CHAPTER 7

CONCEPTUAL RESILIENCY ADAPTATIONS

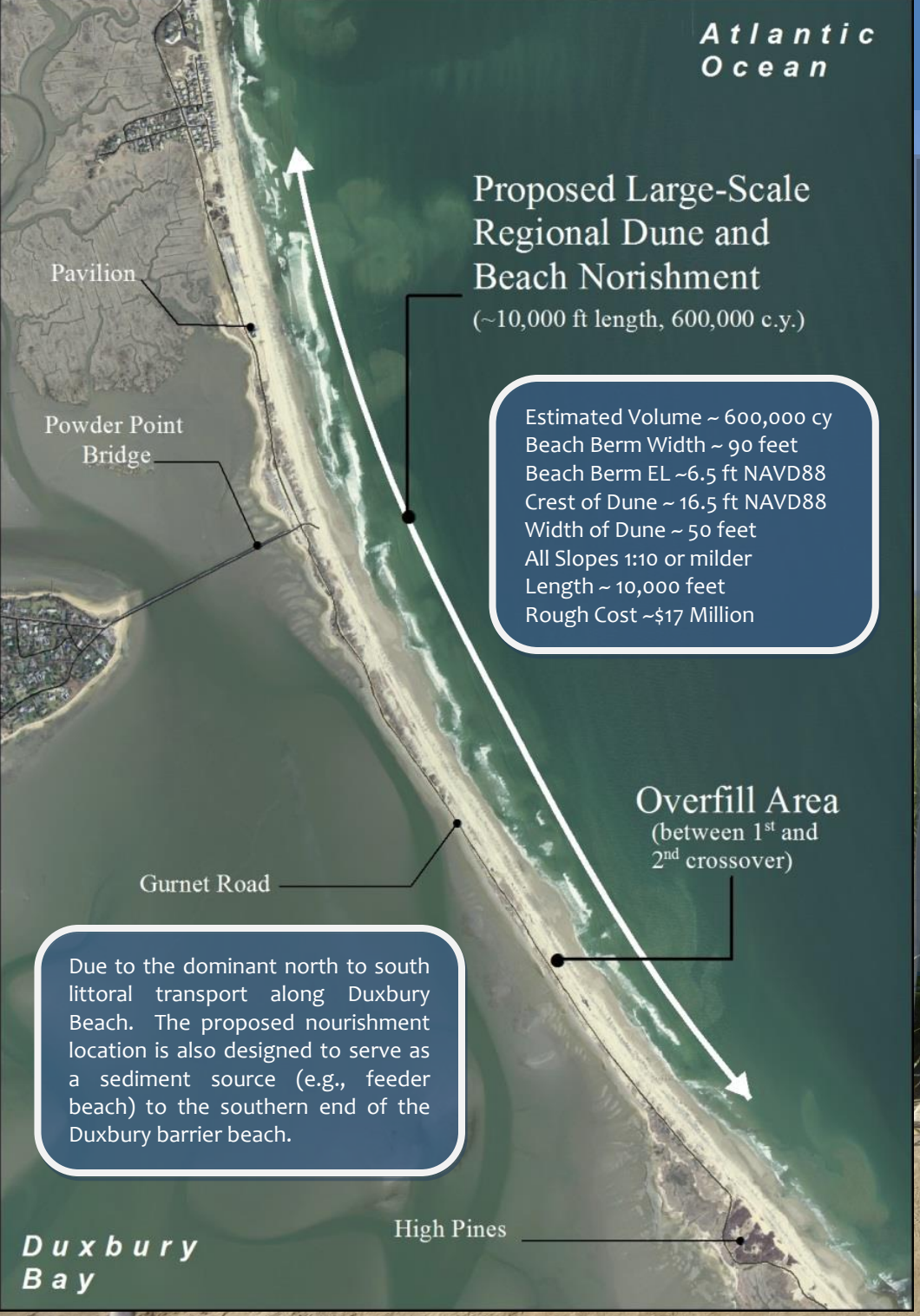
Duxbury Beach is a dynamic environment with an ever-changing landscape. The barrier beach system is shaped by the wind, waves, currents, and tides that constantly impact the shoreline. While the Duxbury barrier beach has long served as a valuable recreational resource and critical ecological habitat, it also provides crucial storm protection to Duxbury, Kingston, and Plymouth developed mainland shore and the vibrant resources within Duxbury Bay. Duxbury Beach Reservation (DBR) has already conducted numerous efforts to build resiliency for the beach system. In the recent past, these efforts have included, but are not limited to:

- Parking lot improvements and road raising
- Doubling the size of the coastal dune along the landward side of the Pavilion
- Beach and dune restoration efforts following major storms in 1991 and 1992
- Annual beach grass planting (40,000 to 1000,000 culms per year)
- Cobble berm construction on the bay side of the barrier beach
- Drift fence installation
- Multiple relocations of the roadway to work with natural barrier beach processes

Now, the potential acceleration of climate change, sea level rise, and increasing frequency and intensity of erosion inducing events are adding expanded pressure to the durability of the beach system. With these mounting pressures, increased resiliency of the barrier beach is paramount and a more comprehensive and prioritized approach to building resilience is required to supplement the ongoing efforts of DBR. Armed with an improved understanding of the coastal processes that influence and shape the Duxbury Beach landscape, this chapter provides some recommended approaches geared towards improving the overall resilience of the barrier beach system.

Due to the delicate balance of the ecosystem and natural landscape, resiliency options and engineering concepts presented herein are green in nature and designed to preserve the ecological and recreational usages, while balancing the need for improved storm damage protection. Proposed measures are presented in this chapter starting with a larger-scale regional approach. In addition to the regional adaptation measure, site-specific adaptations are also provided for critical locations along the beach. These local resiliency measures are intended to be more near-term attainable and fiscally manageable solutions. For each conceptual adaptation, a priority level, developed with the Duxbury Beach Reservation Technical Committee, and an expected time frame and rough cost (final engineering estimates would be required to develop a detailed cost) are presented. These solutions represent approaches of improving the overall resiliency of the beach system, but in more bite size pieces. Some concepts require additional engineering development and design plans to be completed (e.g., site specific surveys); however, the general concepts are fully developed.

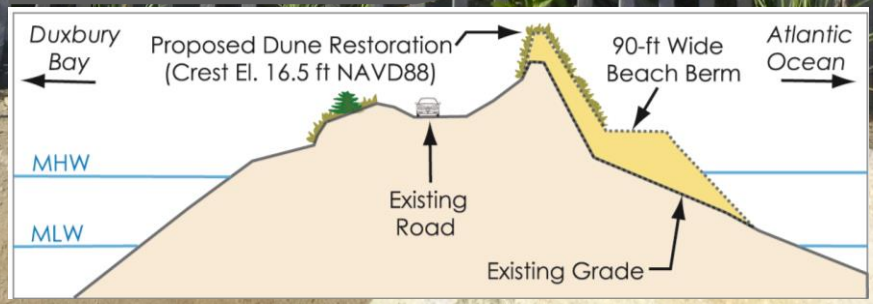
REGIONAL ADAPTATION



One of the primary causes of coastal erosion is a deficit of sediment within the coastal littoral cell. To offset this deficit, nourishing the beach with compatible sediment placement is a logical means for improving the resiliency of a shoreline where such a project is economically feasible. Beach nourishment does not stop erosion, but it does strengthen the system by the addition of compatible material. The damage to landward areas are postponed by extending the shoreline toward the ocean. At a site like Duxbury Beach, the beach also provides a major recreational and ecological benefit. Beach nourishment is typically the most non-intrusive technique for coastal protection and involves placing sand, from an offshore or upland source, in a designed template on an eroding beach. Beach nourishment at Duxbury Beach would be intended to widen the beach, as well as provide added storm protection, increased recreational space, and added habitat area. Although nourished sand is eventually displaced alongshore or transported offshore, the nourished sand that is eroded takes the place of areas that would normally have been lost or eroded during a storm event. Therefore, beach nourishment serves a significant role in storm protection. In addition, beach nourishment is the only alternative that introduces additional sand into the system. For coastlines with a dwindling sediment supply and faced with rising seas, this is critical for long-term success.

The many benefits of beach nourishment, and the ability to control negative environmental impacts with careful design and planning, make beach nourishment a viable resiliency option for Duxbury Beach.

Representative Cross Section



REGIONAL ADAPTATION

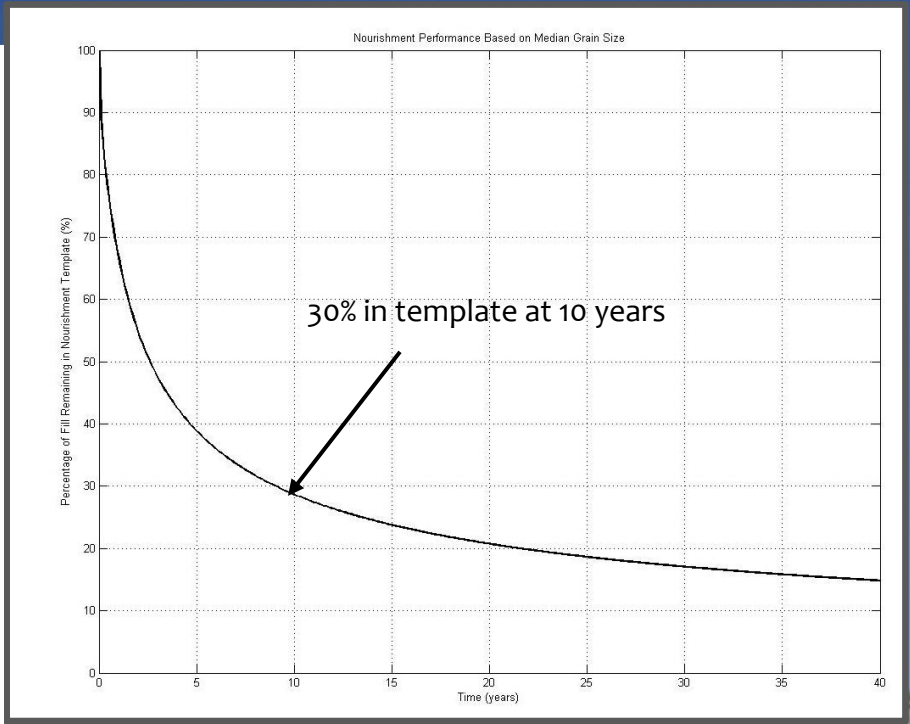
PRIORITY AND TIMING

1 HIGH PRIORITY

LONG-TERM

A large scale beach nourishment project is the recommended regional adaptation and is considered a high priority. The potential project would be expected to take a long time to plan and permit, primarily due to identification of a sediment source and fund raising.

Since the nourishment material diffuses (spreads) over time, it is possible to evaluate the longevity of the nourishment by looking at the amount of material (by percent) left in the project area. The lifetime of the beach nourishment is based upon the percent of the initial beach fill left within the boundary of the initial fill template. The percentage remaining will decrease with time, but that material is not necessarily lost from the system, it has just spread to regions outside of the original nourishment template. For example, sediment will likely be transported to the southeast. Therefore, although the sediment no longer falls within the initial nourishment template, it has not disappeared from the system as a whole. For the proposed nourishment template, approximately 30% of the material will remain in the original template after 10 years.



A successful beach nourishment project consists of more than simply placing sediment on a beach. Beach nourishment projects are engineered. A beach nourishment template, which consists of numerous design parameters, is based on the characteristics of the site and the needs of a project. Every beach nourishment design is unique, since different beaches in different areas have different physical, geologic, environmental, and economic characteristics, as well as different levels of required protection. The design must consider climatology, the shape of the beach, type of native sand, volume and rates of sediment transport, erosion patterns and causes, waves and water levels, historical data and previous storms, probability of certain beach behaviors at the site, existing structures and infrastructure, and past engineering activities in the area.

The structure of a nourishment template is designed to yield a protective barrier that also provides material to the beach. A higher and wider beach berm is designed to absorb wave energy. Dunes are needed to reduce damage from storms. Nourishment length, berm height and width, dune height, volume, and offshore slope are critical elements of a beach nourishment design. The proposed Duxbury Beach regional adaptation consists of a beach nourishment project spanning approximately 1.9 miles along the northern portion of the barrier beach. This material will spread to the south and serve as a longer term source of material for the southern part of Duxbury Beach. The design also consists of overfill areas (additional sediment) in certain areas (e.g., between the first and second crossover) to bolster the protection at critical shoreline stretches or in areas with increased wave energy (Chapter 5). The proposed project would raise the elevation of the existing dune, increase the beach width by over 100 feet at high tide, and be appropriately sloped for habitat restoration.

A large-scale nourishment project for this area would mitigate the on-going erosion, improve storm damage prevention, provide flood protection for the roadway, improve the recreational resources, and enhance the ecological benefit of the beach.

SITE 1
DUXBURY BEACH PARK PAVILION

The Duxbury Beach Park pavilion, initial constructed in 1941, is the only major structure along Duxbury Beach. The Pavilion has restrooms and showers and offers frozen treats and lunch foods throughout the day. Blakeman's Restaurant also resides in the Pavilion and provides a full service dining option for beach goers. The Pavilion is the primary hub for beach visitors and therefore is an important resource to protect.

Historically, efforts were made to protect the Pavilion and surrounding parking infrastructure through use of various configurations of cement blocks and tie-rods. However, during significant storm events (e.g., the Blizzard of 1978) these methods ultimately failed. More recently, sacrificial dune restoration projects have been conducted to bolster the natural state of the dune and beach system in the vicinity of the Pavilion. As indicated in the Chapter 2, these efforts have had a beneficial impact.

Currently, the existing dune in the vicinity of the Pavilion has narrowed significantly, especially directly in front of the Pavilion. This offers limited protection against storm events. As such, a dune restoration and beach berm enhancement project is recommended at this site. The proposed dune would have a crest elevation of 16.5 feet NAVD88 and increase the total width of the dune to approximately 50-55 feet. A 90 foot wide beach berm is also recommended to provide some wave energy dissipation and protection to the dune as vegetation develops. The total length of the proposed restoration is approximately 1,000 feet long and would require approximately 50,000-60,000 cubic yards of compatible material. Improved beach access pathways (e.g., raised boardwalks over the restored dune) are also recommended to limit potential flood pathways.

The current state of the dunes in front of the Pavilion is less than ideal. The dunes have narrowed to 20-25 feet in width and are sparsely vegetated. The proposed adaptation consists of a dune and beach berm restoration project spanning approximately 1,000 feet of shoreline. The restoration proposes to restore the dune to a similar level as the adjacent healthy dunes while adding a fronting beach berm.

PRIORITY AND TIMING

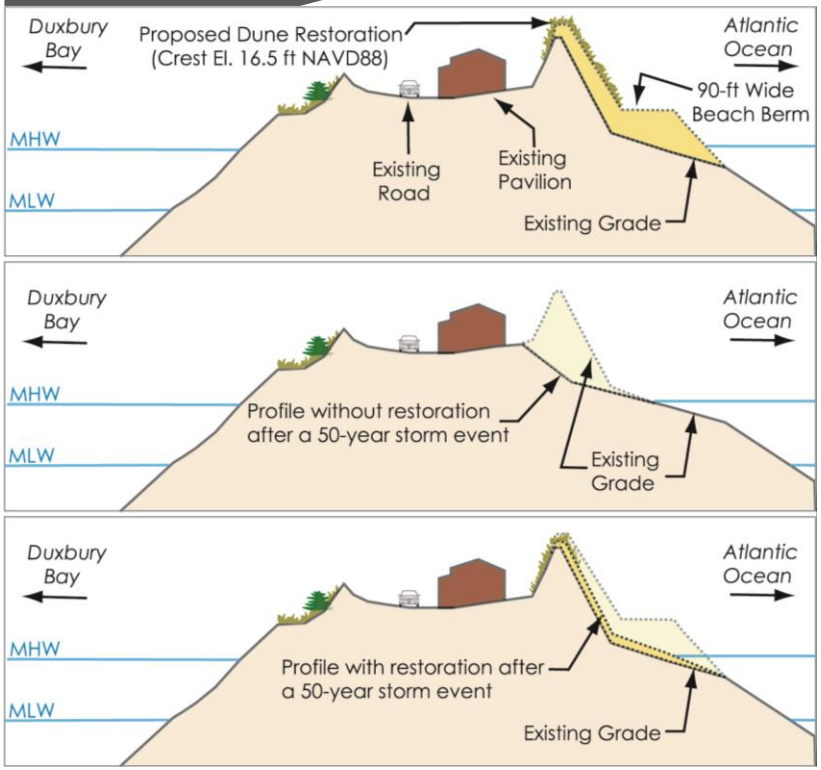
1 HIGH PRIORITY

NEAR-TERM

The Duxbury Beach Reservation technical committee ranked this site as the highest priority project. It can be completed in the near-term as no significant studies, engineering efforts, or permitting hurdles are expected. There are already on-going efforts that consider dune enhancement. Engineering design plans and environmental permitting are needed prior to construction of this adaptation measure.

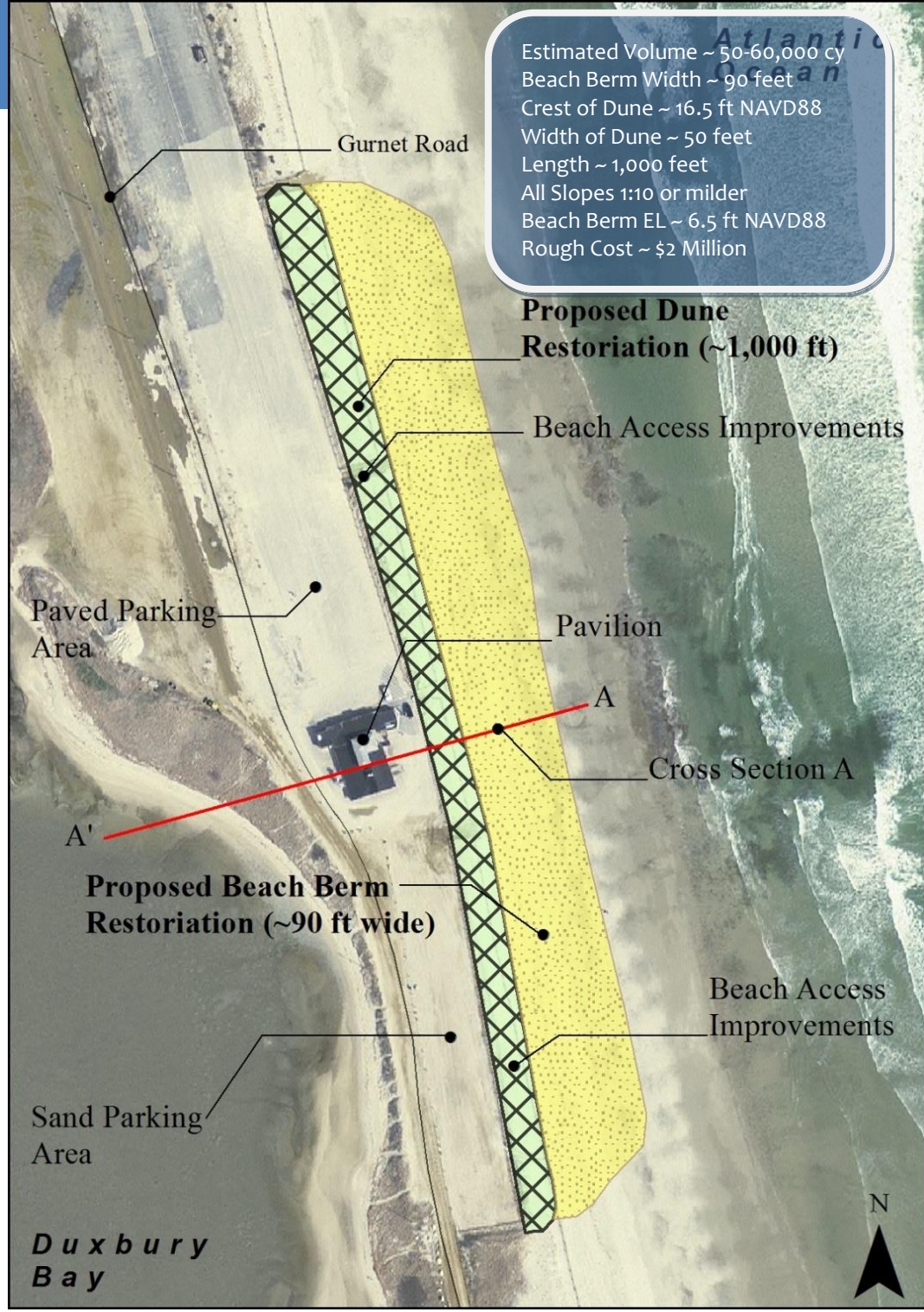
SITE 1
DUXBURY BEACH PARK PAVILION

Cross Section A-A'



The performance of the proposed restoration option is illustrated above. The top panel shows a graphical representation of the proposed dune and beach berm restoration at a cross section in front of the pavilion. The second panel shows the erosion of the existing profile that would be expected to occur if a 50-year storm event impacted the beach. The dashed line shows the pre-storm existing grade, while the solid line shows the post-storm grade. Essentially the dune has been destroyed by the storm. The third panel shows the erosion of the proposed restoration profile caused by the same 50-year storm event. In this case the dune remains.

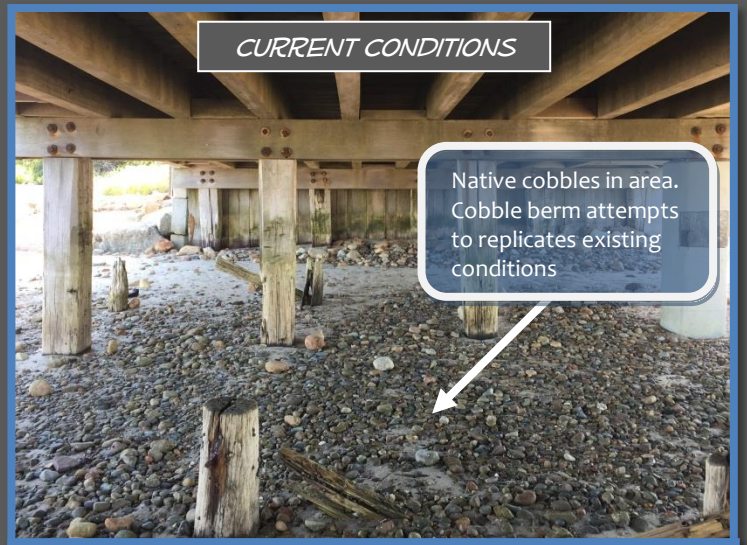
The proposed dune and beach berm restoration provides enhanced protection against moderate to large storm events. While the existing dune may be completely destroyed and the barrier overtopped, the proposed resiliency measure keeps the dune from being overwhelmed and washed away.



SITE 2
POWDER POINT BRIDGE

The original Powder Point Bridge, called the Gurnet Bridge, was constructed in 1892. The bridge shortened an approximate 8 mile trip through Marshfield to under half a mile. In 1987, the bridge was reconstructed replicating the original wooden design. Currently, the bridge stands as the longest wooden bridge in America.

On the eastern side of the bridge, where it connects to the barrier beach, the shoreline adjacent to the abutments is experiencing ongoing erosion due to tidal currents and wind-generated waves produced in Duxbury Bay. Attempts to mitigate this erosion appear to have consisted of loosely placed large armor units next to the bridge abutments; however erosion on either side of the abutments and scour under the bridge seem to have persisted. The proposed resiliency measure at this location consists of creation of a cobble berm along the eroded shoreline area, with larger armor units against the wooden bulkhead and rubber fenders around the piles to avoid impact damage from the cobbles.



PRIORITY AND TIMING

1 HIGH PRIORITY

NEAR-TERM

The Duxbury Beach Reservation technical committee ranked this site as the 3rd highest priority project. It can be completed in the near-term as no significant studies, engineering efforts, or permitting hurdles are expected. Engineering design plans and environmental permitting would need to be conducted prior to construction of this adaptation measure.

SITE 3
BAY SIDE CHANNEL

One of the primary tidal channels within Duxbury Bay (running under the Powder Point Bridge) flows directly adjacent to the bay side shoreline of the barrier beach. Over approximately a 750 foot long stretch, the tidal channel runs extremely close to the shoreline and creates higher velocities that are prone to eroding the barrier beach. As shown in the hydrodynamic model (Chapter 4), this has produced some significant erosional pressure on the back side of the barrier beach in this region, which would be even further heightened during storm events. In addition, not only do the tidal currents induce erosion, but any overwash sediment arriving from the ocean side of the barrier either fills in the channel and must be removed anthropogenically, or is swept away by the tidal currents limiting the barrier width further. This interrupts the natural barrier beach overwash process that results in the rolling landward of the barrier beach and maintains some ongoing maintenance of beach width. Without this process, the barrier beach in this location will continue to narrow and result in a vulnerable area for breaching under future storm conditions and climate change.

However, it isn't just the barrier beach that stands to benefit from channel relocation in this region. The channel itself also may be less prone to shoaling conditions. For example, during a large storm and overwash event, excess sediment could hinder navigation, at least temporarily. This infilling could require maintenance actions or, at minimum, a temporary closure until the tidal currents remove the sediment.

Additionally, potential excess dredge material from the channel relocation could be beneficially re-used to support salt marsh restoration projects at the High Pines region (Site 6). Therefore, potential channel relocation could address multiple resiliency measures.

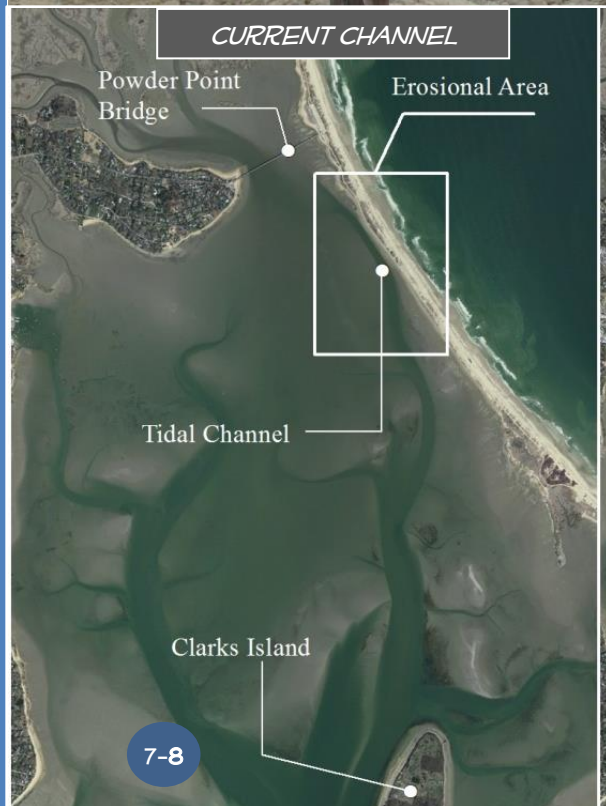
The Duxbury Beach Reservation technical committee ranked this site as the 2nd highest priority. However, the proposed channel relocation project may require a significant permitting effort resulting in extending time requirements. In the near-term, the Duxbury Beach Reservation should continue to monitor and maintain the existing bay side cobble berm. Ocean side restoration could also be considered to help promote a wider beach in this area. Ultimately though, as long as the tidal channel remains in its current location, this site will continue to be a concern, as tidal currents will erode the bay side shoreline and any overwashed material will be swept away resulting in an ongoing narrowing of the barrier beach.

PRIORITY AND TIMING

1 HIGH PRIORITY

LONG-TERM

Rough Cost ~ $6 Million



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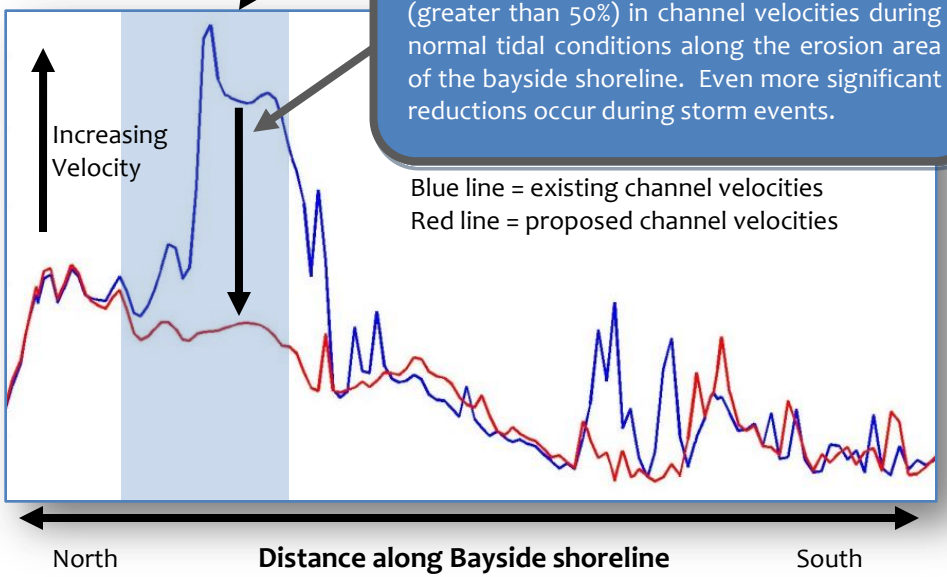
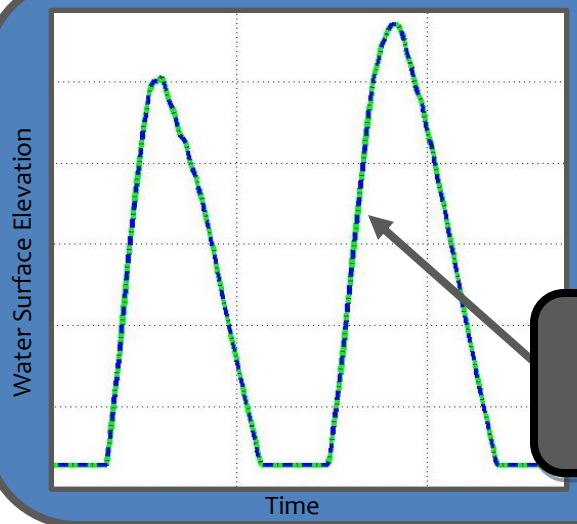
SITE 3
BAY SIDE CHANNEL

The proposed channel location was developed based on hydrodynamics in the system and avoidance known shellfish and oyster farm lease areas. The exact channel layout could be further refined in an engineering design phase such that it carefully avoids resources (shellfish, oyster beds, etc.). Once a preferred orientation is determined, bathymetric surveys would be conducted to determine the volumes of potential dredging required. The hydrodynamic modeling tool develop under this project (Chapter 4) could then be implemented to assess the overall stability of the channel (e.g., would the rate of shoaling of the channel be increased, decreased, or remain the same), appropriate channel dimensions, and the changes to the hydrodynamics and sediment transport.

With known dredge quantities, the amount of material transferred from the new proposed channel to fill in the old channel, as well as the amount of excess material for potential marsh restoration projects (e.g. Site 6), could be determined.

The conceptual channel design simulated in the model resulted in a significant reduction (greater than 50%) in channel velocities during normal tidal conditions along the erosion area of the bayside shoreline. Even more significant reductions occur during storm events.





The hydrodynamic modeling showed no change in the tidal exchange or flushing of the marsh system north of Powder Point Bridge with the proposed channel relocation.

Water surface elevations in upper marsh.
Green = Existing Channel
Blue = Proposed Channel

SITE 4
1ST AND 2ND CROSSOVER

The area between the first and second crossovers along Duxbury Beach is one of the narrowest sections of the barrier beach system. This also is a region that experiences increased wave energy during normal conditions and storm events (Chapter 5).

In the regional beach nourishment, this is an area where an overfill is recommended. However, prior to a large-scale nourishment project, a dune restoration project in this area would provide increased resiliency to the barrier beach and dune system, as well as protect the roadway.

Wave modeling indicated this as a location of focused wave energy, suggesting a higher erosion potential. In stretches between the crossovers, the dune has narrowed to less than 35 feet in width and is at elevations similar or just above the roadway.

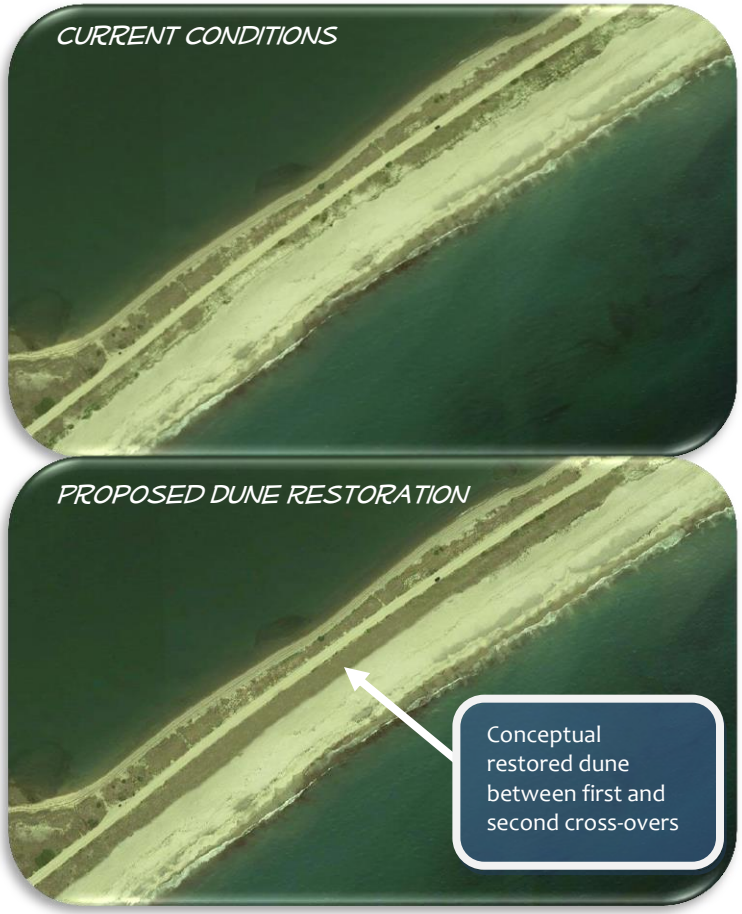
The proposed dune restoration aims at increasing the resiliency of the area between the first and second crossover, while waiting for the longer-term solution of the large-scale regional beach nourishment project. The proposed restoration consists of a restored dune spanning approximately 1,700 feet in length with a crest elevation of 16.5 feet NAVD88. The dune crest is proposed to be approximately 65 feet wide. This resiliency adaptation, along with Site 1, offer a unique opportunity to evaluate the performance of a dune only restoration project (Site 4) against a dune and beach berm restoration project (Site 1).

The Duxbury Beach Reservation technical committee ranked this site as the 4th priority site, indicating a medium priority. It can be completed in the near-term as no significant studies, engineering efforts, or permitting hurdles are expected. Engineering design plans and environmental permitting would need to be conducted prior to construction of this adaptation measure.

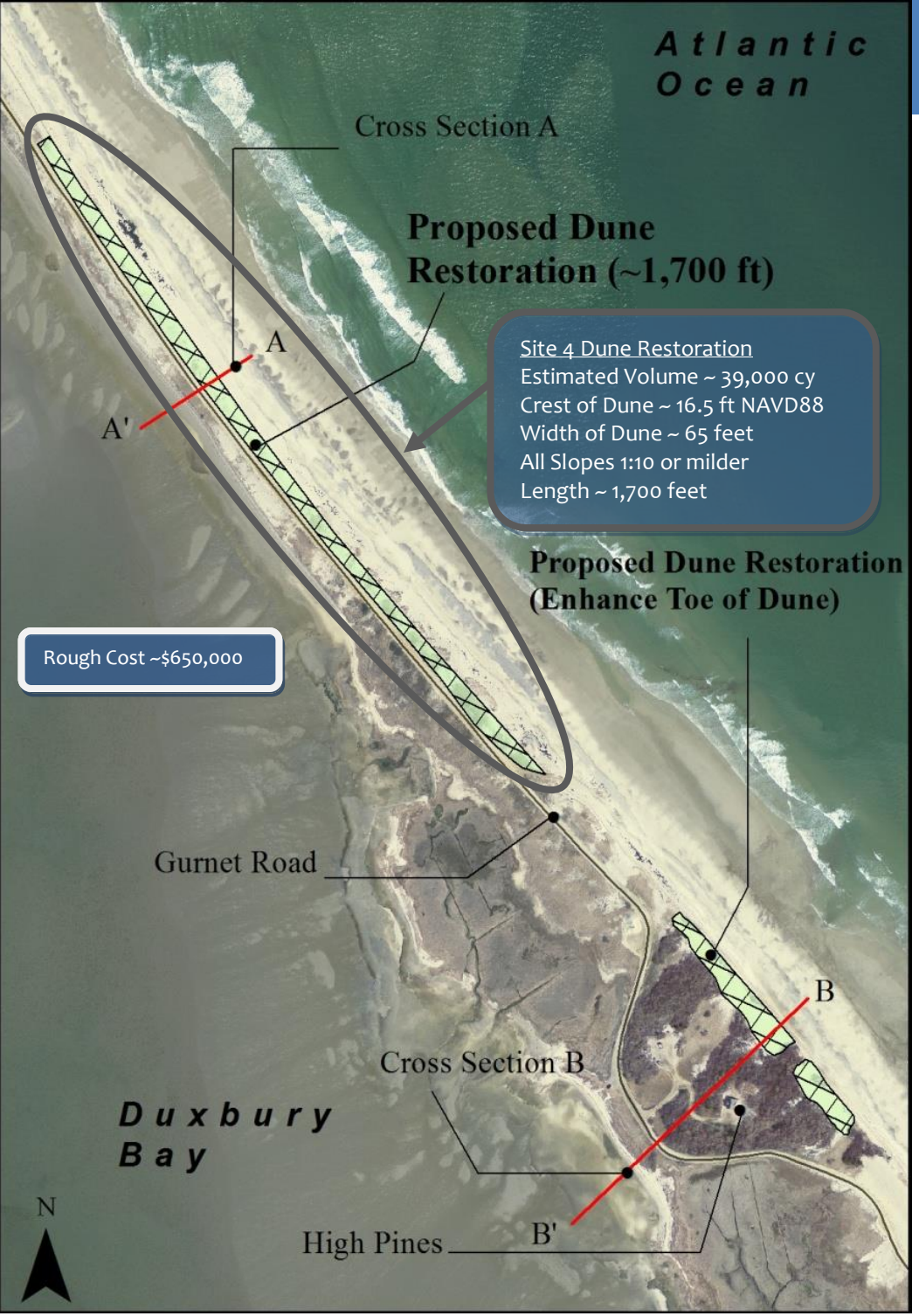
PRIORITY AND TIMING

2 MEDIUM PRIORITY

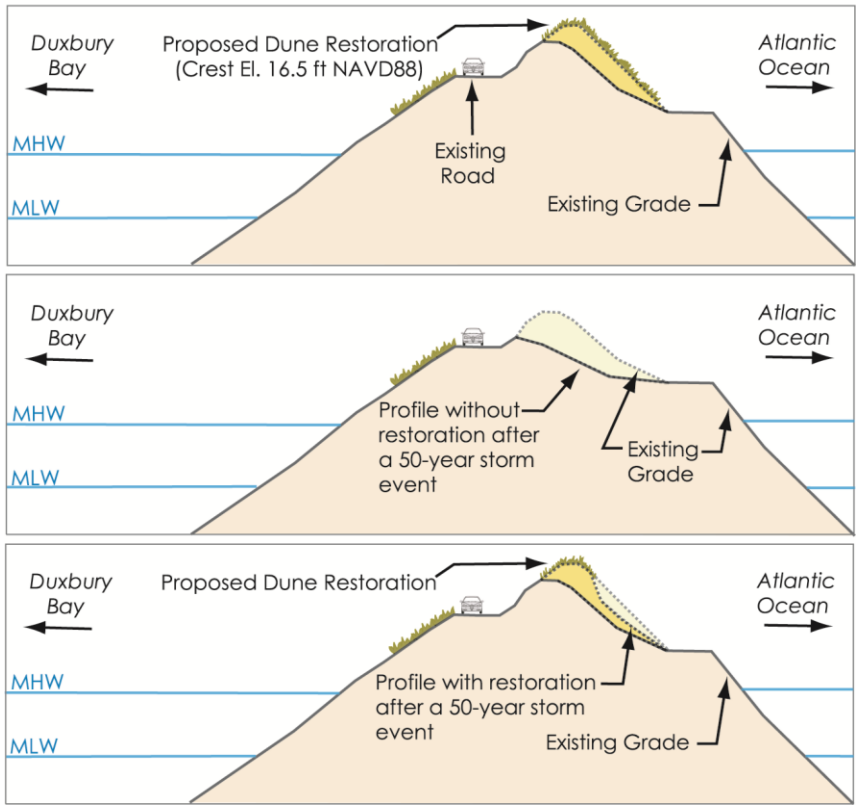
NEAR-TERM



SITE 4
1ST AND 2ND CROSSOVER



Cross Section A-A'



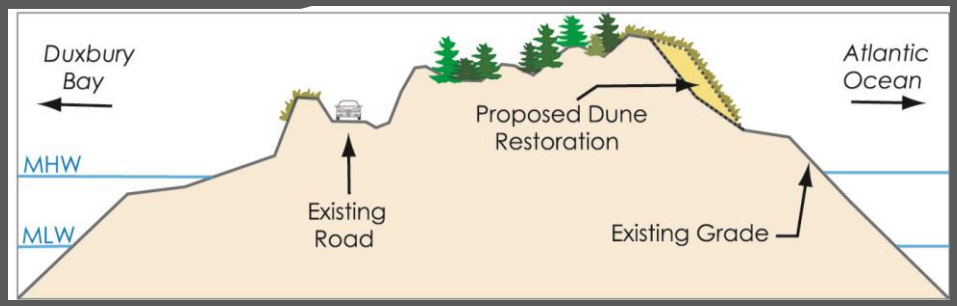
The performance of the proposed resiliency project at Site 4 is illustrated above. The top panel shows a graphical representation of the proposed dune restoration at cross section A-A'. The second panel shows the erosion of the existing profile that would be expected to occur if a 50-year storm event impacted the beach. The dashed line shows the pre-storm existing grade, while the solid line shows the post-storm grade. Essentially the dune has been destroyed and the beach would be overwashed. The third panel shows the erosion of the proposed dune restoration profile caused by the same 50-year storm event. Again, the dashed line shows the pre-storm restored grade, while the solid line shows the post-storm grade. In this case the dune provides increased protection to the roadway and back barrier beach.

SITE 5
HIGH PINES

High Pines, a drumlin located approximately a mile south of the Powder Point Bridge, represents a critical anchor point for the Duxbury barrier beach. While High Pines consists of large sand dunes on the surface, below the surface lies glacial till that makes this area more resilient than the connecting ribbons of sand to the north and south. However, it is still important to actively maintain the High Pines area since this is a critical connector for the entire barrier beach system.

Currently, the High Pines area experiences ongoing erosion at the base of the wind-blown sand dunes facing the Atlantic Ocean. These dune scarps have been maintained through time by DBR, and as part of the proposed resiliency approach should be continually maintained and enhanced to ensure stability of the High Pines anchor point.

Cross Section B-B'

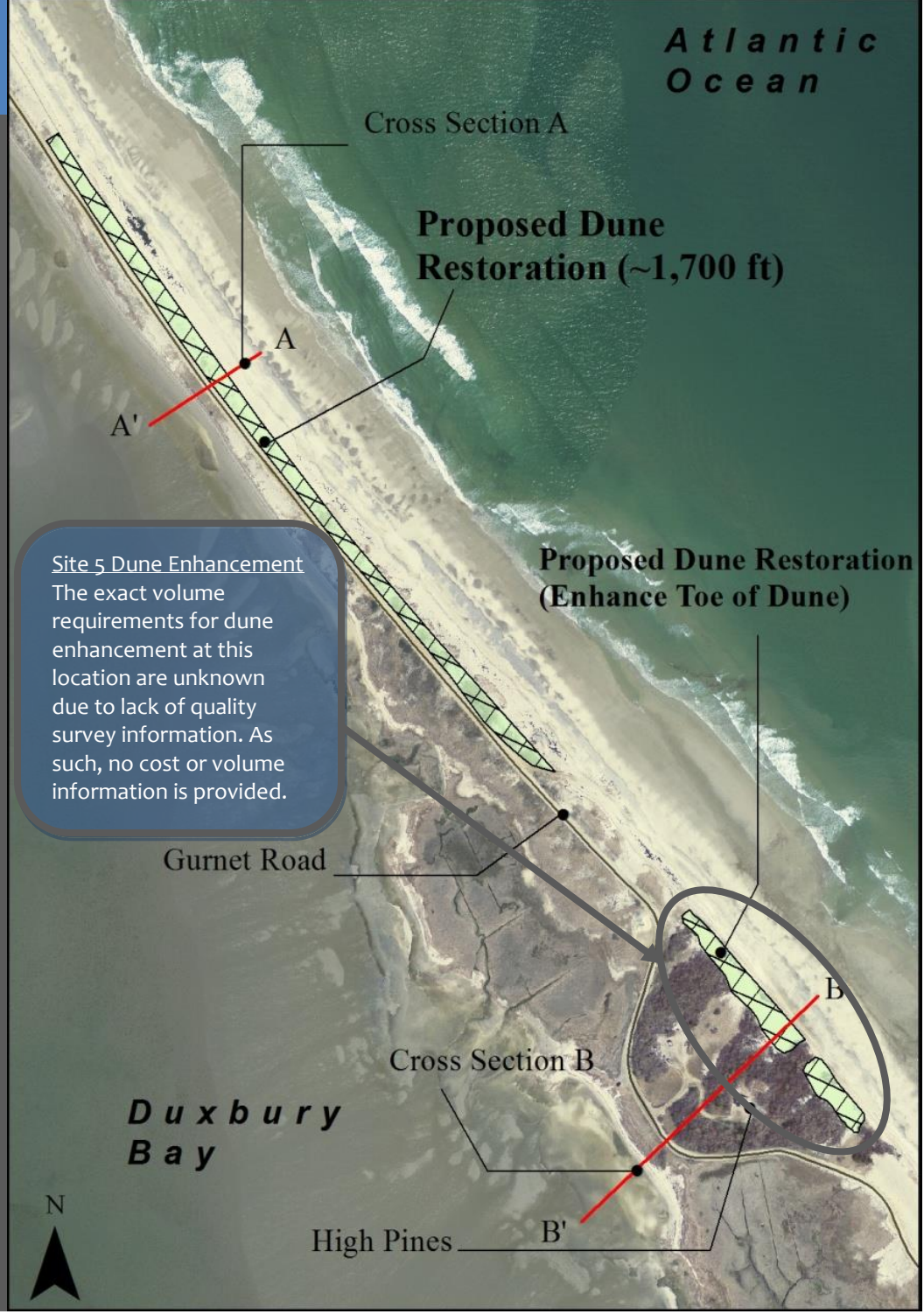


PRIORITY AND TIMING

3 *LOWER PRIORITY*

MID-TERM

The Duxbury Beach Reservation technical committee ranked this site as a lower priority site, due to the overall resiliency of the underlying glacial till and less critical nature of the erosion (wider dune and beach).



SITE 6
HIGH PINES SALT MARSH

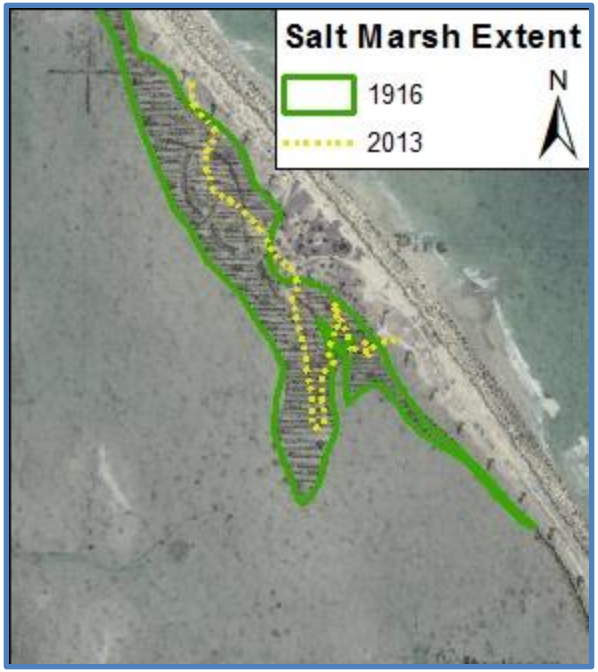
View of existing salt marsh from the southeast. A majority of this area historically was a healthy salt marsh, while now it is primarily tidal flats. All that remains is some smaller isolated islands of marsh.

View of existing salt marsh from the east. Some spines of the former salt marsh still exist with tidal creeks running in between the spines. This area is proposed to be restored to its historic state.

View of existing salt marsh from the north. The overall loss of salt marsh area compared to historic conditions is dramatic. The resiliency project for this location is geared towards returning the marsh to its former levels.

On the bayside, salt marsh resources currently exist to the southeast and northwest of the High Pines drumlin. This is a valuable ecological resource, which also provides protection to the thin barrier beach section just southeast of High Pines. The salt marsh likely originally developed at this location due to the more stable nature of High Pines region.

The goal of the proposed resiliency project at this site is to restore the salt marsh system to a state similar to historical conditions, thereby enhancing ecological resources and also improving resilience of the back side of the barrier beach. This would especially be beneficial to the barrier beach south of High Pines, where the beach width is particularly narrow in the vicinity of the 3rd crossover.



The map from 1916 above shows the historic location and extent of the salt marsh (green outline) that existed adjacent to the High Pines region on the bayside of the barrier beach. The yellow dotted line shows the location and extent of the salt marsh as it existed in 2013. This demonstrates the significant loss of salt marsh over the last century, primarily due to erosion and sea level rise. The proposed resiliency project for this site is aimed at re-creating the salt marsh as it historically existed by expanding the area, specifically to the southern portion of the region.

PRIORITY AND TIMING

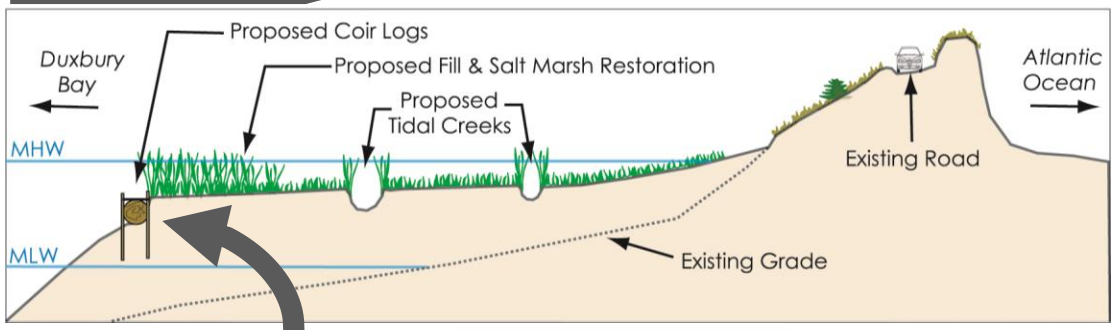
3 LOWER PRIORITY

LONG-TERM

The Duxbury Beach Reservation technical committee ranked this site as a lower priority project. It is expected to be a long-term project that would require significant planning, permitting, and additional engineering efforts. An appropriate source of sediment would also be required to raise the proposed marsh to an adequate grade to promote salt marsh growth. One potential source to consider would be utilizing compatible dredge material from the Site 3 resiliency project.

SITE 6
HIGH PINES SALT MARSH

Cross Section A-A'



The proposed wetlands restoration project at this site consists of raising the existing grade to adequate elevations to support marsh growth, creating and improving the tidal creek network to deliver sediment and salt laden water to the restored marsh, and installing a biodegradable coir log edge (or similar) to help stabilize the sediment placement prior to vegetation growth. Once the grades and creeks are created, the restored marsh areas would be planted with appropriate vegetation. The exact design and volume requirements would need to be refined based on more site-specific survey information.

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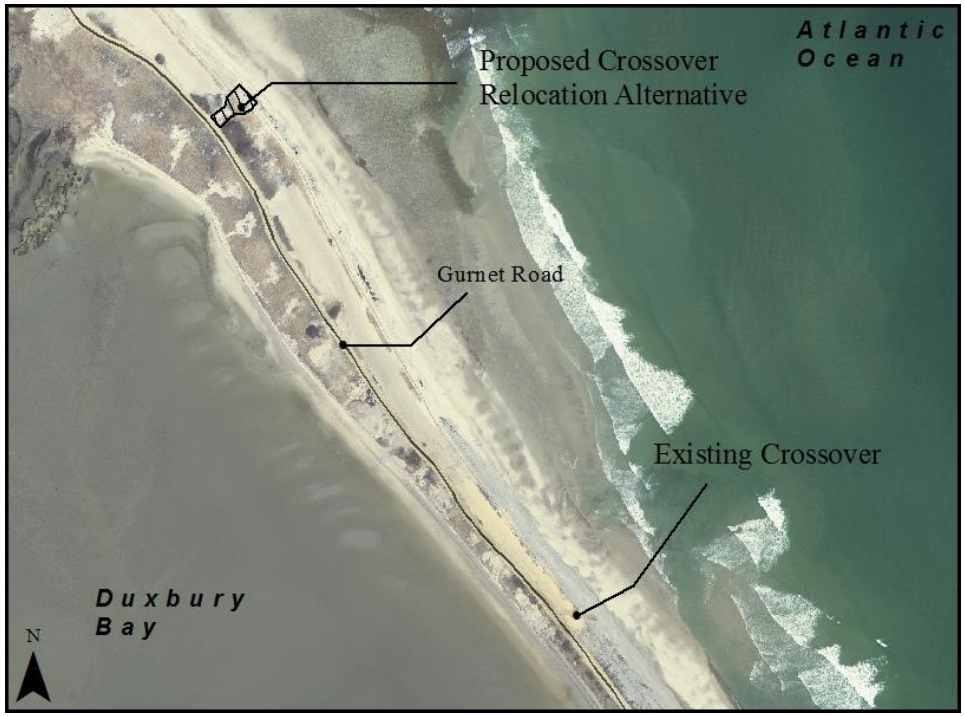
SITE 7
3RD CROSSOVER

There are three maintained crossovers along Duxbury barrier beach that allow beach goers and vehicles access from the roadway to the beach. These crossovers run across the dune and can be closed seasonally for various reasons (e.g., bird nesting). The third crossover, located south of High Pines, is situated on the narrowest section of the barrier beach and has been more difficult to maintain due to storm impacts and overwash effects. The third crossover is also located in an area of higher wave energy (Chapter 5) and therefore is prone to more management concerns. As such, the Duxbury Beach Reservation Technical Committee flagged the third crossover as a problem area and has already planned on moving this feature.

The current location of the third crossover is not ideal given the ongoing coastal processes and existing beach width. The easiest, and least intrusive, solution is to move the third crossover to a more stable and easily maintained location. One potential location, based on the apparent stability of the beach (dune vegetation), historic shoreline change (Chapter 2), and wave energy (Chapter 5) is presented in the adjacent panel. The exact orientation of the crossover would require some site specific surveying and analysis work, but should align with the policies set-up for the other crossover locations. Additionally, the existing crossover location should be completely restored and repaired to match native conditions of the beach and dune system.



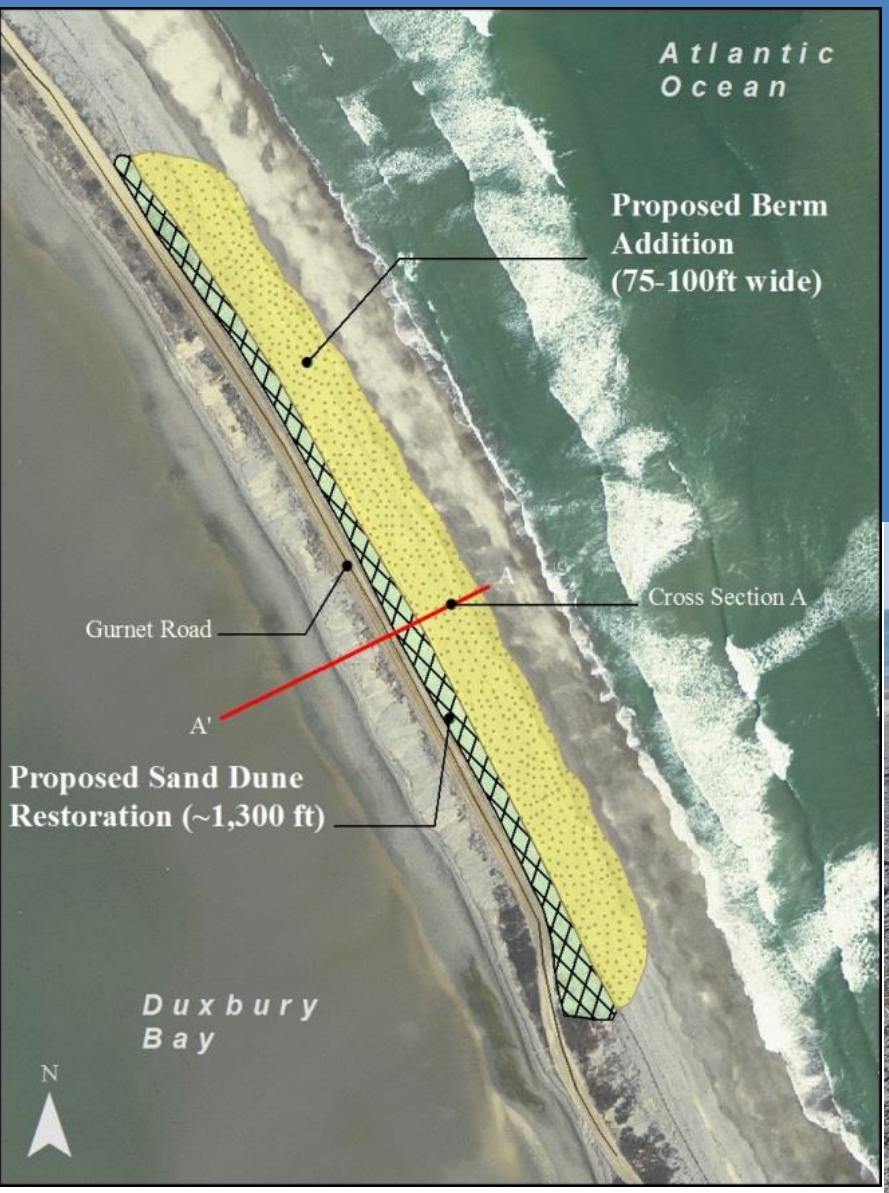
PRIORITY AND TIMING

2 *MEDIUM PRIORITY*

NEAR-TERM

The Duxbury Beach Reservation technical committee ranked this site as a medium priority project and has already begun the planning for moving this crossover. The timing of moving the 3rd crossover would be expected to be fairly swift. The project is not expected to have significant engineering or permitting requirements.

SITE 8
BAY SIDE NEW ROAD



South of the third crossover, where the overall beach width remains narrow, the Duxbury Beach Reservation has recently relocated the road and bolstered the barrier with cobble nourishment on the landward side of overwashes. However, due to the lack of overall beach width in this region, the barrier beach and roadway remain vulnerable to coastal erosion, wave overtopping, and overwash. Various forms of sand fencing have been installed throughout this region to attempt to bolster the beach system through capturing wind-blown sediment; however, this alone cannot provide adequate resiliency for this region. The area also consists of larger median grain size material (Chapter 3) than areas further to the north along Duxbury Beach. There is a mix of cobbles and sand that comprise much of the beach berm and dune system. As such, the proposed resiliency measures attempt to more closely mimic the native grain size distribution in the area by recommending a sand and cobble berm in this region to provide added resiliency to the roadway and reduce breach potential.

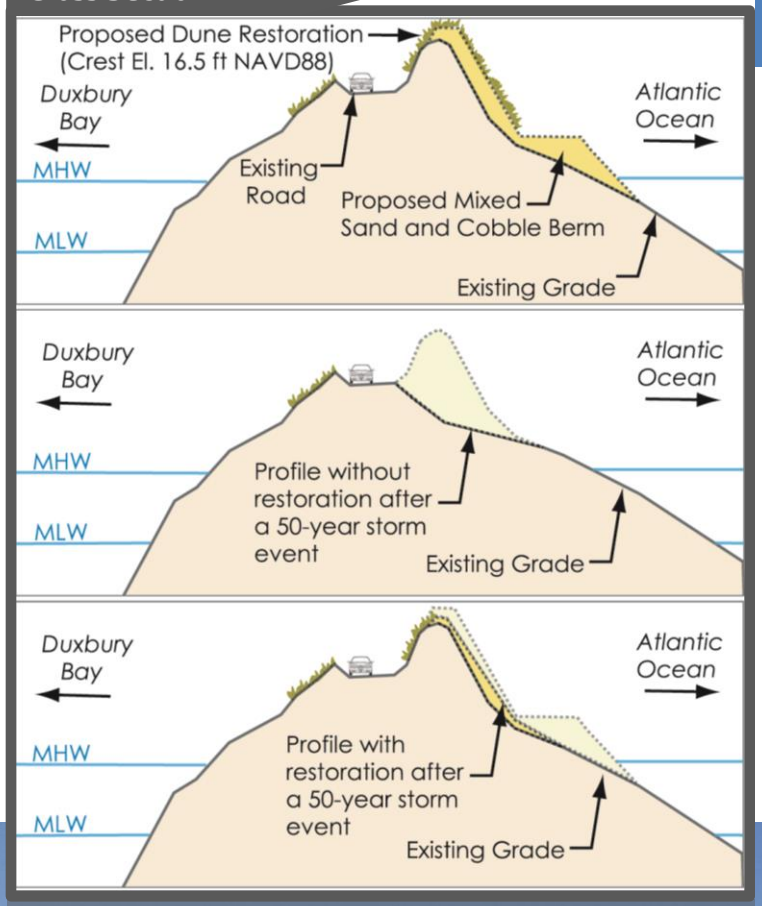
Estimated Volume ~ 100,000 cy
Crest of Dune ~ 16.5 ft NAVD88
Width of Dune ~ 35 feet
Beach Berm Width ~ 75-100 feet
All Slopes 1:10 or milder
Beach Berm EL. ~6.5ft NAVD88
Length ~ 1,300 feet
Rough Cost ~ $4.5 Million

WOODS HOLE GROUP

DUXBURY BEACH RESERVATION, INC.

SITE 8
BAY SIDE NEW ROAD

Cross Section A-A'



The performance of the proposed resiliency project at Site 8 is illustrated above. The top panel shows a graphical representation of the proposed dune and sand/cobble berm restoration at cross section A-A'. The second panel shows the erosion of the existing profile that would be expected to occur if a 50-year storm event impacted the beach. The dashed line shows the pre-storm existing grade, while the solid line shows the post-storm grade. Essentially, the existing beach is unable to protect the road and would be overwashed. The third panel shows the erosion of the proposed dune and beach restoration profile caused by the same 50-year storm event. The dashed line shows the pre-storm restoration grade, while the solid line shows the post-storm grade. In this case the dune and beach berm provide increased protection to the roadway and back barrier beach.

The primary proposed resiliency project at Site 8 consists of a dune restoration coupled with a mixed sand and cobble berm. Due to the narrow width of the beach in this area, the beach berm is designed to be 75-100 feet wide to provide added protection to this region. A secondary management option that should be considered at this location is ongoing monitoring of the roadway itself. Management actions would continue to raise and resurface the roadway as necessary. This management approach could be carried out while waiting for the mixed cobble and sand based nourishment approach presented here.

This proposed project, along with the resiliency projects proposed at Site 1 and 4, offer a unique opportunity to evaluate the performance of potential resiliency approaches and designs through comparisons of dune only restorations, dune and beach restorations, and mixed grain size restoration projects.

PRIORITY AND TIMING

2 MEDIUM PRIORITY

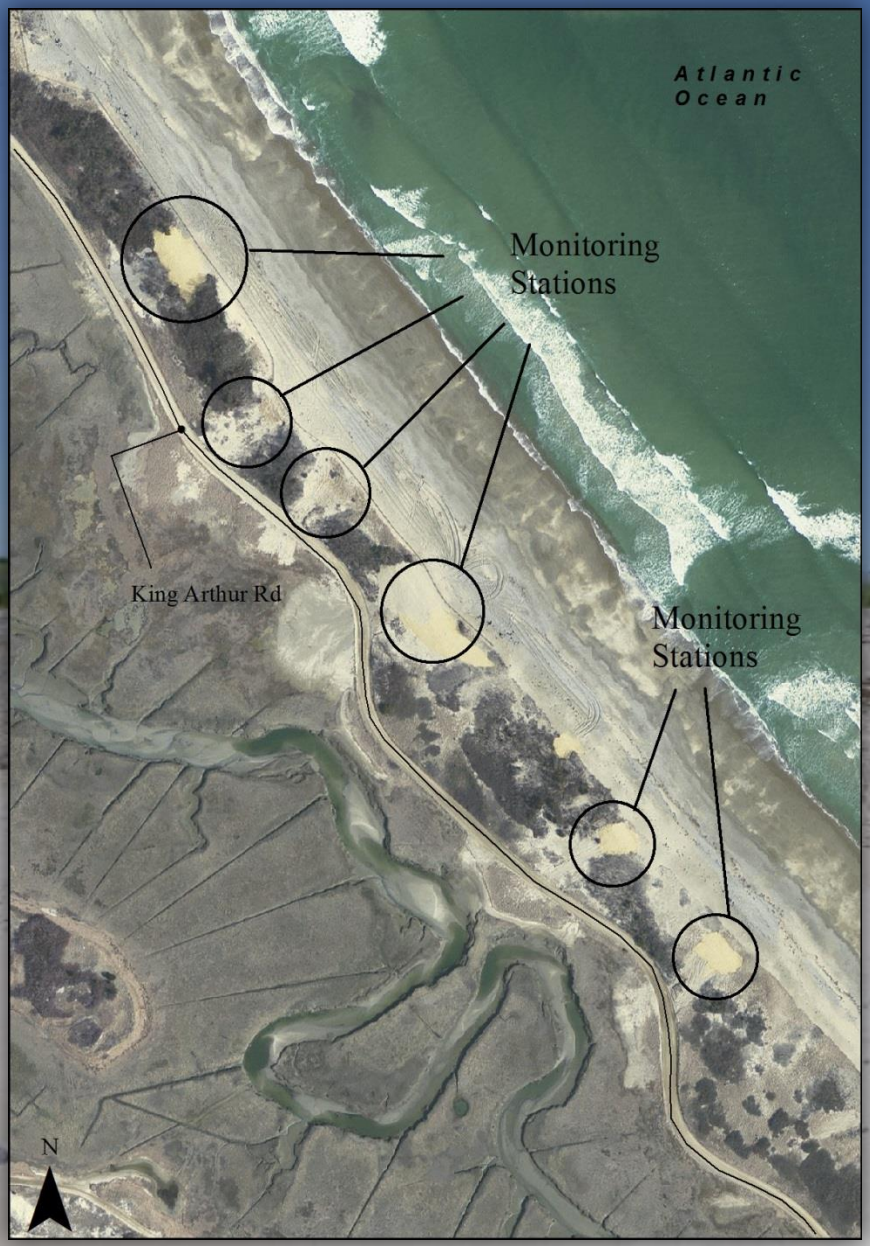
MID-TERM

The Duxbury Beach Reservation technical committee ranked this site as a medium priority project. Engineering design plans and environmental permitting would need to be conducted prior to construction of this adaptation measure. In terms of timing, this would be considered a mid-term project. In the meantime, ongoing monitoring and road maintenance should continue to be conducted.

SITE 9
PLUM HILLS

The Plum Hills area is located on the southern portion of Duxbury Beach (just before reaching Gurnet Point). The area consists of higher vegetated dunes and "hills" in between lower elevation areas that have breached and overwashed in the past. Efforts have been made to restore these breached areas and protect the roadway to Gurnet Point, likely following storm events that have pushed sediment onto the roadway.

At this site, ongoing monitoring is recommended, not only to evaluate the long-term viability of the roadway, but also to ensure that potential breaches and breakthroughs do not have a detrimental effect on the backing salt marsh system.



The Duxbury Beach Reservation technical committee ranked this site as a lower priority project. Currently, it is recommended that the area continues to be monitored and dunes repaired, especially in overwash prone locations. Restoration of these areas has been conducted in the past and can continue to be monitored and restored as necessary. Potential modifications to restoration designs should be considered using an adaptive management framework to determine if there are more effective ways to restore breached locations in the future.

PRIORITY AND TIMING

3 *LOWER PRIORITY*

MID-TERM