



## B. SUMMARY

As coastal communities along the South Shore of Massachusetts, the Towns of Marshfield and Duxbury are vulnerable to coastal flooding, erosion, and wave induced damages caused by nor'easters and hurricanes. Development in the Towns of Marshfield and Duxbury during the early 20th century led to a pattern of single-family homes and some commercial development on small lots located directly along the shoreline. In Marshfield, this development extends along most of the town's 4.7 miles of east facing shoreline. In Duxbury, the northern 0.80 mile of the shoreline is developed, while the southern portion of the barrier beach, down to Gurnet Point, is undeveloped and owned by the Duxbury Beach Reservation. Over the years seawalls and revetments were built to protect the properties from ongoing erosion. Within the Town of Marshfield, approximately 82.5% (i.e., 3.9 miles) of the east facing shoreline is armored, and in Duxbury 91.3% (i.e., 0.7 miles) of the developed barrier beach is armored. Most of these structures are publicly owned and maintained.

Long-term erosion of the beaches in front of the shore protection structures has caused a gradual retreat of the shoreline, and in many places the bases of the structures are inundated at high tide.

A significant portion of the Marshfield shoreline was identified as a coastal erosion hot spot in the 2018 State Hazard Mitigation and Climate Adaptation Plan, where the combination of erosion, storm surge, flooding and waves have caused significant damage to buildings and infrastructure. With continued erosion and no possibility for landward retreat, the elevation of the beach in front of the structures has begun to lower. This has resulted in exposure of many of the seawalls and revetments, where in some cases there is between 5 and 9 feet of vertical wall



exposed to the open ocean. During storms, the lower beach elevations allow deeper water along the shoreline and larger waves to penetrate inland, where they encounter the hard seawalls and revetments. In turn, the higher wave energy during storms increases the potential for beach scour, overtopping, wave-induced damages to infrastructure and upland flooding.

Because of this vulnerability, the local governments have taken an active role in the management of their shorelines. Current practices include repair and maintenance of existing shore protection structures, elevating structures, buying out property owners, and regulating development in high hazards areas. While the current management approach takes steps to address the immediate needs of the community, it does nothing to restore sediment to critically eroded beaches or to make the shoreline more resilient to the impacts of climate change. The current project to permit nourishment at critically eroded beaches and dunes in the Towns of Marshfield and Duxbury is being proposed to augment existing management practices. The project incorporates resilient strategies for shore protection that will mitigate the effects of climate change, improve storm damage protection, reduce wave overtopping,



restore sediment to the littoral system and provide protection for existing shore protection structures.

Alternatives for enhancing shoreline resiliency were evaluated at fourteen (14) different beaches along the Marshfield and Duxbury coastline. Given the long history of hardened shore protection structures, the alternatives assessment focused on addressing the reduced sediment supply to the beaches using soft engineering methods such as beach and dune nourishment. At some locations however, soft engineering was not feasible, and combinations of hard, hybrid and soft methods were evaluated. For these locations additional engineering design will be required before the towns can proceed with permitting. For the remaining sites where soft engineering methods were considered feasible, alternative designs for beach and/or dune nourishment were developed and evaluated for performance, environmental impacts and cost. The impact assessment was then used to select a preferred alternative for permitting.

Beach and/or dune nourishment is being proposed at the following four (4) locations:

- **Rexhame Public Beach** – The preferred alternative (Rexhame Public – Alt 1) includes nourishment to enhance the resiliency of the existing dune. The crest of the dune will be increased to an elevation of 28 ft NAVD88 and a width of 30 ft. The seaward facing side of the dune nourishment will slope at 1V:5H to meet natural grades along the beach. The dune nourishment design calls for 47,240 cubic yards of sand and will provide protection of the existing dunes during storms up to the 50-yr event.
- **Winslow Ave. Beach** – The preferred alternative for Winslow Ave. Beach (Winslow – Alt2) includes nourishment to enhance the resiliency of the existing cobble dune. The crest of the dune will be increased to an elevation of 17 ft NAVD88 and a width of 40 ft. The sides of the dune will slope at 1V:7H to meet natural grades along the beach. The design calls for 17,850 cubic yards of mixed sand and cobble and will provide protection from flooding during storms up to the 10-yr event.
- **Fieldston & Sunrise Beaches** – The preferred alternative for the Fieldston & Sunrise area (Fieldston/Sunrise – Alt 2) includes beach and dune nourishment to minimize wave overtopping and provide protection for the existing seawalls. The design includes a 30 ft wide dune crest at elevation 13 ft NAVD88 and seaward facing slopes of 1V:5H. The beach nourishment will have a 90 ft wide berm at elevation 9.5 ft NAVD88, sloping at 1V:12H to natural grades in the nearshore. The design calls for 389,770 cubic yards of mixed sand and gravel. Protection from wave overtopping is provided during a 10-yr storm event and renourishment intervals are estimated to range from 3.5 to 7.0 years.
- **Bay Ave. and Gurnet Rd. Beaches** – The preferred alternative for the Bay Ave. and Gurnet Rd. area (Bay Ave/Gurnet Rd – Alt 1) includes beach and dune nourishment to minimize wave overtopping and provide protection for the existing shore protection structures. The design includes a 20 ft wide dune crest at elevation 11 ft NAVD88 and seaward facing slopes of 1V:5H. The beach nourishment will have an 85 ft wide berm at elevation 8.0 ft NAVD88, sloping at 1V:20H to natural grades in the nearshore. The



design calls for 313,160 cubic yards of mixed sand and gravel. Protection from wave overtopping is provided during a 10-yr storm event and renourishment intervals are estimated to range from 3.0 to 6.5 years.

The Towns are currently seeking permits for beach and/or dune nourishment at the four (4) locations, while sources of sediment needed to restore the beaches are being identified, investigated, and permitted under separate efforts. Once permits for the nourishment sites are in place, the Towns will be able to pursue sources of compatible sediment from the upland or from nearby dredging projects looking for beneficial reuse opportunities. With additional investigations, they may also identify an offshore borrow site(s) that could be permitted in the future.

The Beach and Dune Nourishment project for the Towns of Marshfield and Duxbury will require the following local, state, and federal permits:

- Executive Office of Energy and Environmental Affairs: Certificate from the Secretary of Energy and Environmental Affairs on the Expanded Environmental Notification Form
- Executive Office of Energy and Environmental Affairs: Final Record of Decision from the Secretary of Energy and Environmental Affairs
- Marshfield Conservation Commission: Order of Conditions
- Duxbury Conservation Commission: Order of Conditions
- Massachusetts Department of Environmental Protection/Waterways Division: Chapter 91 Permit
- Massachusetts Coastal Zone Management: Federal Consistency Determination
- U.S. Army Corps of Engineers: Individual Permits

This Expanded Environmental Notification Form (EENF) is the first application filed for the project which will initiate environmental review. All other applications will be submitted once the Massachusetts Environmental Policy Act (MEPA) review process is complete. The project will not require a land transfer. The Project has received \$175,842 in grant funding from the Massachusetts Coastal Zone Management Coastal Resiliency Program. Project construction is estimated to range from \$0.54 million for the smallest project at Winslow Ave. Beach to \$11.69 million for the largest project at Fieldston and Sunrise Beaches. A combination of local, state, and federal funding will likely be sought for construction funding.

A total of eleven (11) alternatives were evaluated at the four (4) sites selected for beach and/or dune nourishment as summarized below. A detailed description of the alternatives considered is provided in Section D.

#### **Rexhame Public Beach**

- Rexhame Public – Alt 1: dune nourishment; 47,240 cubic yards
- Rexhame Public – Alt 2: dune + beach nourishment; 82,570 cubic yards
- Rexhame Public – Alt 3: beach nourishment; 129,000 cubic yards

#### **Winslow Ave. Beach**



Winslow – Alt 1: dune nourishment; 11,200 cubic yards

Winslow – Alt 2: dune nourishment; 17,850 cubic yards

**Fieldston and Sunrise Beaches**

Fieldston/Sunrise – Alt 1: dune + beach nourishment; 339,350 cubic yards

Fieldston/Sunrise – Alt 2: dune + beach nourishment; 389,770 cubic yards

Fieldston/Sunrise – Alt 3: beach nourishment; 409,100 cubic yards

**Bay Ave. and Gurnet Rd. Beaches**

Bay Ave/Gurnet Rd – Alt 1: dune + beach nourishment; 313,160 cubic yards

Bay Ave/Gurnet Rd – Alt2: dune + beach nourishment; 511,030 cubic yards

Bay Ave/Gurnet Rd – Alt 3: beach nourishment; 527,740 cubic yards

Environmental impacts associated with each alternative were evaluated and are discussed in Section E. Findings from the evaluation of environmental impacts were used to select a preferred alternative that achieves the goals for each site and avoids and/or minimizes adverse environmental impacts. Table B-1 provides a summary of the preferred alternative selected for each site with associated resource area impacts and other selection criteria. Changes to wetland resources (within the project footprints) for each beach, are summarized in Tables B-2 through B-5.



**Table B-1. Summary of Preferred Alternatives with Direct Resource Area Impacts and Other Selection Criteria.**

Beach Site	Area of Impact (acres)								Other Selection Criteria for Preferred Alternative
	Land Under the Ocean	Coastal Beaches	Coastal Dunes	Barrier Beaches	Land Containing Shellfish	Rocky Intertidal Shore	Land Subject to Coastal Storm Flowage	Estimated Habitats of Rare Wildlife	
<b>Rexhame Public Beach</b>									
Rexhame Public - Alt 1	--	2.41	2.93	5.34	--	--	5.34	5.34	Dune only alternative (Alt 1) provides similar level of protection as beach nourishment alternatives, with smaller volume and area of impact to existing resources. Service life of beach nourishment alternatives indicates the need for frequent renourishment.
<b>Winslow Ave. Beach</b>									
Winslow – Alt 2	--	1.49	3.16	2.90	--	--	4.65	--	The larger dune nourishment alternative (Alt 2) provides increased storm damage protection without a significant increase in volume over the smaller dune alternative.
<b>Fieldston &amp; Sunrise Beaches</b>									
Fieldston/Sunrise – Alt 2	2.40	28.10	--	18.14	29.4	1.09	30.50	--	
<b>Bay Ave. &amp; Gurnet Rd. Beaches</b>									
Bay Ave/Gurnet Rd – Alt 1	16.20	34.10	--	50.30	46.20	--	50.30	23.52	



**Table B-2. Summary of Changes to Wetland Resources with Rexhame Public – Alt 1.**

Resource Area	Existing Area in Footprint (acres)	Change in Area (acres)	Proposed Area Remaining in Footprint (acres)
Land Under the Ocean	0	0	0
Coastal Beach	2.41	-2.41	0
Coastal Dune	2.93	+2.41	5.34
Barrier Beach	5.34	0	5.34
Land Containing Shellfish	0	0	0
Rocky Intertidal Shore	0	0	0
Land Subject to Coastal Storm Flowage	5.34	0	5.34
Estimated Habitats of Rare Wildlife	5.34	0	5.34

**Table B-3. Summary of Changes to Wetland Resources with Winslow – Alt 2.**

Resource Area	Existing Area in Footprint (acres)	Change in Area (acres)	Proposed Area Remaining in Footprint (acres)
Land Under the Ocean	0	0	0
Coastal Beach	1.49	-1.49	0
Coastal Dune	3.16	+1.49	4.65
Barrier Beach	2.90	0	2.90
Land Containing Shellfish	0	0	0
Rocky Intertidal Shore	0	0	0
Land Subject to Coastal Storm Flowage	4.65	0	4.65
Estimated Habitats of Rare Wildlife	0	0	0

**Table B-4. Summary of Changes to Wetland Resources with Fieldston/Sunrise – Alt 2.**

Resource Area	Existing Area in Footprint (acres)	Change in Area (acres)	Proposed Area Remaining in Footprint (acres)
Land Under the Ocean	2.40	-2.20	0.20
Coastal Beach	28.10	-1.36	26.74
Coastal Dune	0	+3.59	3.59
Barrier Beach	18.14	0	18.14
Land Containing Shellfish	29.40	-18.80	10.60
Rocky Intertidal Shore	1.09	0	1.09
Land Subject to Coastal Storm Flowage	30.50	0	30.50
Estimated Habitats of Rare Wildlife	0	0	0



**Table B-5. Summary of Changes to Wetland Resources with Bay Ave/Gurnet Rd – Alt 1.**

Resource Area	Existing Area in Footprint (acres)	Change in Area (acres)	Proposed Area Remaining in Footprint (acres)
Land Under the Ocean	16.20	-9.68	6.52
Coastal Beach	34.10	+5.20	39.30
Coastal Dune	0	+4.50	4.50
Barrier Beach	50.30	0	50.30
Land Containing Shellfish	46.20	-18.98	27.22
Rocky Intertidal Shore	0	0	0
Land Subject to Coastal Storm Flowage	50.30	0	50.30
Estimated Habitats of Rare Wildlife	23.52	0	23.52

The project will adhere to the following mitigation measures to avoid and/or minimize environmental impacts during and following construction.

- Pre-construction onsite meetings will be held with the selected contractors, project engineer and Towns of Marshfield and Duxbury to discuss project requirements.
- Boundaries of the beach and/or dune nourishment will be clearly marked prior to construction.
- Construction access to the beach sites will be limited to existing beach access points adjacent or within the proposed nourishment areas.
- Time of year restrictions as determined by the regulatory agencies will be followed for all work to protect endangered species
- Storage of all fuels, hydraulic oil, etc. in a locked storage trailer or removed off site daily
- Vehicles/equipment will be refueled away from the beaches and stormwater systems
- Implementation of a post construction monitoring and plan
- Shorebird inventory, mapping and monitoring in all areas currently mapped as by NHESP as estimated and priority habitat, along with surveillance surveys in nourished areas not currently mapped by NHESP.
- Installation of protective fencing and signage as necessary to protect nesting shorebirds.