beach, Coastal Dune, and Barrier Beach (Map 8, Appendix A). The beach resource extends the entire length of the town-owned property, segmented only by the Little Pond inlet (Figure 29). Coastal Dunes are present on both sides of the inlet, between the beach and the parking lots. Vegetation within the Coastal Dunes consists primarily of beach grass, although the back sides of the dunes also contain beach plum. Because of its location between Little Pond and Vineyard Sound, the entire public beach area is also classified as a Barrier Beach. Sediments on Bristol Beach are composed of coarse-grained sand with a mean particle size of 0.79 mm (Appendix B). In general, these coarse-grained beach sands are uniformly distributed across the site.



**Figure 29. Public beach area at Bristol Beach showing Coastal Beach and Coastal Dune resources.**

The elevation of Menauhant Rd. in the vicinity of Bristol Beach is approximately 5.5 ft NGVD, and the parking lots on either side of the Little Pond inlet range from 5.5 to approximately 8.0 ft NGVD. The dunes are relatively narrow, between 20 and 30 ft wide, with crest elevations of 9.1 to 10.3 ft NGVD (BB1-BB2, Appendix C). The higher dunes are located on the west side of Little Pond inlet. The backshore portion of the beach starts near elevation 6.8 ft NGVD and extends seaward for 45 to 60 ft to the edge of the berm at elevation 4.9 ft NGVD. From here, the beach slopes gradually at 11 to 14% for a distance of 60 to 70 ft to areas below mean low water.

Given the average roadway elevation of 5.5 ft NGVD as compared with FEMA’s predicted elevation of 5.3 ft NGVD for stillwater flooding during a 10-yr storm, it is likely that portions of Menauhant Rd. in the vicinity of Bristol Beach will be flooded starting with storms of 10-yr magnitude and greater. Because of their higher elevation, the beach and dunes provide some protection from the 10-yr storm, with flooding of the roadway occurring from the Little Pond side of the barrier beach. During the 100-yr storm event the FEMA FIRMs show the entire barrier beach at Bristol Beach to be located with a V-zone (Figure 30). Base flood elevations range from 14 ft NGVD on the front side the beach to 13 ft NGVD across Menauhant Rd. and into Little Pond.



**Figure 30. FEMA FIRM showing flood zone designations for Bristol Beach.**

Historical evolution of the shoreline at Bristol Beach from 1846 to 2005 is illustrated in Figure 31. The data show that the beach has experienced significant variations in shoreline position over the years, due in part to man-made influences. Between 1846 and 1890, the shoreline accreted, and was significantly further seaward than the present day shoreline at the eastern end of the beach. By 1938 the shoreline had eroded back to a position near the present day dunes. Installation of the Little Pond jetties and several groins resulted in sediment accumulation along Bristol Beach, and by 1975 the shoreline had built out nearly 100 ft from its previous 1938 position. Since 1975, the shoreline on the western side of the beach has eroded an average of -1.5 ft/yr, while the eastern shoreline adjacent to the inlet has accreted slightly (+0.2 ft/yr). At the far eastern end of the beach (“blanket beach”) in front of the revetment, the shoreline lies at the toe of the revetment, and a beach does not exist, even at low tide. Historical data shown in Figure 31 indicate that the shoreline has been in this same location at the eastern end of the beach since 1938. Bristol Beach is located in the same sediment transport system as Falmouth Heights Beach; net directions of transport are from west to east.

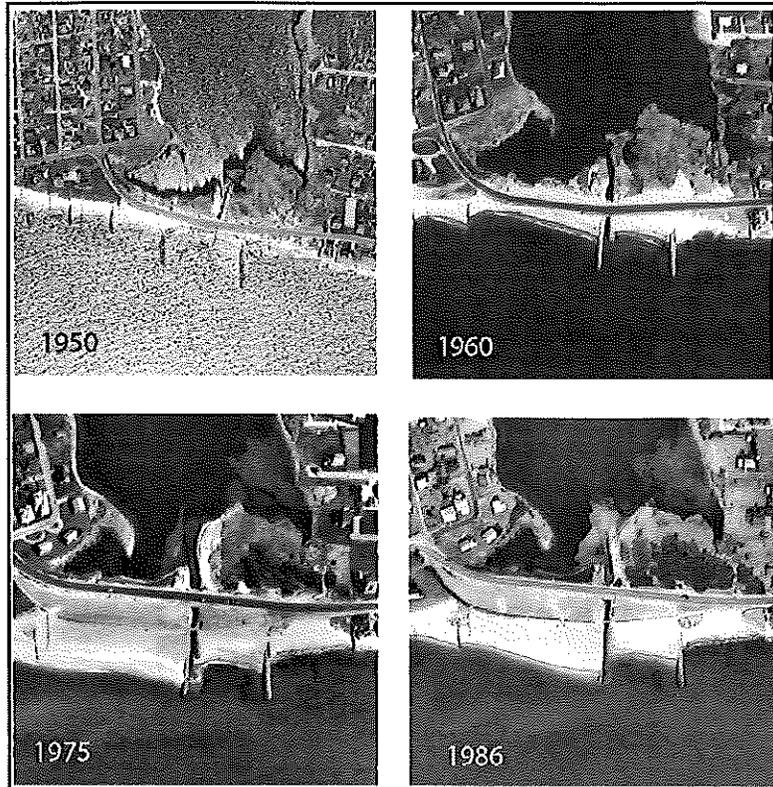


**Figure 31. Historical shoreline change from 1846 to 2005 for Bristol Beach.**

### 2.7.2 Anthropogenic Features

A number of anthropogenic changes have taken place at Bristol Beach over the years. Sometime before 1950, two stone groins were built to stabilize the beach, and portions of the concrete seawall at the eastern end of the beach were also in place (Figure 32). A number of groins were also in place along private properties to the west. Following Hurricane Carol in 1955 the jetties protecting the entrance to Little Pond were installed and one of the previously existing groins was dismantled (western groin). The beach was also widened to protect Menauhant Rd (Mass DPW Contract No. 1464). The design for the inlet structures included a western jetty that was nearly twice as long as the eastern jetty. Also at this time the eastern seawall was badly compromised, allowing tides to influence to the beach area behind the wall. The shoreline west of the inlet was significantly narrower than present day, approaching the edge of Menauhant Rd (Figure 32). By 1975 the paved parking lots at Bristol Beach has been installed and the seawall protecting the “blanket beach” had been reinforced with rip rap. Also at this time the shoreline west of Little Pond had accreted to the end of the jetty. The 1986 photograph shows that the beach remained relatively stable over the 11 year period since 1975.

Other anthropogenic features at Bristol Beach include a wooden retaining wall along the back sides of the dunes, and sand fencing along the edges of the dune access paths (Figure 29). The edges of the parking lot are defined by split rail fencing and sections of guardrail. A storage vault for beach rescue equipment is located in the dunes on the eastern side of the beach. Additionally, two catch basins are located in the eastern parking lot.



**Figure 32. Historical aerial photographs from 1950 to 1986 showing the early development of Bristol Beach.**

### 2.7.3 Public Beach Services

Bristol Beach is open for those with resident beach stickers only. The Town provides two paved parking lots which can handle 112 vehicles; the parking lots are open during the summer from 9:00 AM to 9:00 PM. On average, the ratio of beach area to parking spaces provides 706 sq ft of beach per vehicle. During the winter months the parking lots are open 24 hours a day, 7 days a week. Handicap parking areas are available and clearly marked. The parking lots are staffed by 1-2 attendants during the summer months. The Town also staffs the beach with 3 lifeguards during the summer season from the hours of 9:00 AM to 5:00 PM. Portable restrooms are available at the eastern end of the parking lots during the summer months only. No shower facilities are available at Bristol Beach. A mobile food concession serving ice cream also visits the beach on a regular daily basis during the summer months. Bristol Beach has 1 recycling bin and 3 trash bins that are serviced during the summer; one trash bin remains at the beach during the winter season. Two mutt mitt stations are also provided in the parking lots.

## 2.8 MENAUHANT BEACH – WEST & EAST

The West and East Beaches at Menauhant are located along Menauhant Rd. in the village of East Falmouth (Figure 2). The beaches are bound to the south by the open waters of Vineyard Sound and to the north by the Bournes Pond estuary system. The inlet to Bournes Pond forms the boundary between Menauhant Beach West and East. Privately developed properties abut the beaches to the east and west.

### *2.8.1 Natural Features and Coastal Processes*

The town-owned beach at Menauhant Beach – West is approximately 6.3 acres in size, including the new Haddad parcels that were acquired during 2007. Menauhant Beach – East is considerably smaller at 2.8 acres. Wetland resources at the western beach include Coastal Beach, Coastal Dune, Barrier Beach, and Salt Marsh (Map 9, Appendix A). The Coastal Dune resource is most extensive at the western end of the beach, although a narrow dune still exists along portions of the parking area at Menauhant Beach – West (Figure 33). The Salt Marsh resource is located in the vicinity of the old bridge and tidal inlet to Bournes Pond. Vegetation within the salt marsh consists of phragmites and spartina. Resources at Menauhant Beach – East include Coastal Beach, Coastal Dune, and Barrier Beach (Map 10, Appendix A). The Barrier Beach resource at both beaches includes all Coastal Beach and Coastal Dune areas, as well as the natural surface parking lots. Vegetation on the seaward side of the dunes is primarily beach grass; woody species of beach plum and *rosa rugosa* are on the landward side. The sediments are generally coarse-grained sand with mean particle sizes between 0.82 and 0.75 mm (Appendix B).

The beach profiles collected at Menauhant Beach – West & East show that the entire barrier is relatively low in elevation (MH1-MH2, Appendix C). The roadway and parking areas range in elevation from 6.0 to 7.0 ft NGVD. At both beaches, significant portions of the seaward facing sides of the parking areas are protected by Coastal Dunes; the other sections of parking lot directly abut the Coastal Beach. The dunes range in width from 60 ft on the west side, to approximately 30 ft wide on the eastern side. Maximum elevations along the crest of the dunes are between 10.0 and 11.0 ft NGVD. In areas where the parking areas directly abut the Coastal Beach, maximum elevations are only 6.4 to 7.7 ft NGVD. The width of the beach between the edge of the parking area and/or toe of the dunes, and mean high water, is about 50 ft, with slopes of 11%.

Based on FEMA's predicted elevation of 5.3 ft NGVD for stillwater flooding during a 10-yr storm event, and the low elevation of the beach, it is likely that overwash will occur during storms of 10-yr magnitude and greater. Although the adjacent dunes are above the 10-yr stillwater elevation, they would also experience a significant level of storm damage and erosion. Large portions of Menauhant Rd. in the vicinity of the public beaches would also be flooded. The FEMA FIRM showing flood designations during the 100-yr storm event for the Menauhant Beach area is shown in Figure 34. Even though the FIRM still depicts the Bournes Pond inlet in its pre-1987 location, it is clear that most of the barrier beach, up to and including Menauhant Rd., falls within a V-zone with a BFE of 14 ft NGVD. The landward side of the barrier and much of Bournes Pond is in an A-zone with a BFE of 11 ft NGVD.

Historical evolution of the Menauhant Beach – West & East shorelines is illustrated in Figure 35. The data shows significant variations in shoreline position over the years, largely due to differences in the location of Bournes Pond inlet. During the late 1800s, the location of the inlet was towards the western end of Menauhant Beach, resulting in a progradation of the shoreline as sediment built up at the mouth of the inlet. By 1975, the shoreline had eroded considerably, although a surplus of sediment still existed near the



**Figure 33. Public beach area at Menauhant Beach – West & East showing Coastal Beach and Coastal Dune resources.**

mouth of the inlet at the western end of Menauhant Beach. Between 1975 and 2005 the inlet was relocated from the western end of the beach to its current location. This major engineering project resulted in significant erosion of the shoreline in the area of the previous inlet. Over the 30 year period from 1975 to 2005 the shoreline retreated a maximum of 220 ft, yielding an erosion rate of -7.3 ft/yr. Most of this erosion has taken place since 1992. Rates of erosion decreased towards the east for an average rate of -3.8 ft/yr. Since 1975 the rates of shoreline change to the east of the Bourne Pond inlet have been much more stable than along the western side. The data between 1975 and 2005 indicate a net accretion on the order of +0.5 ft/yr (Figure 35). Menauhant Beach – West & East are located in a sediment transport system that stretches from the entrance to

Great Pond to the Eel River. The net direction of sediment transport is from west to east. Sediment supply to the public beach area has been limited over the years by the installation of numerous groins, revetments, and seawalls.

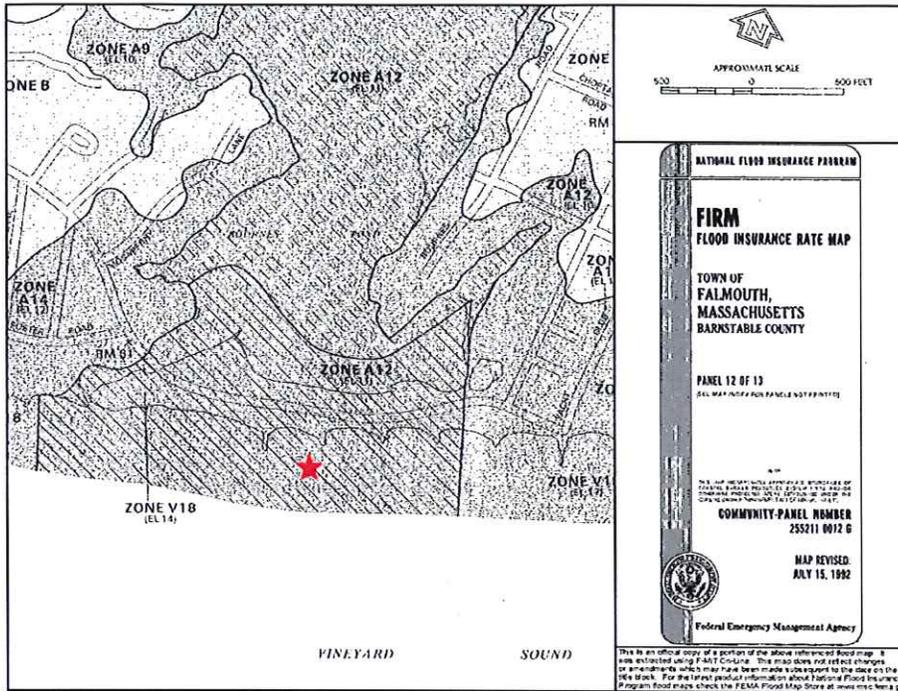


Figure 34. FEMA FIRM showing flood zone designations for Menauhant Beach.

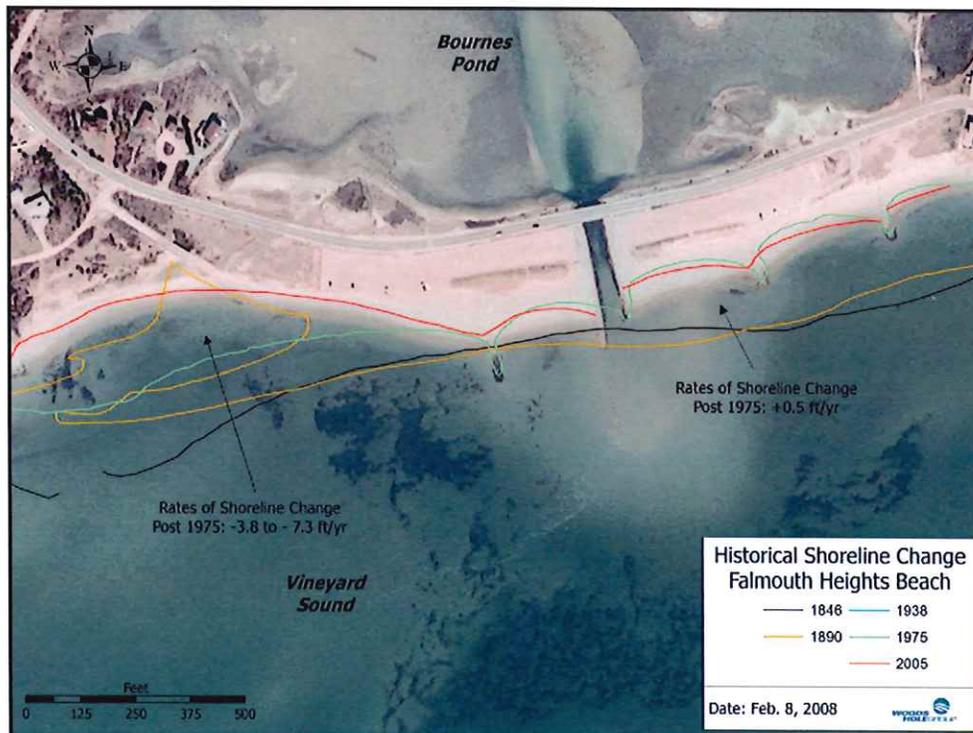


Figure 35. Historical shoreline change from 1846 to 2005 for Menauhant Beach.

### 2.8.2 Anthropogenic Features

Anthropogenic activities at the Menauhant Beach and Bournes Pond area during the late 1900s have been dominated by engineering of the inlet. In the 1950s, the inlet was located near the western end of Menauhant Beach, and a significant effort was underway to control the location and flow of the inlet (Figure 36). Large retaining walls (or seawalls) were installed on the Bournes Pond side of the inlet to channelize the flow, and additional structures were placed on the beach side of the inlet to redirect the flow to the southeast. Also by 1950, a series of 4 stones groins were in place along Menauhant Beach. The width at the eastern end of the beach was extremely narrow at this time, approaching the edge of the roadway. By 1968, the engineering activities at the inlet were complete, and the orientation at the seaward end of the channel was to the southwest as a large spit accumulated east of the channel (Figure 36). Sediment accumulation within the groin field in the 1968 photograph clearly illustrates the net easterly flow of material along this beach. By 1986, the reconstruction of Menauhant Rd. in a more northerly location was well underway. Additionally, the new jetties that would protect the soon to be relocated inlet, were also under construction. The 1991 photograph in Figure 36 shows the existing Bournes Pond inlet near the center of Menauhant Beach, in conjunction with closure of the original tidal inlet.

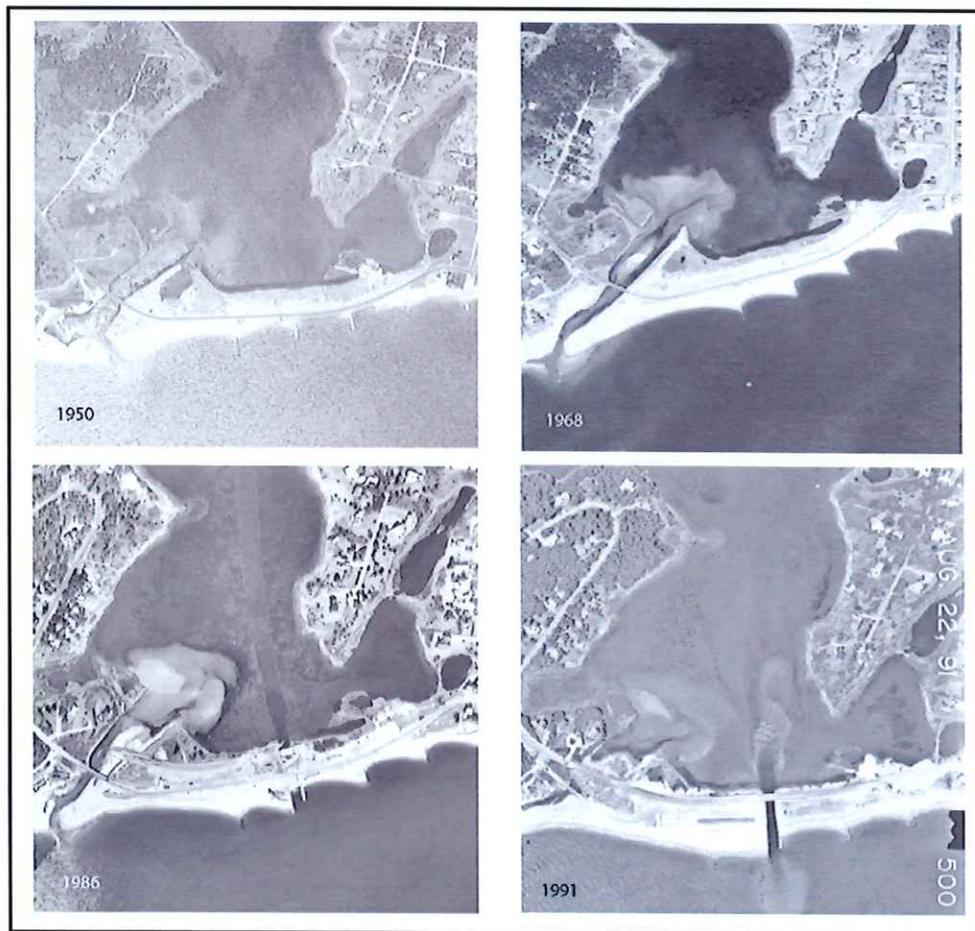


Figure 36. Historical aerial photographs from 1950 to 1991 showing the early development of Menauhant Beach – West & East.

As shown in the 1991 photograph the beach now contains two stone jetties, and two natural surface parking areas. Menauhant Beach – West also contains a stone groin as well as a number of rip rap structures along the shoreline at the newly purchased Haddad property to the west. Menauhant Beach – East contains two stone groins along with the natural surface parking area. Other anthropogenic structures at the beaches include split rail fencing between the parking areas and roadway, and sand fencing around the seaward side of the eastern dunes at Menauhant Beach – East. A storage vault is also located near the southeast corner of the parking area at Menauhant Beach – West.

### *2.8.3 Public Beach Services*

The public beaches at Menauhant Beach – West & East are open to residents with beach stickers as well as the general public on a fee basis. The Town provides two natural surface parking areas for approximately 313 vehicles. On average, the ratio of beach area to parking spaces provides 545 sq ft of beach per vehicle. The parking area at Menauhant Beach – West is open during the summer from 9:00 AM to 9:00 PM, while the Menauhant Beach – East parking area remains open 24 hours a day for use by fishermen. During the winter months both parking areas are open 24 hours a day, 7 days a week. Handicap parking areas are available and clearly marked in both lots. The parking area are staffed by 2-4 attendants during the summer months, who are responsible for checking beach stickers and directing traffic. The Town also staffs the beach with 4 to 6 lifeguards during the summer season from the hours of 9:00 AM to 5:00 PM. Seasonal restrooms and a shower facility are provided in a mobile trailer located at the western end of the parking area at Menauhant Beach – West. These facilities are available only during the summer months. A mobile food concession serving ice cream also visits the beach on a regular daily basis during the summer months. Both beaches at Menauhant have 4 trash bins and 1 recycling bin that are serviced during the summer; two trash bins remain at the beach during the winter season. Three mutt mitt station are also provided near the parking areas for clean up after dogs, which are allowed on the beach only during the period October 1 through April 30.

### 3.0 Management Structure of Falmouth Public Beaches

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### 3.0 MANAGEMENT STRUCTURE OF FALMOUTH PUBLIC BEACHES

The management structure for public beaches within the Town of Falmouth involves a number different departments and personnel. As with many municipal organizations, there are a variety of departments and individuals with different interests in the beach. These interests range from the daily operations of the beach and summer staffing, to facilities maintenance, to conservation and protection of natural resources. As part of this Beach Management Plan, the roles and responsibilities of the various departments working on the public beaches have been identified. This information will be useful in providing coordinated and effective management of the Towns public beach sites, and ultimately for meeting the goal set by the Board of Selectmen for improving the quality of Falmouth Beaches.

#### 3.1 DEPARTMENT ROLES AND RESPONSIBILITIES

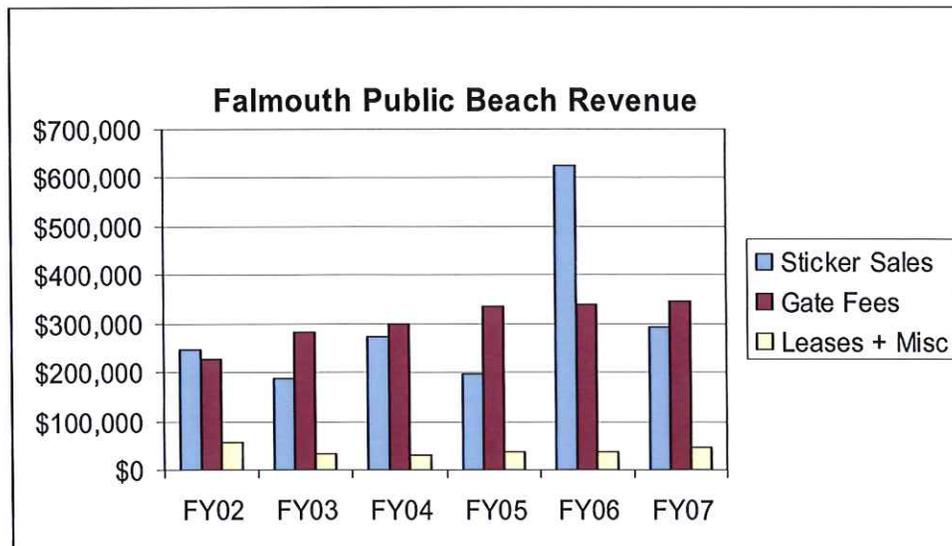
- **Board of Selectmen** - The Board of Selectmen is the chief executive and policy making body for the Town of Falmouth. In relation to operation of the public beaches, the Board is in charge of making decisions on hours of operation, rates for beach stickers and day passes, seasonal dog restrictions, etc. The Board is also responsible for issuing all permits for special use of the public beach properties including weddings and special events. All capital expenses and the Annual Operating Budget for the beaches are also reviewed by the Board of Selectmen.
- **Town Manager** - The Town Manager is the chief administrative officer of the town and is responsible for administering and coordinating all employees, activities and departments within the Town of Falmouth. The Town Manager also implements the goals and carries out the policies of the Board of Selectmen.
- **Beach Department** - The Town of Falmouth Beach Department has the overall responsibility for operating the public beaches. The Beach Department is staffed with a Superintendent and an Assistant Superintendent, and is also guided by a five member, volunteer Beach Committee that is appointed by the Board of Selectmen. The Beach Department controls the budget for items such as office supplies, bathing suits, first aid supplies, rescue equipment, and utilities for the bathhouse/concession buildings. Specific responsibilities of the Beach Department and the Beach Committee include, but are not limited to, the following:
  - day to day operations of the beaches
  - summer staffing of lifeguards and parking attendants
  - lifeguard training
  - advertising and hiring of seasonal concession contracts
  - development and operation of swim lesson program

- environmental permitting required for operation of public beaches
- notification to other town departments (via work order) regarding maintenance needs
  
- **Department of Public Works** – The Department of Public Works (DPW) is responsible for all maintenance activities at the public beaches and for the bathhouse/concession buildings. The DPW Highway Department, Facilities Maintenance Department, and the Engineering Division all contribute to necessary work at the public beaches. Specific responsibilities of the DPW Departments and Divisions include, but are not limited to, the following:
  - pre- and post-season maintenance (cleaning, painting, etc.) of the bathhouse/concession buildings
  - placement of lifeguard chairs and parking stands
  - placement and daily servicing of trash and recycling bins
  - installation of seasonal swim buoys
  - installation and/or replacement of signage
  - beach raking and litter control
  - pre-season beach regrading and parking lot sweeping
  - parking lot maintenance and daily opening/closing
  - catch basin cleaning and maintenance
  - contracting for seasonal restrooms (portable toilets)
  - upgrades and repairs at the bathhouse/concession buildings
  - septic system maintenance at bathhouse concession buildings
  - fence installations and repairs
  - inspection services for coastal engineering structures
  - dredging required to maintain flow within Fresh River and Little Pond inlets
  
- **Harbor Master and Waterways Committee** – The Harbor Master and Waterways Committee are responsible for managing and patrolling all of Falmouth's fourteen harbors, seventy miles of coastline, and three thousand moorings. As part of this work, maintenance of navigable waterways to the harbors often involves dredging and associated disposal. Past projects in the immediate vicinity of the public beaches that have been designed and permitted by the Harbor Master and Waterways Committee include dredging/beach nourishment at Bournes Pond and Eel River.
  
- **Conservation Commission** – The Conservation Commission is responsible for reviewing and issuing decisions on all permit applications submitted under the Massachusetts Wetland Protection Act and the Falmouth Wetland Bylaw and Regulations. Any activities at the public beaches that remove, fill, dredge, build upon, degrade, or otherwise alter resources subject to protection require review by the Conservation Commission.

### 3.2 PUBLIC BEACH REVENUE AND EXPENSES

Continued use and maintenance of the Town of Falmouth public beaches as both natural protective buffers and important recreational resources is largely dependent on prudent financial management. As with most municipal organizations, the limited financial resources within the town must be carefully planned so that the necessary services and goods can be provided. To assess the adequacy of current financial management practices, and to help with long-range fiscal planning, a summary of the operating budget for the Town of Falmouth public beaches has been prepared as part of the Beach Management Plan.

Revenue generated by the public beaches comes from several different sources. The largest contributions come from the sale of resident beach stickers which have increased in price over the years. Since fiscal year 2002, the price of a resident beach sticker has increased from \$10/year, to \$20/year, to \$60 for a two year period. Significant revenue is also generated through the daily parking fees at Old Silver, Surf Drive, and Menauhant Beaches. Swim lessons offered at a nominal fee and seasonal leases to the concessionaires also provide a source of revenue. Over the past 6 years, annual beach revenues have ranged from \$502,000 to \$998,000 per year. A summary of public beach revenues generated during the period FY02 to FY07 is shown in Figure 37.

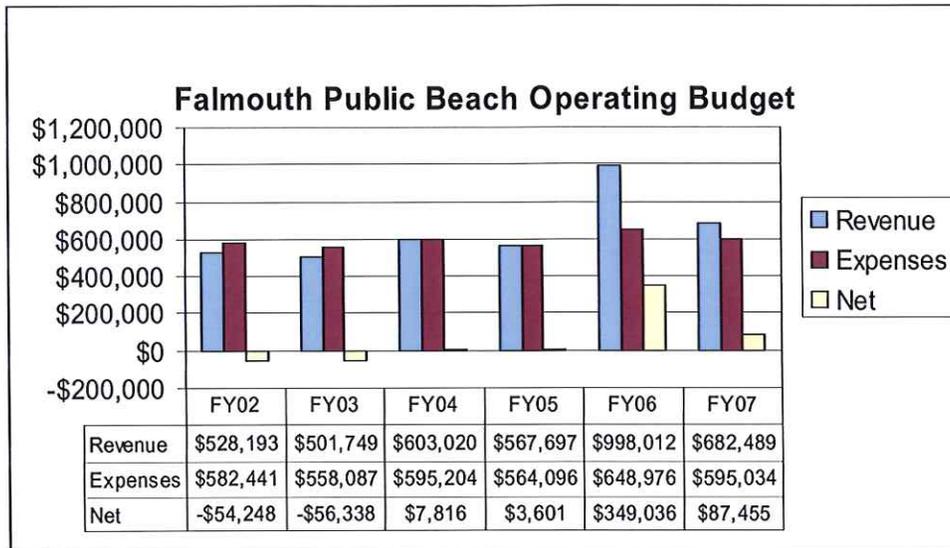


**Figure 37. Summary of public beach revenue by source (FY06 sticker sales reflect year one of a two year cycle).**

Operational expenses associated with the public beaches can be attributed to a number of different categories. The Beach Department budget covers salaries for the staff and seasonal employees such as lifeguards, parking attendants, and sticker clerks. Expenses for first aid supplies, rescue equipment, bathing suits, and utilities for the bathhouse/concession buildings are also covered under the Beach Department budget. DPW salaries for pre- and post-season bathhouse maintenance and seasonal trash pickup are also required for beach operations. Other costs incurred by the DPW are for maintenance of the facilities and miscellaneous supplies. Since fiscal year 2002, the

annual expenditures required to operate the public beaches have ranged from \$558,000 to \$649,000.

A comparison of annual beach revenue and expenditures for the past six years is provided in Figure 38. The data show a net deficit during fiscal years 2002 and 2003, followed small gains in fiscal years 2004 and 2005. Significant gains were realized during fiscal years 2006 and 2007, primarily due to the increased rates for resident beach stickers.



**Figure 38. Summary of public beach revenue by source (FY06 sticker sales reflect year one of a two year cycle).**

Improvements to the public beach properties or purchases that are funded through the Town of Falmouth capital plan must also be factored into the overall financial management. The capital plan identifies projects over \$10,000 that will require funding over the next five years. The current capital plan, which looks at projects over the five year period from 2009 to 2013, has the following items identified for beach improvements:

- Pave parking lots
- Replace retaining wall at Bristol Beach
- Replace stairway handrails at Falmouth Heights and Old Silver Beaches
- Maintenance/improvements at storage shed
- Purchase new storage vaults
- Replace retaining wall at Old Silver Beach
- Repair of seawall at Old Silver Beach
- Beach nourishment plan
- Install Falmouth Heights comfort station (no longer under consideration)
- Install seagull deterrent system at bathhouses
- Renovate Old Silver Beach – Reserve bathhouse/concession building

4.0 Recommended Management Activities for Falmouth Public Beaches

## 4.0 RECOMMENDED MANAGEMENT ACTIVITIES FOR FALMOUTH PUBLIC BEACHES

Information gathered and analyzed as part of the inventory of Falmouth beaches has been used to develop recommended management activities for the Town of Falmouth public beaches. The recommendations represent a balance between preserving and restoring the natural functions of the various beach and dune resources, and providing a quality public beach resource for recreational purposes. As such, the competing interests of the various stakeholders have been taken into consideration and protected to the extent possible.

In some cases, the management recommendations include activities that are already being implemented by the Town of Falmouth under existing management practices, and the course of action is simply to continue business as usual. In other cases, the management recommendations define new activities that will require changes to existing practices. Some of the recommendations can be implemented immediately, while others will require long-range planning, as well as potential permitting and fund raising before they can be implemented. Where possible, a schedule or frequency for implementation has been specified, as some activities require work on a routine or annual basis, while others are needed infrequently, for example only after storms. Although the management recommendations represent a thorough and comprehensive list of activities, the dynamic nature of the public beach sites dictates a need for flexibility in future application. As such, the Beach Management Plan and associated recommendations should be considered a "living document" that must be reviewed and updated periodically to adjust to the changing conditions of the beaches.

The recommended beach management activities have been broken into 7 distinct categories. These include the following: (1) management and planning-level activities, (2) infrastructure maintenance and improvement activities, (3) monitoring activities, (4) routine maintenance activities, (5) restoration activities, (6) education and enforcement activities, and (7) fund-raising activities. A brief description of each recommendation is provided below. Where possible, details are given on specific components of the recommendation including beach locations, responsible party, timing for implementation, purpose, relative priority, and additional resources. Where site specific recommendations have been made for a particular beach location, annotations have been added to the existing conditions plans provided in Appendix A.

### 4.1 MANAGEMENT AND PLANNING-LEVEL ACTIVITIES

**Activity 4.1.1:** Evaluate municipal management structure for Falmouth public beaches.

**Purpose:** To identify measures that will improve the efficiency and allocation of resources and funding for daily beach operations (ex. trash removal, portable toilet service, etc.) and routine maintenance (ex. repair parking lots, install fencing, etc.), and to prioritize capital improvements (ex. concession upgrades, beach nourishment, etc.).

**Details:**

1. Meet with responsible municipal departments to identify and discuss shortcomings of existing system.

2. Review management structure for public beaches used by other Cape towns as potential models.
3. Identify a system for assigning priorities to daily beach operations and routine maintenance.
4. Implement changes in municipal management structure if determined to be beneficial.
5. Add a coastal scientist or coastal engineer to the Beach Committee.

Timing: 2008

Priority: High

Responsibility: Town Manager, Board of Selectmen, DPW (Facilities Maintenance, Highway Division, Engineering Division), Beach Department, Fire Department, Police Department

**Activity 4.1.2:** Establish a record keeping system for beach/dune restoration and inlet dredging activities, as well as storm damages at each beach.

Purpose: To maintain a history of work and storm response at each beach to guide future restoration and management decisions.

Details:

1. For all beach nourishment and/or dune restoration work, document dates of work, location, volume, elevation and slope of fill, as well as source and quality of sediment. Document each activity with photographs.
2. Maintain records for dredging work at inlets located adjacent to the public beaches, that include dates and location of work, volume and quality of material dredged, placement location(s), and dredging/placement methodology.
3. Document all storms and associated beach impacts, by recording date and duration of storm, beach sites impacted, extent of erosion, and impacts to infrastructure. Flag high marks as soon after major storm events as possible at all impacted beach sites. Survey and record the location and elevation of the high water flags.
4. Identify lead department/responsible party for updating and maintaining the necessary records.
5. The Massachusetts Coastal Hazards Commission (CHC) provided a similar recommendation (#5) for the state-wide collection of post-storm event data (Coastal Hazards Commission, 2007). As such, the lead department from the Town of Falmouth should coordinate with Massachusetts CZM to facilitate data sharing and to periodically update data collection techniques.
6. A sample documentation spreadsheet is provided in Appendix E.

Timing: Annually and post-storm

Priority: High

Responsibility: Beach Department, DPW (Engineering Division), Waterways Committee, Conservation Commission, Natural Resources

**Activity 4.1.3:** Prepare spring letter to the Falmouth Conservation Commission describing necessary beach activities required to open the public beaches.

**Purpose:** To inform the Commission regarding the level of activity required and to ensure protection of the wetland resources.

**Details:**

1. Conduct site visits to each beach during early March to identify the necessary activities.
2. Identify the types of work, locations, schedule, and equipment needed, as well as the work methodology. The spring letter should reference the applicable Town of Falmouth public beach Order of Conditions, and describe all anticipated work allowed under the Order. A sample letter is included in Appendix E.
3. Provide opportunity for a meeting and/or site visit with the Conservation Commission to discuss the upcoming work.

**Timing:** Annually; March to April

**Priority:** High

**Responsibility:** Beach Department, Conservation Commission

**Activity 4.1.4:** Prepare fall letter to the Falmouth Conservation Commission describing activities undertaken during the previous year at each of the public beaches.

**Purpose:** To inform the Commission of the required activities and resources protected, and to document compliance with the active Order of Conditions.

**Details:**

1. Describe all beach activities completed including location, dates and duration, and equipment utilized. A sample letter is included in Appendix E.
2. Describe all anticipated winter beach activities planned for construction under Town of Falmouth public beach Order of Conditions.

**Timing:** Annually; October to November

**Priority:** High

**Responsibility:** Beach Department, Conservation Commission

**Activity 4.1.5:** Maintain active environmental permits for work on Falmouth public beaches.

**Purpose:** To allow work within the resource areas and buffer zones on Falmouth public beaches, as required by the Massachusetts and Falmouth Wetlands Regulations.

**Details:**

1. Maintain a database of all permits obtained for work on public beach sites, including issuing agency, permit and/or tracking number, dates of issuance and expiration, recording information, and dates of any extensions. The database should be readily available to all departments within the town; however, one lead department should be responsible for updating the database.
2. Maintain a notebook with all permits, referenced plans, and extension permits. The notebook should be maintained by the Beach Department.
3. Prepare all extension requests and applications for re-issuance 3 months prior to permit expiration.
4. Ensure that Certificates of Compliance are requested, received, and recorded.

**Timing:** As-needed

**Priority:** High

**Responsibility:** Beach Department, DPW (Engineering Division), Waterways Committee, Conservation Commission, Information Technology

**Activity 4.1.6:** Develop pre- and post-storm response plans for Falmouth public beaches.

**Purpose:** To minimize risks of storm damage to wetland resources and public/private infrastructure, and to avoid adverse impacts to resources during post-storm clean-up.

**Details:**

1. Identify specific activities that must be performed in advance of an upcoming hurricane or major storm, such as closing bathhouse/concession buildings, removing all unsecured items from the beach and parking areas, etc.
2. Identify responsible parties for all pre-storm activities
3. Develop a chain of command list with contact information for all pre- and post-storm activities. Points of contact should be included for local, state, and federal emergency management officials, utility suppliers for electricity and gas, local materials haulers, heavy equipment contractors, and tree trimming specialists. Update points of contact as necessary.
4. Replace all clean sand overwashed from the public beaches to the roadways back to the beaches. All sandy material should be used to restore the dunes or the beach above the high water line.

**Timing:** 2008-2009

**Priority:** High

**Responsibility:** Beach Department, DPW (Facilities Maintenance, Highway Division), Fire Department, Police Department, Emergency Preparedness Department, Conservation Commission

**Activity 4.1.7:** Complete and implement a multi-hazard mitigation plan for the Town of Falmouth pursuant to the Disaster Mitigation Act of 2000 and the applicable Interim Final Rules.

**Purpose:** To minimize risks of storm damage to wetland resources and public/private infrastructure.

**Details:**

1. The Town of Falmouth must have a multi-hazard mitigation plan completed and accepted by FEMA in order to be eligible for grants issued under FEMA's Pre-Disaster Mitigation (PDM) and Hazard Mitigation Grant Programs (HMGP). PDM funds provide monies to eligible municipalities for hazard mitigation planning and implementation of mitigation projects prior to a disaster event, while HMGP funds are for implementation of long-term hazard mitigation measures after a major disaster declaration.
2. Identify lead department responsible for completion of the multi-hazard mitigation plan. Coordinate with the Cape Cod Commission (CCC), Massachusetts Emergency Management Agency (MEMA), and FEMA for assistance with plan preparation.
3. The Massachusetts Coastal Hazards Commission (CHC) provided a similar recommendation (#16) for hazard mitigation planning in all coastal communities (Coastal Hazards Commission, 2007). As such, the lead

department from the Town of Falmouth should coordinate with Massachusetts CZM to identify potential support for completing Activity 4.1.7.

Timing: 2008-2009

Priority: High

Responsibility: Planning Department, Beach Department, DPW (Engineering Division)

**Activity 4.1.8:** Develop protocols for concessionaires at Old Silver Beach – Reserved & Public and Surf Drive Beach that define storage of potentially hazardous materials.

Purpose: To prevent the release of potentially hazardous materials such as propane and cooking oil into sensitive coastal resources, to protect human health, and to minimize the risk of storm damage.

Details:

1. Wherever possible, the propane tanks at Old Silver Beach – Reserved & Public and Surf Drive Beach should be removed and stored off-site during the winter season. If removal is not possible, then provisions should be made to securely anchor the tanks and to empty them after the summer season. Recommended anchoring techniques developed by FEMA are provided in Appendix D.
2. Cooking oil used by the concessionaires should be stored in a secure and locked outdoor location. At Old Silver Beach - Reserved & Public the cooking oil should be stored outside the FEMA velocity-zone in a location adjacent to the existing propane tanks. At Surf Drive Beach it is not possible to store the cooking oil outside the FEMA velocity-zone; however a screened and lockable storage container on the concrete apron near the existing propane tank would provide a suitable location. Used oil should be disposed of in an approved off site location on a regular basis.

Timing: 2008

Priority: High

Responsibility: DPW (Facilities Maintenance), Beach Department, Board of Health, Conservation Commission

**Activity 4.1.9:** Prepare manual for the annual operations of Falmouth public beaches.

Purpose: To identify, define, and delegate the range of activities required to operate the beaches on an annual basis.

Details:

1. Prepare annual schedule, responsible parties, and details associated with the advertisement and hiring of seasonal employees.
2. Prepare annual schedule, responsible parties, and details associated with the advertisement and selection process for concessionaires (mobile and permanent facilities).
3. Prepare annual schedule and servicing requirements for portable toilet facilities, and pumping of the Old Silver Beach – Public and Reserved septic systems.
4. Prepare schedule and list of activities required to open and close the concession buildings at Old Silver Beach – Reserved & Public and Surf Drive Beach.

5. Prepare schedule and requirements for annual installation and removal of lifeguard/parking attendant stands, swim markers, seasonal signage, trash containers, recycle bins, and bicycle racks.
6. Develop list of responsibilities and daily schedules for beach staff (lifeguards, parking lot attendees).
7. Prepare list and schedule for procurement of items typically needed for routine operations (ex. first aid supplies, rescue equipment, mutt mitts, etc.). Define methods and sources for procurement.

Timing: 2008 - 2009

Priority: Moderate

Responsibility: Beach Department, DPW (Facilities Maintenance, Highway Division)

**Activity 4.1.10:** Identify storm-prone properties adjacent to and landward of the public beach areas that may be candidates for acquisition by the Town of Falmouth.

Purpose: To protect and preserve coastal landform functions and habitats, minimize storm damage to shoreline structures, and to increase public access and recreational opportunities.

Details:

1. Identify existing developed and undeveloped properties in close proximity to the public beaches that could be purchased by the Town of Falmouth. These properties could be used to increase public access to the shoreline, or for the landward relocation of public beach infrastructure.
2. Explore opportunities for land acquisition using Community Preservation Funds, 300 Committee support, or other similar open space protection groups.
3. Explore alternate means of protecting the natural functions of the shoreline through conservation easements or rolling easements.
4. The Massachusetts Coastal Hazards Commission (CHC) provided similar recommendations (#14-15) for acquisition of storm-prone properties (Coastal Hazards Commission, 2007).
5. The Town of Falmouth Coastal Resources Working Group (CRWG, 2003) proposed similar recommendations for the south shore of Falmouth.

Timing: On-going; post-storm

Priority: Moderate

Responsibility: Town Manager, Board of Selectmen, Planning Department, Conservation Commission, Beach Department, Community Preservation Committee

**Activity 4.1.11:** Conduct an engineering study of the culverts and jetties at the Fresh River – Surf Drive Beach entrance.

Purpose: To evaluate the feasibility of design changes that would improve tidal flushing in the Fresh River system, reduce the frequency of dredging, minimize seaweed accumulation, maximize natural sediment bypassing, and improve public safety.

Details:

1. Perform hydrodynamic analysis of the Fresh River system.
2. Evaluate the effects of different culvert designs on tidal flushing.
3. Quantify the rates and directions of longshore transport.

4. Evaluate the effects of redesigning and/or rebuilding the jetties on natural sediment bypassing and reducing the frequency of dredging. Changes to jetty elevation, length and permeability should be evaluated.
5. The engineering study should also evaluate the need for replacing the existing culvert headwall which is deteriorated and currently presents a public safety issue.
6. Follow recommendations provided in Activity 4.5.4 for improved handling of sediment dredged from the inlet, until such time as an engineering study is complete.
7. The Massachusetts Coastal Hazards Commission (CHC) provided a similar recommendation (#21) for identification of tidal constrictions in need of improvement (Coastal Hazards Commission, 2007). As such, the lead department from the Town of Falmouth should coordinate with Massachusetts CZM to identify potential support services.



Timing: 2008 to 2012 (funds requested for design work)

Priority: Moderate

Responsibility: DPW (Engineering Division), Conservation Commission, Beach Department

**Activity 4.1.12:** Review and update Beach Management Plan on a periodic basis.

Purpose: To ensure effective management of the public beaches by adjusting future management practices to respond to the changing conditions and uses of the beaches.

Details:

1. Review past maintenance and restoration activities, as well as storm damage records. Update the Beach Management Plan as necessary.

Timing: Every 5 years

Priority: Moderate

Responsibility: Beach Department

## **4.2 INFRASTRUCTURE MAINTENANCE AND IMPROVEMENT ACTIVITIES**

**Activity 4.2.1:** Upgrade the existing wastewater disposal system at Old Silver Beach – Reserved.

Purpose: To protect surface and ground water, drinking water supplies, wildlife habitat, and surface water bodies from pathogens and nutrients introduced through wastewater.

Details:

1. Conduct a cost benefit analysis of potential upgrades to the existing wastewater disposal system. The analysis should look at alternate locations for installation of a Title V denitrifying system as well as an enclosed “tight tank” that would require routine pumping during the summer season.
2. Incorporate costs for the selected upgrades into the Capital Plan and implement the project.

Timing: 2009-2013

Priority: High

Responsibility: Town Manager, Board of Selectmen, Beach Department, DPW (Engineering Division), Board of Health, Conservation Commission

**Activity 4.2.2:** Relocate existing municipal water line at Menauhant Beach – West outside the Coastal Beach resource.

Purpose: To protect drinking water supplies and minimize storm damage to municipal infrastructure.

Details:

1. The existing water line to the Menauhant Beach – West area runs along the seaward edge of the Coastal Dune and Beach. Because this area is currently experiencing significant erosion, there is a potential for damage to the water line. Services provided by the Town at this beach include portable toilets and showers which require the water line.
2. Install a new water line away from the seaward side to the beach along the edge of Menauhant Rd.
3. Leave the existing water line in place until such time as it is exposed by erosion, and can be removed without damage to the resources.



Menauhant Beach water line

Timing: 2008-2009

Priority: High

Responsibility: DPW (Engineering Division, Highway Division), Beach Department, Conservation Commission

**Activity 4.2.3:** Develop long-range plans to eliminate direct discharge of storm water onto Falmouth Heights Beach.

Purpose: To protect public health and surface water bodies from pollutants (oil, grease, coliform, etc.) introduced through surface water runoff.

Details:

1. Continue to work under the NEPDES program to improve existing storm water management practices that impact Falmouth Heights Beach.
2. Identify the boundaries of the storm water drainage system that currently feeds into the Falmouth Heights Beach discharge points. Encourage low impact development practices within this drainage basin that infiltrate storm water back to the groundwater, and remove it from the municipal storm water drainage system.
3. Evaluate potential locations and designs for shallow infiltration structures that could be installed to intercept storm water currently discharged as a point source to Falmouth Heights Beach. Potential locations may include the Heights ballfield, esplanade area along Worcester Ct., or grassy areas between the seawall and Grand Ave.

Timing: 2009-2020

Priority: Moderate

Responsibility: Town Manager, Board of Selectmen, DPW (Engineering Division, Highway Division), Beach Department, Conservation Commission



Storm water discharge at Falmouth Heights



**Activity 4.2.4:** Renovate and upgrade bathhouse/concession buildings at Old Silver Beach – Reserved and Surf Drive Beaches.

Purpose: To reduce the potential for storm damages and flooding, to meet ADA handicap accessibility requirements, and to maximize the efficiency of services to meet current and projected levels of use.

Details:

1. Incorporate design criteria to protect against flooding and high winds where economically feasible. The Old Silver Beach – Reserved bathhouse is located in an A-zone (BFE – 15 ft NGVD) and the Surf Drive bathhouse is located in a V-zone (BFE – 14 ft NGVD). Example design modification include, raise electrical system components above the BFE, install high wind connectors on roof framing, install storm shutters, brace end walls on gabled structures, utilize flood resistant materials, install flood proof veneer to exterior walls, install sewer backflow valves, and secure composition shingle roofs. Guidance documents on these design criteria are provided in Appendix D.
2. Consult FEMA’s Coastal Construction Manual for additional upgrades to minimize risks from flooding and storm damage (FEMA, 2001).
3. Incorporate state and local building code requirements for ADA accessibility by upgrades to sidewalks, points of access, restroom, and shower facilities.

Timing: 2009-2013 (design for the Surf Drive bathhouse partially completed in 2006)

Priority: Moderate

Responsibility: Town Manager, Board of Selectmen, Beach Department, DPW (Facilities Maintenance, Engineering Division), Conservation Commission, Building Committee, Commission on Disabilities



Ellen T. Mitchell Bathhouse at Surf Drive



Bathhouse at Old Silver Beach - Reserved

**Activity 4.2.5:** Install sea gull deterrent systems at Old Silver Beach – Reserved and Surf Drive Beaches.

**Purpose:** To enhance public safety by minimizing high concentrations of sea gulls around the bathhouse/concession buildings.

**Details:**

1. Purchase and install a system similar to the one at Old Silver Beach – Public.

**Timing:** 2009-2010 (in capital plan for FY09)

**Priority:** Moderate

**Responsibility:** Beach Department, DPW (Facilities Maintenance)

**Activity 4.2.6:** Relocate access stairs at Chapoquoit Beach.

**Purpose:** To improve public safety by separating beach access point for board sailors from main portion of the beach.

**Details:**

1. Move northern most stairway approximately 80 ft to the north to its previous location.

**Timing:** 2008-2013 (Beach Department requested in 2006)

**Priority:** Moderate

**Responsibility:** DPW (Facilities Maintenance), Beach Department

**Activity 4.2.7:** Replace handrails on beach access stairways with corrosion resistant materials.

**Purpose:** To increase public safety by eliminating deteriorating handrails.

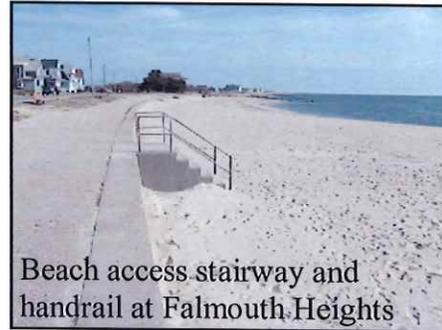
**Details:**

1. Install new handrails at Old Silver Beach – Reserved & Public, Falmouth Heights Beach, and Megansett Beach.

**Timing:** 2008-2013 (in capital plan for FY10)

**Priority:** Moderate

**Responsibility:** DPW (Facilities Maintenance), Beach Department



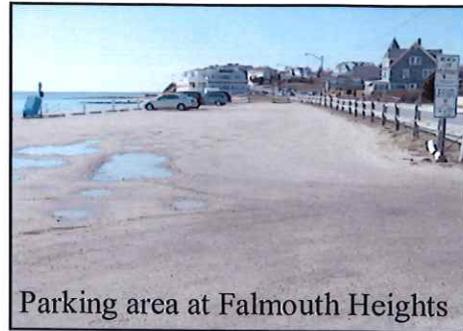
**Activity 4.2.8:** Maintain and upgrade the natural surface parking areas.

**Purpose:** To improve public safety and storm water management, and minimize the need for frequent regrading.

**Details:**

1. Upgrade the Falmouth Heights Beach parking area to a lower maintenance design using grass pavers, modular block systems, or other porous-type surface.
2. Incorporate storm water management components to any Falmouth Heights parking area design that involves hard resurfacing, so that pollutants are not directed onto the beach. The parking area should be crowned so as to direct surface water away from the beach and into drainage structures installed around the edges of the parking area.

3. The parking areas at Old Silver Beach – Overflow Area, Surf Dr. – Mill Rd., and Menauhant Beach – West & East should be left in their natural state, with regrading as needed to prevent potholes and standing water. All regrading should be performed so that water is directed away from the resource areas.
4. Improved storm water management for the Mill Rd. parking lot is currently under design by the DPW (Engineering Division) and will be permitted with the Conservation Commission as part of a larger project to address storm water issues at the end of Mill Rd. All drainage from the parking area will be directed into shallow infiltration trenches.



Timing: On-going (regrading); Upgrade to Falmouth Heights parking area: 2009-2013 (in capital plan for FY09 to FY12)

Priority: Regrading High; Falmouth Heights upgrade Moderate

Responsibility: DPW (Highways Division, Engineering Division), Beach Department, Conservation Commission

**Activity 4.2.9:** Install and maintain barriers at beach access points wide enough for a vehicle.

Purpose: To prevent vehicles from accessing the beach and to protect the resources.

Details:

1. Install posts at all beach access points greater than 6 ft wide.
2. Posts/cables should be installed using a design that allows removal for access by authorized vehicles only.
3. Vehicle barriers are needed at Megansett Beach, Old Silver Beach – Public (“Chute area”), and Bristol Beach. Vehicle barriers already exist at Woodneck Beach.

Timing: 2008-2013

Priority: Low

Responsibility: DPW (Facilities Maintenance), Beach Department

**Activity 4.2.10:** Relocate storage vaults outside the primary resource areas.

Purpose: To restore the functions of the Coastal Dune and to continue to provide a convenient space for storage of rescue equipment.

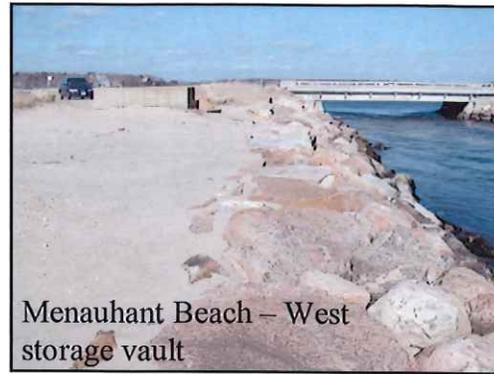
Details:

1. Move storage vaults that are located directly on Coastal Dune resources to the nearby parking areas.
2. Storage vaults at Bristol Beach and Menauhant Beach – West should be relocated.
3. Install new storage vaults outside the primary resource areas at Megansett, Stoney, and Grews Pond Beaches.

Timing: 2009-2013

Priority: Low

Responsibility: Beach Department, DPW (Facilities Maintenance)



**Activity 4.2.11:** Install seasonal shower towers at public beaches currently without shower facilities.

Purpose: To improve services for public enjoyment of the beaches.

Details:

1. Install seasonal shower facilities, similar to the one at Falmouth Heights Beach, at Chapoquoit Beach, Woodneck Beach, and Bristol Beach. Continue to contract for portable shower facilities during the summer months at Menauhant Beach.

Timing: 2008-2013

Priority: Low

Responsibility: Beach Department

### **4.3 MONITORING ACTIVITIES**

**Activity 4.3.1:** Conduct bi-annual beach profile and photographic surveys at all public beaches.

Purpose: To quantify long-term and seasonal changes in beach profile and shoreline location, and to identify when beach nourishment and dune restoration are needed.

Details:

1. Collect beach profiles at all locations established as part of this Beach Management Plan (Appendix A,C; Table 1).
2. Survey beach profiles bi-annually in the late winter (Mar. to Apr.) and early fall (Sep. to Oct.).
3. Utilize GPS or total station survey equipment to collect horizontal (x,y) and vertical (z) positions along each beach profile. Collect information regarding position of high and low water during the surveys, as well as breaks in slope, type of resource area, extent of vegetation.
4. Maintain the survey data in a GIS database or spreadsheet format such as Microsoft Excel. An example spreadsheet of the Nov. 2007 data is provided in Appendix C.
5. Compare successive surveys to evaluate changes in elevation, volume, and shoreline position. Review beach profile data on an annual basis to identify areas where beach width is consistently narrowing, or where dune

width/height are compromised. Establish these areas as priority sites for beach nourishment and dune restoration.

6. Establish 2-4 sites at each beach for the collection of photographs that can be used to document visual changes. Collect the photography bi-annually along with the beach profile data. Document the dates and tide levels during the photography and maintain in a binder or electronic database.

Timing: Bi-annually

Priority: High

Responsibility: DPW (Engineering Division), Beach Department, Geographic Information Department

**Activity 4.3.2:** Conduct annual condition surveys of all coastal engineering structures at the public beaches.

Purpose: To identify damaged or deteriorating structures in need of repair.

Details:

1. Document the condition of the structures by examining rip rap placement, filter cloth exposure, toe scour and undermining, concrete failure, backfill erosion, etc.
2. Collect photographs of structures during each survey.
3. Current structures in need of repair include the western jetty at Menauhant Beach, and possibly the Fresh River jetties (pending results of Activity 4.1.11).

Timing: Annually

Priority: Moderate

Responsibility: DPW (Engineering Division)

**Activity 4.3.3:** Conduct shorebird surveys at the public beach sites located within mapped Priority and Estimated Habitat Sites.

Purpose: To protect rare and endangered shorebird species.

Details:

1. Utilize trained observers to monitor the mapped beaches during the nesting season starting during the beginning of March. Mapped beaches include Megansett Beach, Woodneck Beach, and Menauhant Beach – West & East.
2. Immediate notification to the Massachusetts NHESP should be made if any nesting sites are located.
3. An exclusionary zone 50 yards around each nest should be established using symbolic fencing. The nests should be monitored until such time as the chicks have fledged.

Timing: Annually

Priority: Moderate

Responsibility: Natural Resources

**Activity 4.3.4:** Update estimates of shoreline change using additional aerial photography.

Purpose: To quantify long-term trends in shoreline change and to improve decisions regarding sediment management.

Details:

1. Review and update the CZM shoreline change database by incorporating additional aerial photography from 1950, 1960, 1968, 1975, 1986, 2001, and 2004.
2. Continue to update the shoreline change analysis with new photographs as they become available, approximately every 5 years.
3. Use the updated shoreline change data to forecast erosion rates as the basis for planning restoration opportunities.

Timing: 2009-2013

Priority: Low

Responsibility: Beach Department

#### 4.4 ROUTINE MAINTENANCE ACTIVITIES

**Activity 4.4.1:** Complete pre-season activities required to open the public beaches.

Purpose: To provide the services required to operate the public beaches.

Details:

1. Perform pre-season maintenance on bathhouse/concession buildings at Old Silver Beach – Reserved & Public and Surf Drive Beach, to include the following: cleaning, painting, activate utilities, clean range hoods, update fire suppression systems, test fire extinguishers, etc.
2. Install swim marker buoys at all beaches and warning markers at Old Silver Beach and Menauhant Beach.
3. Install lifeguard stands and parking attendant booths at all beaches.
4. Place and service trash bins and recycling bins at all beaches.
5. Oversee pre-season placement of portable toilets by contractors and install temporary privacy screening.
6. Replace and install signs as necessary.

Timing: Annually - May

Priority: High

Responsibility: Beach Department, DPW (Facilities Maintenance, Highway Division)



**Activity 4.4.2:** Perform maintenance of the parking areas at all public beaches.

Purpose: To maintain and preserve existing parking lots and to ensure public safety.

Details:

1. Sweep all paved parking lots and return clean sand back to the beach above the high tide line. Any sand that is contaminated with oil or grease, or mixed with trash or debris should be removed to an approved off site location. Any questions regarding sand contamination should be resolved using best management practices including stockpiling on the parking area, and site meetings with the DPW supervisor, Beach Superintendent and/or Conservation Commission.
2. Paint parking lines, directional arrows, and seal parking areas as needed.
3. Regrade natural surface parking areas at the beginning of the beach season, and as needed throughout the year to avoid the collection of rain water.

Timing: Annual and as needed

Priority: High

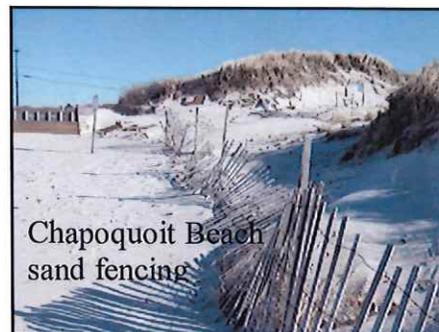
Responsibility: DPW (Highways Division)

**Activity 4.4.3:** Repair existing sand fencing, split rail fencing, wind fencing, and guard rail fencing as needed.

Purpose: To maintain fencing for public safety and protection of the resource areas.

Details:

1. Conduct an inventory of damaged fencing in March or April.
2. Repair and/or replace fencing as needed. All work in the Coastal Dune and Coastal Beach areas should be performed by hand, and should avoid disturbance of existing vegetation.
3. Dispose of old fencing in an approved off site location.



Timing: Annual – Spring or Fall

Priority: High

Responsibility: DPW (Highways Division, Facilities Maintenance), Beach Department

**Activity 4.4.4:** Regrade windblown sand from backshore areas of the beach, walkways, and stairs.

Purpose: To improve public safety and minimize loss of sand from the beach.

Details:

1. Utilize a bobcat, front end loader, bulldozer, or beach rake to regrade windblown sand that accumulates against structures and wind fencing during the winter. This practice is needed at Megansett, Old Silver Beach – Reserved & Public, Chapoquoit (“L” area), Surf Drive, and Falmouth Heights.



2. Beach regrading should only be performed above mean high water and no sand should be removed from the beach. Beach regrading should not be performed in areas that are vegetated.
3. Sand that has accumulated on walkways and stairs should be removed by hand or small bobcat, and returned to the dune or beach area above mean high water.

Timing: April to May

Priority: High

Responsibility: DPW (Highways Division, Facilities Maintenance), Beach Department

**Activity 4.4.5:** Perform beach raking during the summer season.

Purpose: To improve the quality and aesthetics of the beach environment.

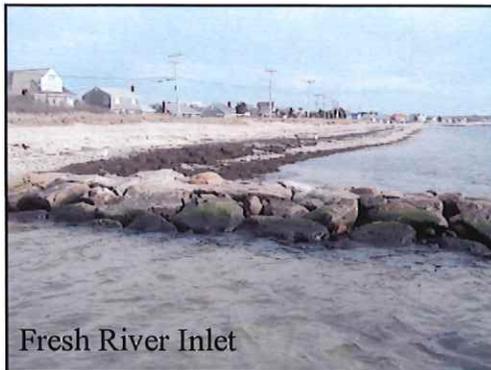
Details:

1. Utilize a beach rake to remove seaweed and perform beach raking on a weekly basis, or more frequently as needed. All beach raking should be performed above the mean high water line, and all accumulated trash and debris should be removed off site to an approved location. Any rocks or gravel raked from the beach should be placed back on the beach above the mean high water line.
2. The beach raking should be performed only during the peak beach use season from May 1 through September 30.
3. At Chapoquoit Beach which is located in the Black Beach/Great Sippewissett Marsh DCPC, seaweed removal should be performed by hand only. At all other beaches the seaweed and beach raking should be performed using the mechanized beach rake.
4. Heavy accumulations of seaweed below the mean high water line should be removed as needed only.

Timing: May 1 through Sep. 30

Priority: High

Responsibility: DPW (Highways Division), Beach Department



**Activity 4.4.6:** Prune shrubs and other vegetation at the edges of the parking areas and along the sidewalks.

Purpose: To maintain full use of the parking areas and to improve public safety.

Details:

1. Pruning should be limited to vegetation that overhangs or encroaches on the parking areas and sidewalks.
2. All work should be performed by hand and the clippings should be removed off site to an approved location.
3. This activity is routinely needed at Megansett Beach, Old Silver Beach – Reserved & Public (including overflow parking area), Chapoquoit Beach (parking lot and sidewalk across the road), Bristol Beach, Menauhant Beach, Surf Drive Beach, and infrequently needed at the other two public beaches.

Timing: Annually and as needed.

Priority: High

Responsibility: DPW (Trees, Parks, Forestry, and School Grounds), Beach Department

**Activity 4.4.7:** Inspect and clean parking lot catch basins at all public beach sites.

Purpose: To manage storm water runoff, minimize impacts to the resources, and protect public health.

Details:

1. Develop a program of monthly inspections at all of the catch basins in the public beach parking lots. Clean as needed.

Timing: Inspect monthly, clean as needed

Priority: High

Responsibility: DPW (Highways Division), Beach Department



**Activity 4.4.8:** Control growth of poison ivy.

Purpose: To improve public safety.

Details:

1. Spray herbicide or grub out poison ivy from areas around parking lots as needed.

Timing: As needed

Priority: Moderate

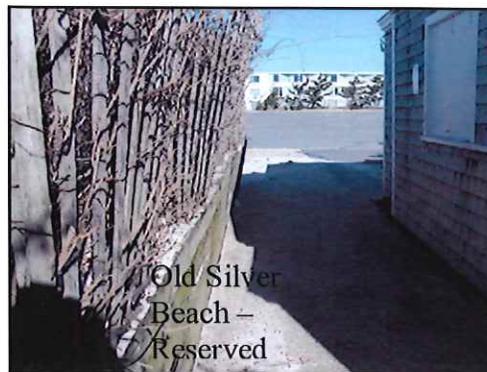
Responsibility: DPW (Trees, Parks, Forestry, and School Grounds), Beach Department

**Activity 4.4.9:** Replace and maintain the wooden retaining walls that contain the Coastal Dunes.

Purpose: To maintain use of existing parking lot areas and to improve public safety.

Details:

1. Utilize specifications developed for retaining walls at Chapoquoit Beach (Appendix D).



2. All work should be performed from the parking lot side of the walls to avoid disturbance to the dunes.
3. Old timbers and materials should be removed off site to an approved disposal location.
4. Retaining wall work is needed at Old Silver Beach – Reserved & Public and Bristol Beach.

Timing: 2009-2013

Priority: Moderate

Responsibility: DPW (Facilities Maintenance, Highway Division), Beach Department

**Activity 4.4.10:** Install temporary winter sand fencing at strategic locations to minimize the loss of sand due to aeolian activity.

Purpose: To maintain ability of beach and dune system to provide storm damage protection and flood control.

Details:

1. Install sand fencing at locations where wind blown activity causes significant volumes of sand to be blown to the parking lots and away from the public beach properties.
2. Temporary winter sand fencing is needed to control sand loss at Old Silver Beach – Reserved (ramp area) & Public (end of “Chute”), Chapoquoit Beach (“L” area), Surf Drive Beach (west of bathhouse), Falmouth Heights Beach (east end), and Bristol Beach (dune crossovers and adjacent to both sides of the Little Pond channel).

Timing: October – November (installation); April (removal)

Priority: Moderate

Responsibility: DPW (Highway Division, Facilities Maintenance), Beach Department

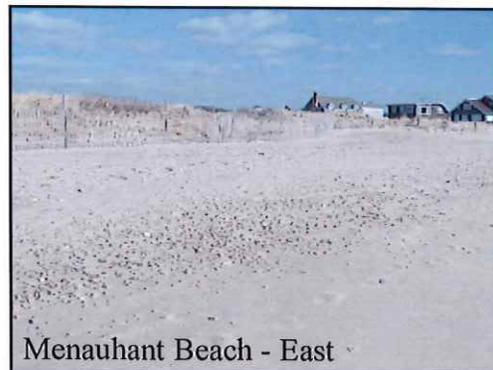
#### **4.5 RESTORATION ACTIVITIES**

**Activity 4.5.1:** Install sand fencing and/or symbolic fencing around Coastal Dunes.

Purpose: To promote sand accumulation and dune growth, and to minimize disturbance of the dunes by foot traffic.

Details:

1. Install new sand fencing and repair existing sand fencing around the seaward sides of all Coastal Dunes, and along the edges of all dune access paths. This type of fencing should be installed at all beaches, except Falmouth Heights where dunes are not present.
2. The sand fencing should be attached to wooden posts installed about 10 ft apart. The posts could be installed using a rubber-tired backhoe with an auger attachment in locations where access will not disturb the dunes, and should be installed by hand in all other locations. The fencing should be stapled and/or wired to the posts by hand. The sand fencing



- should be no taller than 3 ft high.
3. The sand fencing should be inspected after storm events to repair and maintain damaged fencing.
  4. Temporary symbolic fencing should be installed along the road side of Coastal Dunes that are susceptible to heavy foot traffic during special events (July 4<sup>th</sup> fireworks, Falmouth Road Race, etc.).
  5. Symbolic fencing should be installed using wooden or metal stakes driven by hand and connected with string and delineated by fluorescent surveyor tape. All symbolic fencing should be removed after the events are complete.

Timing: Annually and as needed

Priority: High

Responsibility: DPW (Facilities Maintenance), Beach Department

**Activity 4.5.2:** Initiate dune restoration programs at Surf Drive Beach, Bristol Beach, and Menauhant Beach – West & East.

Purpose: To improve the ability of the Coastal Dunes to provide storm damage protection and flood control.

Details:

1. Identify suitable sources of sand that are compatible in size to the existing dune sands, including material from upland and dredging sources.
2. Facilitate the use of compatible sand sources generated from local dredging projects, both private and public, for restoration of dunes at the public beaches. Applicants for private dredging projects should be made aware of beneficial reuse options on the town beaches during the Conservation Commission review and permitting process. Dredge quantities and sediment analyses should be made available to the Beach Department for determining suitability as beneficial reuse. Acceptance of compatible dredge sediments should be confirmed through a letter to the applicant, with a copy to the Conservation Commission.
3. Maximize the dune profile at each of the above referenced beaches by increasing the height and width. The ideal dune design would meet FEMA's 540 sq ft rule for protection during a 100-yr storm event (Appendix D); however, not all of the dune and beach systems provide sufficient area to create such a dune. Recommended cross-sections that maximize the height and width of dunes at Surf Drive Beach, Bristol Beach, and Menauhant Beach – West & East are provided in Appendix C.
4. At Menauhant Beach – West & East, extend the existing dunes along the seaward sides of both parking areas.
5. Vegetate all dune restoration areas with beach grass and protect with sand fencing.

Timing: 2008-2013

Priority: High

Responsibility: DPW (Highways Division), Beach Department, Conservation Commission

**Activity 4.5.3:** Develop short- to intermediate-range plans for beach nourishment programs at Chapoquoit Beach, Surf Drive Beach, and Menauhant Beach – West & East.  
**Purpose:** To increase the ability of the Coastal Beaches to provide storm buffers, flood control, sediment to adjacent beaches, to mitigate on-going erosion, and to enhance the recreational resource.

**Details:**

1. Identify suitable sources of sand for beach nourishment programs, including sand from channel and harbor dredging, offshore dredging, and upland sources.
2. Explore opportunities for cooperation with other municipalities, private stakeholders, and state and federal agencies for the implementation of large-scale nourishment projects.
3. Establish coordination with the US Army Corps of Engineers regarding potential for beneficial reuse of sediment dredged from the Cape Cod Canal. Request early notification by the US Army Corps of Engineers of future dredging so that the necessary agreements for beneficial reuse can be developed.
4. Focus nourishment activities in the following areas: Chapoquoit Beach – entire public beach; Surf Drive Beach – entire public beach with emphasis on area east of “kiddie pool” and west of Fresh River inlet; Menauhant Beach – West – western end of beach from Haddad parcel to groin; Menauhant Beach – East – first groin compartment adjacent to jetties.
5. Identify potential funding sources for large-scale beach nourishment projects.

**Timing:** 2008-2013

**Priority:** High

**Responsibility:** Town Manager, Board of Selectmen, Beach Department, DPW (Highways Division, Engineering Division), Conservation Commission

**Activity 4.5.4:** Utilize sand dredged from Fresh River and Little Pond inlets following storm events as beach nourishment on nearby south shore beaches.

**Purpose:** To minimize shoaling, facilitate sediment bypassing, and mitigate on-going beach erosion.

**Details:**

1. The dewatering area for sand dredged from the Fresh River inlet should be on the beach west of the inlet and above the high water line. Dredged sand should be left in the stockpile area only as long as it takes to dewater.
2. As soon as the Fresh River material is dewatered, it should be spread across the public beach area west of the inlet, between the dune and the high water line. During times when the beach width west of the Fresh River inlet extends to a point near the end of the jetty (ie., jetty is filled to entrapment), the dredged sand should be placed at the western end of the beach, or used to nourish the beach at the end of Shore St. (east of the “kiddie pool”).
3. The dewatering area for sand dredged from the Little Pond inlet can be either side of the inlet; however the stockpile area should always be above the high water line. Dredged sand should be left in the stockpile area only as long as it takes to dewater.

4. As soon as the Little Pond material is dewatered, it should be used to restore the dunes as recommended in Activity 4.5.2 (Appendix C). Once a suitable dune profile is achieved, all remaining dredged material should be used to restore dunes at Menauhant Beach – West & East as recommended in Activity 4.5.2 (Appendix C).

Timing: On-going; as needed

Priority: High

Responsibility: DPW (Engineering Division, Highways Division), Beach Department, Conservation Commission

**Activity 4.5.5:** Utilize sand dredged from the inlets to Bournes Pond and Green Pond, and Eel River as beach nourishment and dune restoration at Menauhant Beach – West & East.

Purpose: To minimize shoaling, facilitate sediment bypassing, and mitigate on-going beach erosion.

Details:

1. All material dredged by the town from these locations should be used to nourish eroding beaches and build dunes at Menauhant Beach – West & East.
2. Maintain active permits for continued dredging of these areas, with reference to Menauhant Beach – West & East as the beneficial reuse sites.
3. Develop engineering plans for a beach nourishment template that will maximize the lifetime of the nourishment, and minimize shoaling at the entrance to Bournes Pond.
4. Dredging and/or beach nourishment (below spring high tide) at Menauhant Beach – West & East should not be performed during the period May 1 to August 1 in order to protect spawning Horseshoe Crabs.

Timing: On-going

Priority: High

Responsibility: Waterways Committee, Beach Department, Conservation Commission

**Activity 4.5.6:** Initiate program of revegetation within the Coastal Dunes.

Purpose: To promote sand accumulation and dune growth, and to minimize disturbance of the dunes by foot traffic.

Details:

1. Revegetate sparsely covered areas of the Coastal Dunes with beach grass and beach plum. Beach grass should be utilized for the seaward facing sides of the dunes and the beach plum should be planted along the more protected landward sides of the dunes.
2. All planting work should be conducted by hand, and care should be taken to protect existing vegetation.
3. The beach grass should be purchased as bare root culms and planted 2-3 culms per hole, spaced 12 inches on center.



4. All revegetation work should take place during the period Oct. 1 through April 1.

Timing: Annually and as needed

Priority: Moderate

Responsibility: Beach Department, DPW (Highways Division), Conservation Commission

**Activity 4.5.7:** Eliminate unnecessary dune access paths.

Purpose: To minimize disturbance to the Coastal Dunes and to improve their ability to function as storm damage protection and flood control.

Details:

1. Eliminate unnecessary dune access paths by filling with dune compatible sand, revegetating with beach grass and/or beach plum, installing fencing, and educational signage.
2. Closure of dune paths is recommended at Old Silver Beach – Reserved & Public, Surf Drive Beach, and Bristol Beach.

Timing: 2009-2013

Priority: Moderate

Responsibility: DPW (Highways Division), Beach Department

**Activity 4.5.8:** Reorient the angle of dune access paths and install at grade decking or elevated walkways.

Purpose: To minimize risks from storm damage and flooding.

Details:

1. Dune access paths should be reoriented so that they are not perpendicular to the shoreline.
2. During the process of reorienting the paths, the old pathways should be filled with dune compatible sand and revegetated.
3. Paths that receive the greatest use should be protected with decking placed at grade. The decking should be used seasonally to protect the access paths from scour, and removed during the winter season. The decking should start at the edge of the parking lot or dune and extend several feet beyond the toe of the dune. Alternately, elevated walkways can be used; however, these are generally more costly, and may require maintenance following storms.

Timing: 2009-2013

Priority: Moderate

Responsibility: DPW (Facilities Maintenance, Highway Division), Beach Department, Conservation Commission

**Activity 4.5.9:** Relocate or redesign the handicap access ramp at Old Silver Beach – Public outside the Coastal Dune.

Purpose: To minimize adverse impacts to the Coastal Dune and improve its ability to function as storm damage protection and flood control.

Details:



Ramp at Old Silver Beach - Public

1. Work with the Commission on Disabilities and the Conservation Commission to explore alternate sites for relocation of the handicap access ramp that will be outside the Coastal Dune resource. Redesign of the ramp as an elevated walkway above the dune is a suitable alternative.
2. Remove old access ramp by hand and dispose of all materials at an approved off site location.

Timing: 2009-2013

Priority: Moderate

Responsibility: DPW (Facilities Maintenance), Beach Department, Conservation Commission, Commission on Disabilities  
Old Silver Beach - Public

#### **4.6 EDUCATION AND ENFORCEMENT ACTIVITIES**

**Activity 4.6.1:** Update signage for all public beach areas.

Purpose: To improve the dissemination of important information regarding the beaches and to increase public safety.

Details:

1. Prepare a comprehensive list of necessary signage for the public beach sites (ex., hours of operation, dog access and leashing, dune protection, daily fees, no feeding of birds, etc.). Prepare a similar list of signage for strategic locations throughout town that direct visitors to the public beaches.
2. Develop a plan to upgrade the signs as necessary, using a consistent format and unified design.
3. Identify strategic locations where signs will have the greatest impact and determine the number of signs needed at each beach.
4. Install and replace signs as needed.



Megansett Beach signs

Timing: On-going

Priority: High

Responsibility: Beach Department, DPW (Highways Division), Design Review Committee

**Activity 4.6.2:** Increase activities associated with enforcement of dog regulations on the public beaches.

Purpose: To protect public health and safety.

Details:

1. Consider increased patrolling of public beach areas by the police department before and after regular beach areas.
2. Issue citations for violations of dog regulations.



Timing: May 1 through Sep. 30

Priority: High

Responsibility: Natural Resources Department, Beach Department, Police Department

#### **4.7 FUND RAISING ACTIVITIES**

**Activity 4.7.1:** Identify opportunities for pre- and post-disaster funding for projects from FEMA.

Purpose: To secure funding for upgrades to the bathhouse/concession buildings, dune enhancement, etc. that will reduce the potential for storm damages.

Details:

1. Finalize and submit Falmouth multi-hazard mitigation plan per Activity 4.1.7 to become eligible for FEMA grant monies.
2. Review needs on an annual basis and submit the necessary grant applications.
3. Utilize information available at the following FEMA web site to investigate grant opportunities - <http://www.fema.gov/plan/mitplanning/index.shtm#3>.

Timing: 2008-2013

Priority: High

Responsibility: Town Manager, Board of Selectmen, Planning Department, Beach Department, DPW (Engineering Division)

**Activity 4.7.2:** Identify opportunities for pre- and post-disaster funding for projects from FEMA.

Purpose: To secure funding for upgrades to the bathhouse/concession buildings, dune enhancement, etc. that will reduce the potential for storm damages.

Details:

1. Finalize and submit Falmouth multi-hazard mitigation plan per Activity 4.1.7 to become eligible for FEMA grant monies.
2. Review needs on an annual basis and submit the necessary grant applications.
3. Utilize information available at the following FEMA web site to investigate grant opportunities - <http://www.fema.gov/plan/mitplanning/index.shtm#3>.

Timing: Annually

Priority: High

Responsibility: Town Manager, Board of Selectmen, Planning Department, Beach Department, DPW (Engineering Division)

**Activity 4.7.3:** Identify opportunities for financial and technical assistance through the Rivers and Harbors Grant Program.

Purpose: To secure funding for various waterways-related projects that would benefit Falmouth public beaches.

Details:

1. Utilize information available from Massachusetts Department of Conservation and Recreation (DCR) to investigate grant opportunities. Typical projects qualifying for the program include: dredging of channels for navigation and tidal flushing; provision of public access; management activities for improving public access; water-dependent recreation or habitat enhancement for recreational purposes; beach nourishment for barrier beach maintenance, habitat enhancement or recreational purposes; coastal wetlands restoration; and shoreline erosion control protection.

2. Review needs on an annual basis and submit the necessary grant applications.

Timing: Annually

Priority: High

Responsibility: Town Manager, Board of Selectmen, Planning Department, Beach Department, DPW (Engineering Division)

**Activity 4.7.4:** Identify opportunities for financial and technical assistance through the Buzzards Bay Watershed Wetlands and Open Space Protection Grant Program.

Purpose: To secure funding for various projects that would benefit Falmouth public beaches.

Details:

1. Utilize information available from the Buzzards Bay Project National Estuary Program (BBP) to investigate grant opportunities. Typical projects qualifying for the program include: protection of open space, rare and endangered species habitat, and saltwater wetlands; restoration of tidally restricted salt marshes; remediation of stormwater discharges that threaten water quality.
2. Review needs for Buzzards Bay beaches on an annual basis and submit the necessary grant applications.

Timing: Annually

Priority: High

Responsibility: Town Manager, Board of Selectmen, Planning Department, Beach Department, DPW (Engineering Division)

**Activity 4.7.5:** Identify opportunities for financial and technical assistance through the Coastal Pollutant Remediation (CPR) Grant Program.

Purpose: To secure funding for remediation of stormwater drainage at Falmouth Heights Beach.

Details:

1. Utilize information available from Massachusetts CZM to investigate grant opportunities. The CPR program provides funding to municipalities to assess and remediate stormwater pollution from paved surfaces or to design and construct boat waste pumpout facilities.
2. Review grant application requirements and coordinate with CZM.

Timing: Annually

Priority: High

Responsibility: Town Manager, Board of Selectmen, Planning Department, Beach Department, DPW (Engineering Division)

**Activity 4.7.6:** Identify financial opportunities for coastal land acquisition through the Coastal and Estuarine Land Conservation Program (CELCP) and the CPC.

Purpose: To secure funding for land acquisition that would provide flexibility for expansion of public beaches in the Town of Falmouth, and/or future relocation of beach sites as required by sea-level rise and coastal erosion.

Details:

1. Utilize information available from Massachusetts CZM to investigate grant opportunities available through the CELCP. The CELCP program provides

funding for the purpose of protecting important coastal and estuarine areas that have significant conservation, recreation, ecological, historical, or aesthetic values, or that are threatened by conversion from their natural or recreational state to other uses.

2. Review the CELCP for Massachusetts approved by NOAA in February, 2008 for properties in the Town of Falmouth identified as potential project sites. Evaluate eligibility of the sites as well as potential for future uses.

Timing: Annually

Priority: High

Responsibility: Town Manager, Board of Selectmen, Planning Department, Beach Department, DPW (Engineering Division)

5.0 Environmental Statutes and Regulations

## 5.0 ENVIRONMENTAL STATUTES AND REGULATIONS

A variety of environmental statutes and regulations apply to work on the Town of Falmouth public beaches. A summary is provided as follows:

Agency: Falmouth Conservation Commission

Activities Subject to Regulation: Any activity within a resource area, or within 100 feet of a resource area, that will remove, fill, dredge, build upon, degrade, or otherwise alter an area subject to protection under the bylaw.

Regulations: FWR 10.00

Application: Notice of Intent

Permit: Order of Conditions

Agency: Massachusetts Department of Environmental Protection - Wetlands

Activities Subject to Regulation: Any activity within a resource area, or within 100 feet of a resource area, that will remove, fill, dredge, or alter an area subject to regulation under M.G.L. c. 131, § 40.

Regulations: 310 CMR 10.00

Application: Notice of Intent (filed jointly with Falmouth Conservation Commission)

Permit: Order of Conditions (issued jointly by Falmouth Conservation Commission)

Agency: Massachusetts Division of Fisheries and Wildlife

Activities Subject to Regulation: Any activity within sites mapped as Estimated or Priority Habitat.

Regulations: 321 CMR 10.00

Application: MESA Project Review

Permit: MESA Project Review Decision

Agency: Massachusetts Environmental Policy Act Unit (MEPA)

Activities Subject to Regulation: Projects that exceed review thresholds listed in 301 CMR 11.03.

Regulations: 301 CMR 11.00 – 12.00

Application: Environmental Notification Form (ENF) or Environmental Impact Report

Permit: Certificate from the Secretary of Environmental Affairs

Agency: Massachusetts Environmental Policy Act Unit (MEPA)

Activities Subject to Regulation: Projects that exceed review thresholds listed in 301 CMR 11.03.

Regulations: 301 CMR 11.00 – 12.00

Application: Environmental Notification Form (ENF) or Environmental Impact Report

Permit: Certificate from the Secretary of Environmental Affairs

Agency: Massachusetts Department of Environmental Protection - Waterways

Activities Subject to Regulation: In general, any activities that require work below the mean high water line, or in Commonwealth Tidelands.

Regulations: 310 CMR 9.00

Application: Chapter 91 License or Permit application

Permit: Chapter 91 License/Permit

Agency: Massachusetts Department of Environmental Protection – Water Quality  
Activities Subject to Regulation: Activities that involve the discharge of dredged or fill material, dredging, and dredged material disposal activities in waters of the Commonwealth.

Regulations: 314 CMR 9.00

Application: Water Quality application

Permit: Water Quality Certificate

Agency: US Army Corps of Engineers

Activities Subject to Regulation: In general, any activities that require work below the extreme high water line.

Regulations: 33 CFR 320-331, 40 CFR Part 230

Application: Programmatic General Permit or Individual Permit applications

Permit: Programmatic General Permit, Individual Permit

6.0 References Cited

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## 6.0 REFERENCES CITED

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7.0 Appendix A  
Existing Conditions Plans

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8.0 Appendix B  
Grain Size Analysis

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9.0 Appendix C  
Beach Profiles

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10.0 Appendix D  
Sample Specifications

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12.0 Appendix F  
Glossary of Terms

## Glossary of Terms

### A

**Accretion:** The accumulation of (beach) sediment, deposited by natural fluid flow processes.

**Aeolian:** Wind-deposited sediments, such as sand dunes.

### B

**Backshore:** (1) The upper part of the active beach above the normal reach of the tides (high water), but affected by large waves occurring during a high. (2) The accretion or erosion zone, located landward of ordinary high tide, which is normally wetted only by storm tides.

**Barrier beach:** Narrow low-lying strip of land generally consisting of coastal beaches and coastal dunes extending roughly parallel to the trend of the coast. It is separated from the mainland by a narrow body of fresh, brackish or saline water or a marsh system. A barrier beach may be joined to the mainland at one or both ends.

**Bay:** A recess or inlet in the shore of a sea or lake between two capes or headlands, not as large as a gulf but larger than a cove.

**Beach nourishment:** The process of replenishing a beach by artificial means; e.g., by the deposition of dredged materials, also called beach replenishment or beach feeding.

**Beach profile:** A cross-section taken perpendicular to a given beach contour; the profile may include the face of a dune or sea wall, extend over the backshore, across the foreshore, and seaward underwater into the nearshore zone.

**Beach width:** The horizontal dimension of the beach measured normal to the shoreline.

**Berm:** A nearly horizontal plateau on the beachface or backshore, formed by the deposition of beach material by wave action or by means of a mechanical plant as part of a beach recharge scheme.

**Berm crest:** The seaward limit of the berm, or the minimum depth of a submerged berm; also called berm edge.

**Bypassing, sand:** Hydraulic or mechanical movement of sand from the accreting updrift side to the eroding downdrift side of an inlet or harbor entrance. The hydraulic movement may include natural as well as movement caused by man.

## C

**Coastal Beach:** Unconsolidated sediment subject to wave, tidal and coastal storm action which forms the gently sloping shore of a body of salt water and includes tidal flats. Coastal beaches extend from the mean low water line landward to the dune line, coastal bankline or the seaward edge of existing man-made structures, when these structures replace one of the above lines, whichever is closest to the ocean.

**Coastal Dune:** Any natural hill, mound or ridge of sediment landward of a coastal beach deposited by wind action or storm overwash. Coastal dune also means sediment deposited by artificial means and serving the purpose of storm damage prevention or flood control.

**Coastal processes:** Collective term covering the action of natural forces on the shoreline, and the nearshore seabed.

**Coastal zone:** The land-sea-air interface zone around continents and islands extending from the landward edge of a barrier beach or shoreline of coastal bay to the outer extent of the continental shelf.

**Coastline:** (1) Technically, the line that forms the boundary between the coast and the shore. (2) Commonly, the line that forms the boundary between land and the water.

## D

**Downdrift:** The direction of predominant movement of littoral materials.

**Dredging:** Excavation or displacement of the bottom or shoreline of a water body. Dredging can be accomplished with mechanical or hydraulic machines. Most is done to maintain channel depths or berths for navigational purposes; other dredging is for shellfish harvesting or for cleanup of polluted sediments.

## E

**Elevation:** The distance of a point above a specified surface of constant potential; the distance is measured along the direction of gravity between the point and the surface.

**Erosion:** Wearing away of the land by natural forces. On a beach, the carrying away of beach material by wave action, tidal currents or by deflation. (2) The wearing away of land by the action of natural forces.

**Estuary:** (1) A semi-enclosed coastal body of water which has a free connection with the open sea. The seawater is usually measurably diluted with freshwater. (2) The part of the river that is affected by tides. (3) The zone or area of water in which freshwater and saltwater mingle and water is usually brackish due to daily mixing and layering of fresh and salt water.

## F

**Foreshore:** (1) The part of the shore, lying between the berm crest and the ordinary low water mark, which is ordinarily traversed by the uprush and backrush of the waves as the tides rise and fall. (2) The same as the beach face where unconsolidated material is present.

## G

**Geographic Information System (GIS):** A system of spatially referenced information, including computer programs that acquire, store, manipulate, analyze, and display spatial data.

**Global Positioning System (GPS):** A navigational and positioning system developed by the U.S. Department of Defense, by which the location of a position on or above the Earth can be determined by a special receiver at that point interpreting signals received simultaneously from several of a constellation of special satellites.

**Groin:** (1) A shore-protection structure (built usually to trap littoral drift or retard erosion of the shore). It is narrow in width (measured parallel to the shore) and its length may vary from tens to hundreds of meters (extending from a point landward of the shoreline out into the water). Groins may be classified as *permeable* (with openings through them) or *impermeable* (a solid or nearly solid structure). (2) A barrier-type structure extending from the backshore or stream bank into a water body for the purpose of the protection of a shoreline and adjacent upland by influencing the movement of water and/or deposition of materials.

## I

**Inlet:** (1) A narrow strip of water running into the land or between islands. (2) An arm of the sea (or other body of water) that is long compared to its width, and that may extend a considerable distance inland.

**Intertidal:** The zone between the high and low water marks.

## J

**Jetty:** (1) On open seacoasts, a structure extending into a body of water to direct and confine the stream or tidal flow to a selected channel, or to prevent shoaling. Jetties are built at the mouth of a river or entrance to a bay to help deepen and stabilize a channel and facilitate navigation. (2) A structure usually projecting out into the sea at the mouth of a river for the purpose of protecting a navigational channel, a harbor or to influence water currents.

L

**Longshore:** Parallel and close to the coastline.

**Longshore drift:** Movement of sediments approximately parallel to the coastline.

**Longshore transport rate:** Rate of transport of sedimentary material parallel to the shore. Usually expressed in cubic meters (yards) per year. Commonly used as synonymous with littoral transport rate.

M

**Mean high water (MHW):** The average elevation of all high waters recorded at a particular point or station over a considerable period of time, usually 19 years. For shorter periods of observation, corrections are applied to eliminate known variations and reduce the result to the equivalent of a mean 19-year value. All high water heights are included in the average where the type of tide is either semidiurnal or mixed.

**Mean low water (MLW):** The average height of the low waters over a 19-year period. For shorter periods of observation, corrections are applied to eliminate known variations and reduce the result to the equivalent of a mean 19-year value.

**Moraine:** An accumulation of earth, stones, etc., deposited by a glacier, usually in the form of a mound, ridge or other prominence on the terrain.

N

**Nearshore:** (1) In beach terminology an indefinite zone extending seaward from the shoreline well beyond the breaker zone. (2) The zone which extends from the swash zone to the position marking the start of the offshore zone, typically at water depths of the order of 20 m.

**Nourishment:** The process of replenishing a beach. It may be brought about naturally, by longshore transport, or artificially by the deposition of dredged materials.

O

**Offshore:** (1) In beach terminology, the comparatively flat zone of variable width, extending from the shoreface to the edge of the continental shelf. It is continually submerged. (2) The direction seaward from the shore. (3) The zone beyond the nearshore zone where sediment motion induced by waves alone effectively ceases and where the influence of the sea bed on wave action is small in comparison with the effect of wind. (4) The breaker zone directly seaward of the low tide line.

**Orthophotograph:** A photograph prepared from a perspective photograph by removing distortions and displacements of points caused by tilt, relief, and perspective.

**Overtopping:** Water carried over the top of a coastal defense due to wave runup or surge action exceeding the crest height.

## R

**Revetment:** A facing of stone, concrete, etc., to protect an embankment, or shore structure, against erosion by wave action or currents.

**Riprap:** (1) Broken stones used for revetment, toe protection for bluffs, or structures exposed to wave action, foundations, etc. (2) Foundation of wall or stones placed together irregularly.

**Runup:** the rush of water up a structure or beach on the breaking of a wave. The amount of runup is the vertical height above stillwater level that the rush of water reaches.

## S

**Salt Marsh:** Coastal wetland that extends landward up to the highest high tide line, that is, the highest spring tide of the year, and is characterized by plants that are well adapted to or prefer living in, saline soils. Dominant plants within salt marshes are salt meadow cord grass (*Spartina patens*) and/or salt marsh cord grass (*Spartina alterniflora*). A salt marsh may contain tidal creeks, ditches and pools.

**Sand:** An unconsolidated (geologically) mixture of inorganic soil (that may include disintegrated shells and coral) consisting of small but easily distinguishable grains ranging in size from about .062 mm to 2.0 mm.

**Sea level rise:** The long-term trend in mean sea level.

**Seawall:** (1) A structure built along a portion of a coast primarily to prevent erosion and other damage by wave action. It retains earth against its shoreward face.

**Sediment transport:** The main agencies by which sedimentary materials are moved are: gravity (gravity transport); running water (rivers and streams); ice (glaciers); wind; the sea (currents and longshore drift). Running water and wind are the most widespread transporting agents.

**Shoal:** (1) A detached area of any material except rock or coral. The depths over it are a danger to surface navigation. Similar continental or insular shelf features of greater depths are usually termed banks.

**Shoreline:** (1) The intersection of a specified plane of water with the shore.

**Slope:** The degree of inclination to the horizontal. Usually expressed as a ratio, such as 1:25, indicating one unit rise in 25 units of horizontal distance; or in a decimal fraction (0.04).

**Storm surge:** A rise or piling-up of water against shore, produced by strong winds blowing onshore. A storm surge is most severe when it occurs in conjunction with a high tide. See Figure 10.

**Surge:** (1) Long-interval variations in velocity and pressure in fluid flow, not necessarily periodic, perhaps even transient in nature. (2) The name applied to wave motion with a period intermediate between that of an ordinary wind wave and that of the tide. (3) Changes in water level as a result of meteorological forcing (wind, high or low barometric pressure) causing a difference between the recorded water level and that predicted using harmonic analysis, may be positive or negative.

## T

**Tidal flats:** Any nearly level part of a coastal beach which usually extends from the mean low water line landward to the more steeply sloping face of the coastal beach or which may be separated from the beach by land under the ocean.

**Toe:** (1) Lowest part of sea- and portside breakwater slope, generally forming the transition to the seabed. (2) The point of break in slope between a dune and a beach face.

## U

**Updrift:** The direction to which the predominant longshore movement of beach material approaches.

**Upland:** Generally described as the dry land area above and landward of the ordinary high water mark.



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