# RECORD OF DECISION

**Herring River Restoration Project**
**Environmental Impact Statement / Environmental Impact Report**

**Cape Cod National Seashore, Massachusetts**

## INTRODUCTION

The Department of the Interior, National Park Service (NPS), has prepared this Record of Decision (ROD) for the Herring River Restoration Project Final Environmental Impact Statement / Environmental Impact Report, May 2016 (FEIS/FEIR), at Cape Cod National Seashore, Massachusetts. This ROD states the decision, describes the other alternatives considered and the environmentally preferable alternative, discusses the basis for the decision, and lists measures to minimize environmental harm. In accordance with NPS policy, a non-impairment determination for the selected action is attached to this ROD. Complete references for in-text citations used in the ROD and non-impairment determination may be found in the FEIS/FEIR, available online at the NPS Planning, Environment, and Public Comment (PEPC) web site (http://parkplanning.nps.gov/caco) and Cape Cod National Seashore's web site (www.nps.gov/caco).

## PURPOSE AND NEED FOR THE PLAN

The Herring River Restoration Project is a joint project of the Cape Cod National Seashore, the Town of Wellfleet, the Town of Truro, the Massachusetts Division of Ecological Restoration, the U.S. Fish and Wildlife Service, the National Oceanic and Atmospheric Administration, and the Natural Resource Conservation Service. The purpose of this project is to restore self-sustaining coastal habitats on a large portion of the 1,100-acre Herring River estuary in Wellfleet and Truro, Massachusetts, where wetland resources and natural ecosystem functions have been severely damaged by 100 years of tidal restriction and salt marsh drainage. The goal is to balance tidal restoration objectives with flood control by allowing the highest tide range practicable while also ensuring flood proofing and protection of vulnerable properties.

Historically, the Herring River estuary and flood plain was the largest tidal river and estuary complex on the Outer Cape and included about 1,100 acres of salt marsh, intertidal flats, and open-water habitats (HRTC 2007) in a complex network of five valleys: The Herring River, Mill Creek, Pole Dike Creek, Bound Brook, and Duck Harbor.

The Chequessett Neck Road dike was built in 1908 at the mouth of the Herring River to restrict natural tidal flows. Ditches were constructed to drain the normally saturated flood plain soil. Homes, roads, and the Chequessett Yacht and Country Club (CYCC), a private country club and golf course, were built at low elevations in the flood plain. By the 1960s, the dike had fallen into disrepair, causing periodic flooding of the private properties. The dike was rebuilt in 1974 but did not allow the tidal range required by an Order of Conditions issued by the Wellfleet Conservation Commission under the Massachusetts Wetlands

Protection Act (310 CMR 10,00). In 1977, control of the dike was transferred to the Massachusetts Department of Environmental Protection (MassDEP) so that increased tidal flow could be attained in the interest of restoration (HRTC 2007).

Currently, the once extensive salt marshes have been transformed into freshwater stands of invasive plants, shrubby thickets, and forests. The old salt marsh peat, deprived of the tides, has decomposed and compressed, sinking the surface of the flood plain as much as three feet. The decomposition of peat has released sulfuric acid that kills fish and other aquatic life, and low summertime dissolved oxygen has also harmed aquatic life. In 2003, water quality problems caused the MassDEP to list Herring River as "impaired" under the federal Clean Water Act, Section 303(d) for low pH and high metal concentrations. More recently, NPS researchers identified bacterial contamination as another result of restricted tidal flow and reduced salinity (Portnoy and Allen 2006).

## DECISION (SELECTED ACTION)

The NPS' s decision is to implement alternative D: New Tide Control Structure at Chequessett Neck – Dike at Mill Creek that partially restores tidal flow as the selected action, which was described as the NPS' s preferred alternative in the FEIS/FEIR. The selected action, with its various restoration components, will provide a strategy for long–term, systematic monitoring, management, and restoration of the Herring River estuary. Specific components of the selected action are discussed below. The complete description of the selected action can be found in the FEIS/FEIR.

### CHEQUESSETT NECK ROAD DIKE

Reconstruction of the dike to allow greater tidal exchange is the primary element of the restoration project. The selected action will involve the replacement of the current dike with a box beam bridge/dike structure equipped with adjustable and removable tide gates spanning a total opening width of 165 feet. These gates will be gradually and incrementally opened during implementation to achieve a target mean high water spring tide of 5.6 feet and coastal storm driven tide of 7.5 feet in the Lower Herring River, and to restore a tidally–influenced area of 956 acres. In addition to functioning as a tide control structure, the new bridge will also feature 11–foot automobile travel lanes, an 8–foot wide parking lane, and adjacent 5–foot wide sidewalks on the eastern and western sides of the bridge. It will have a final crest height similar to the existing dike (approximately 12 feet NAVD88, compared to the present 11.3 feet). The new dike will also include enhanced parking, canoe, kayak, and pedestrian access, viewing platforms, improved stormwater management, and burial of overhead utilities.

### MILL CREEK DIKE

The selected action includes construction of a secondary dike, using a single sheet pile wall design, to control tidal exchange in Mill Creek sub–basin. The dike will contain five openings, each five feet high and five feet wide, for a 25 foot wide total opening. Each opening will have an adjustable combination flap–slide gate that would be gradually and incrementally opened in a similar manner to the Chequessett Neck Road tide gates. The selected action would limit mean high spring tides to 4.7 feet and coastal storm driven events to 5.9 feet in Mill Creek. The dike will be constructed with a crest height of 9.5 feet, based on a maximum, storm–of–record high tide on the downstream side of 7.5 feet. This provides two feet of freeboard against an extreme storm event. An area of salt marsh approximately 300 feet long by 12 feet wide will require stabilization to provide occasional vehicle access from the adjacent upland area to the

tide gates for maintenance. A cantilevered walkway along the top of the wall will provide access to the tide gate controls.

### Pole Dike Creek Road Culvert and Flap Gate

The selected action includes creation of a third tide control structure by installing an adjustable tide gate, similar to those used at the Chequessett Neck Road Dike and Mill Creek Dike, on a new, and likely larger, culvert under Pole Dike Creek Road. Pole Dike Creek Road itself would be elevated and regraded to avoid tidal flow impacts to the roadway and areas upstream. The tide gate would be managed in a manner similar to those at Mill Creek, where tidal flow will be prevented or limited and monitored while flood prevention agreements are negotiated with affected landowners.

### Incremental Tidal Restoration and Adaptive Management

Under the selected action, reestablishment of tidal influence will be long-term, phased process over several years, in which the gradual opening of adjustable tide gates would incrementally increase the tidal range in the estuary. The primary reason to implement the project in this manner is to allow monitoring of the system so that unexpected and/or undesirable responses could be detected and appropriate response actions taken. In addition, the complexity of the project also dictates use of an adaptive management approach, including field monitoring. Details of this process and its application to the Herring River project are described in "Appendix C: Overview of the Adaptive Management Process for the Herring River Restoration Project" to the FEIS/FEIR.

### Vegetation Management

One of the most important, noticeable, and desirable changes of restoration will be a transition from one set of plant community types to another as changes occur to environmental parameters such as tidal range, frequency and duration of tidal flooding, soil saturation, and, most notably, salinity. However, this transition is likely to result in many acres of standing dead trees and shrubs that will require direct vegetation management to remove woody debris that might impede fish passage, remove large trees that will eventually die, topple and leave holes on the wetland surface where mosquitoes might breed, and encourage re-establishment of tidal marsh. Potential management techniques include cutting, chipping, burning, and targeted herbicide application, or a combination of these techniques. Details about vegetation management are described in "Appendix C: Overview of the Adaptive Management Process for the Herring River Restoration Project" to the FEIS/FEIR.

### Restoration of Tidal Channel and Marsh Surface Elevation

The selected action will include several supplementary management actions to address marsh surface subsidence, artificially straightened river channels, and a legacy of mosquito ditches and spoil berms. These actions include:

- Dredging to establish a natural river bottom and maximize ebb tide drainage
- Creation of small channels and ditches to improve tidal circulation
- Restoring natural channel sinuosity
- Removing spoil berms and other anthropogenic material on the marsh surface

- Applying thin layers of dredged material to build up subsided marsh surfaces

Details about supplementary management actions to restore tied channels and marsh surface elevation are described in "Appendix C: Overview of the Adaptive Management Process for the Herring River Restoration Project" to the FEIS/FEIR.

## Low-Lying Road Crossings and Culverts

The selected action will involve actions to address potential flood impacts on several low lying roads. These include:

- High Toss Road Culvert – this culvert will be replaced with a larger box culvert or opening to eliminate any constriction of tidal flow, but the road surface will not be elevated above future maximum tide heights.
- Old County Road, Bound Brook Island Road and Pole Dike Creek Road – Proposed elevated roadway segments for Old County Road, Bound Brook Island Road and Pole Dike Creek Road consist of two 11-foot travelways and two three-foot unpaved shoulders with a 3:1 side slope treatment. Approximately 6,175 linear feet of these roads will be elevated to a minimum grade of 5.5 feet, 1 to 3 feet above the current grade, to prevent overtopping by storm driven tides. Six culverts, including the culvert described under Pole Dike Creek Road Culvert and Flap Gate, would be replaced and enlarged. Elevating these roads will also require widening the road bases. Grading will be minimized to limit fill outside the existing right-of-way and minimize wetland impacts. However, in some locations it may be necessary to extend fill onto private and municipal properties. The FEIS/FEIR estimated this total impact at approximately 24,000 sf, but this is subject to change based upon final project design and resolution of access agreements. This may include adjustments to isolated public or private driveways to eliminate negative sloping and ponding.

## Actions to Protect Low Lying Properties, Including the CYCC Golf Course

To address flooding concerns on low -lying properties, the selected action includes, where necessary, elevating or relocating driveways and landscaping, moving wells, building small berms or flood walls, and moving or elevating structures. In all but two properties, flood damage to low-lying structures appears to be preventable by these types of mitigation measures. The specific plans for these preventative mitigation measures will be arranged with private property owners on a case by case basis; this process is currently underway for a number of private properties that will, at some point in time during the tidal restoration process, require preventative mitigation.

In the case of two private properties that are at very low elevations in the Lower Herring River sub-basin, an area not protected by either the Mill Creek Dike or Pole Dike Creek Road Flap Gate, it does not appear that preventative flood mitigation measures are feasible. Under the selected action, NPS would seek to acquire these properties from a willing seller. In the absence of a willing seller, NPS may consider an eminent domain taking. At present, a voluntary exchange is being negotiated for one of these two properties.

The selected action will also provide preventive flood mitigation for affected portions of the CYCC golf course. The selected action will regrade and elevate approximately 8.3 acres of the golf course above the high tide line. The existing layout of the golf course will remain essentially unchanged. Most of the area

that will be elevated is currently classified as wetlands, although this area is now maintained by the CYCC as part of the golf course. A small portion, approximately 4,800 square feet, is naturally vegetated. Fill may be obtained from an approximately 5-acre borrow area on adjacent uplands under CYCC ownership, or from another source if an agreement cannot be reached with CYCC on the use of their borrow site. The current practice area will be restored as wetland, and the borrow site would be regarded as a new practice area.

These preventive flood mitigation measures require that an agreement be reached with CYCC. If an agreement is achieved prior to the preparation of the project' s permitting applications, the golf course work will be proposed as part of the initial phase of design, permitting, and funding for the restoration project. If an agreement cannot be reached prior to preparation of permit applications:

1. Tidal restoration will not be proposed in the Mill Creek sub-basin until a later project phase after mitigation agreements are finalized with the CYCC and other affected Mill Creek landowners;
2. The Proponent will continue to advance permitting and other elements of the project that support tidal restoration in the main Herring River basin; and
3. The Proponent will, in good faith, continue to seek mitigation agreements with CYCC and other affected landowners in the Mill Creek sub-basin.

## Public Access and Recreation Opportunities

The selected action will include safe fishing access points on the new Chequessett Neck Road dike, launch sites on the upstream and downstream sides of the new dike, and a safe portage route between those launch sites. Launches for canoes or kayaks could also be provided at other points in the estuary. Walking trails could include access to the variety of habitats established by the restoration process. Over the long term, access to recreational shellfishing areas could also be considered once the shellfish resource is sustainable and capable of supporting harvest.

## Construction Methods, Timeframe, and Resource Protection Measures

The selected action includes the staging and use of standard construction methods and equipment, including earth-moving equipment, graders, cranes, dump trucks, cement trucks, and other equipment. Fill, armor stones, and other construction materials will also be staged. To the extent possible, previously disturbed areas will be used to stage equipment and materials. The selected action will involve clearing and grading two acres of upland vegetation to create a staging area for construction of the new Chequessett Neck Road Dike; this will be restored to close to its original condition after use, or adapted for use as recreational parking. For in-water dike construction, the sites will be de-watered using coffer dams and pumps, or other common methods for dike construction. Construction of the new dike at Chequessett Neck Road Dike is expected to take approximately 12-18 months to complete. Improvements to low-lying roads will take approximately 6-12 months to complete. At Mill Creek, the new dike will take approximately 3-6 months. It is likely that individual construction elements will be phased in over time and will not occur concurrently. Improvements to some of the roads that are in the more upstream reaches of the flood plain could be phased with the later incremental dike openings. Best management practices (BMPs) will be implemented to limit sediment movement and protect water quality. Areas of temporary disturbance, such as access roads and equipment and material staging areas, will be returned to natural grade and seeded with native vegetation.

### Traffic Control During Construction

The selected action will include the construction of a temporary bypass route on the eastern side (upstream) of Chequessett Neck Road to allow for a one-lane signalized alternating two-way traffic setup. The bypass route will consists of a temporary prefabricated modular steel bridge that will span approximately 190 feet across the Herring River. A cantilevered walkway platform will be provided as a bypass route for pedestrians and dismounted cyclists.

## MEANS TO AVOID OR MINIMIZE ENVIRONMENTAL HARM

All practical means to avoid or minimize environmental harm from the selected action have been evaluated and adopted. Restoration activities will proceed in an incremental and phased approach that will be guided by, and adjusted in response to, the adaptive management plan (see appendix C of the FEIS/FEIR). Monitoring will be conducted in accordance with the adaptive management plan, and will determine factors contributing to the success or failure of the restoration, justify adaptive management actions, and allow for the better understanding of factors contributing to the state of the system.

The project will require multiple permits and approvals from federal, state, and county agencies before construction commences and prior to some of the secondary management actions that will be taken during the course of the restoration process. Permits that must be obtained for the project will require application of pollution prevention principles, spill prevention measures, standard practices related to air quality, and implementation of appropriate sediment and erosion control practices (see "Appendix N: Massachusetts Environmental Policy Act Draft Section 61 Findings and Proposed Mitigation Measures" in the FEIS/FEIR). In addition to measures specifically mentioned in the FEIS/FEIR, the required permits will also dictate construction timing to prevent adverse effects on fish spawning and wildlife reproduction seasons. It is expected that additional measures to minimize environmental harm will be stipulated through the permitting process and consultation.

## ENVIRONMENTALLY PREFERABLE ALTERNATIVE

The NPS has identified alternative D as the environmentally preferable alternative. This alternative will allow for the most environmental benefits associated with tidal exchange restoration, including creation of habitat, water quality and floodplain protection benefits, improvement of coastal/marine resources, historic and archeological resources, and improvement of visitor experience.

### Alternatives Considered but Not Selected

#### Alternative A: No Action

Under alternative A, the existing 18-foot-wide structure would remain in place, and no tidal restoration would occur.

#### Alternative B: New Tidal Control Structure at Chequessett Neck – No Dike at Mill Creek, No Flap Gate at Pole Dike Creek Road Culvert

Like the other Action Alternative, alternative B would have replaced the existing Chequessett Neck Road Dike with a box beam bridge/dike structure with a total opening width of 165 feet spanned by a series of adjustable and removable tide gates to allow passage of Wellfleet Harbor tides. The tide gates would have

been opened gradually according to guidelines set forth in the Adaptive Management Plan with an objective to ultimately reach a mean high spring tide of 4.8 feet and a maximum coastal storm driven tide of 6.0 feet in the Lower Herring River, a lower target range than the selected action. These elevations represent the maximum restoration possible without the need to install a secondary tide control structure at Mill Creek and Pole Dike Creek Road to protect private properties. Flood prevention would have been designed to accommodate maximum coastal storm driven high tides up to 5.9 feet within the Mill Creek sub-basin and 5.3 feet in the Upper Pole Dike Creek sub-basin, and would have included preventative mitigation at the CYCC golf course and other private properties in Mill Creek, Pole Dike Creek, and other sub-basins.

**Alternative C: New Tidal Control Structure at Chequessett Neck – Dike at Mill Creek that Excludes Tidal Flow**

Similar to the other action alternatives, tide gates at a reconstructed Chequessett Neck Road Dike would be opened gradually; once fully opened the gates would have allowed mean high water spring tides up to 5.6 feet and coastal storm driven tides up to 7.5 feet in the Lower Herring River. Alternative C would have provided the highest practicable high tide water surface elevations possible in most sub-basins, but would have included a tidal exclusion dike at the mouth of Mill Creek. A mechanical pump would have been required to drain freshwater from the Mill Creek sub-basin into Herring River. This dike would have eliminated all restoration benefits and flood prevention requirements, such as elevating portions of the CYCC golf course, in Mill Creek sub-basin. While flood prevention measures would not be needed in Mill Creek sub-basin, these activities would have been required for some properties in other sub-basins.

## BASIS FOR DECISION

In selecting alternative D: New Tide Control Structure at Chequessett Neck – Dike at Mill Creek that partially restores tidal flow, the NPS evaluated each alternative based on its ability to meet the project/plan objectives (see table 2-4 of the final EIS/EIR), its environmental impacts (see "Chapter 4: Environmental Consequences" of the final EIS/EIR), the anticipated effort to implement it, the degree of management flexibility it affords, and its cost.

An initial review of the alternatives was accomplished by the project team through the Value Analysis/Choosing by Advantages process held in June 2011 (Kirk Associates 2011), which concluded that alternative D represented the best value restoration approach based on consideration of natural and cultural resources effects, operational factors, socioeconomic effects, and project cost. Subsequently, these alternatives were published in the DEIS/DEIR in October 2012.

Based on comments received on the DEIS/DEIR, the option of installing an adjustable flap gate on the culvert at Pole Dike Creek Road was incorporated into alternative D in order to enhance flood protection for low-lying properties in Pole Dike Creek Sub-basin. Also, additional design and cost information led to a determination to purse the "elevate" option, as opposed to the "relocate" option, for portions of the golf course requiring preventative flood measures. No other public or agency comments led to a reassessment of alternative D as the preferred approach; therefore, the updated alternative D was identified as the preferred alternative in the FEIS/FEIR, published in June 2016.

In summary, alternative D is selected because it restores the largest number of acres among the action alternatives evaluated, it provides the greatest improvement to the ecological function of the estuary

compared with the other action alternatives, and it accomplishes these objectives while providing the same degree of flood protection for low-lying roads and properties as the other action alternatives.

## CONCLUSION

Overall, among the three action alternatives considered, the selected action best meets the purpose, need, and objectives of the restoration project and is expected to provide the greatest benefits in terms of restored acreage and ecological function of the estuary. The selected action has been identified as the environmentally preferable alternative and incorporates all practical means to avoid or minimize environmental harm.

The required "no-action period" before approval of the ROD was initiated on July 15, 2016, with the publication by the U.S. Environmental Protection Agency of a Notice of Availability of the FEIS/FEIR in the *Federal Register*.

The NPS official responsible for the decision is the Northeast Regional Director.

The NPS official responsible for implementing the selected action is the Superintendent of Cape Cod National Seashore.

**Recommended by:**

George E. Price, Jr., Superintendent

Cape Cod National Seashore

Approved by:

9/15/2016

Michael A. Caldwell, Regional Director

Northeast Region, National Park Service

# ATTACHMENT A: NON-IMPAIRMENT DETERMINATION

By enacting the NPS Organic Act of 1916 (Organic Act), Congress directed the U.S. Department of the Interior and the NPS to manage units "to conserve the scenery, natural and historic objects, and wild life in the System units and to provide for the enjoyment of the scenery, natural and historic objects, and wild life in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (54 U.S.C. 100101).

NPS *Management Policies 2006* (NPS 2006), Section 1.4.4, explains the prohibition on impairment of park resources and values:

> "While Congress has given the Service the management discretion to allow impacts within parks, that discretion is limited by the statutory requirement (generally enforceable by the federal courts) that the Park Service must leave park resources and values unimpaired unless a particular law directly and specifically provides otherwise. This, the cornerstone of the Organic Act, establishes the primary responsibility of the National Park Service. It ensures that park resources and values will continue to exist in a condition that will allow the American people to have present and future opportunities for enjoyment of them."

The NPS has discretion to allow impacts on park resources and values when necessary and appropriate to fulfill the purposes of a park (NPS 2006, Section 1.4.3). However, the NPS cannot allow an adverse impact that will constitute impairment of the affected resources and values (NPS 2006, Section 1.4.3). An action constitutes impairment when its impacts "harm the integrity of park resources or values, including the opportunities that otherwise will be present for the enjoyment of those resources or values" (NPS 2006, Section 1.4.5). To determine impairment, the NPS must evaluate the "particular resources and values that will be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts: (NPS 2006, Section 1.4.5).

As stated in NPS *Management Policies 2006* (NPS 2006, Section 1.4.5), an impact on any park resource or value may constitute an impairment, but an impact would be more likely to constitute an impairment to the extent that it affects a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park; or
- key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or
- identified in the park's general management plan or other relevant NPS planning documents as being of significance.

This non-impairment determination has been prepared for the selected action, as described in the Record of Decision (Alternative D in the final EIS: New Tide Control Structure at Chequessett Neck - Dike at Mill Creek that partially restores tidal flow). In making this non-impairment determination, the purpose of Cape Cod National Seashore was considered, as interpreted in the most recent General Management Plan (NPS 1998):

- Preserve the nationally significant and special cultural and natural features, distinctive patterns of human activity, and ambience that characterize the outer Cape, along with the associated scenic, cultural, historic, scientific, and recreational values.
- Provide opportunities for current and future generations to experience, enjoy, and understand these features and values.

This non-impairment determination is made for the following resources: salinity of surface waters, water and sediment quality, sediment transport and soils, wetland habitats and vegetation, aquatic species, federal and state-listed rare, threatened, and endangered species, terrestrial wildlife, and cultural resources.

## WATER RESOURCES

### Salinity of Surface Waters

Under the selected action, permanent, beneficial estuary-wide changes in the penetration of high salinity water into lower and mid-flood plain sub-basins, which currently receive little or no tidal influence, will occur. This increase in salinity is a critical factor in achieving the desired transition from a degraded freshwater wetland to a functioning estuarine wetland, which is an ecologically critical component of the coastal ecosystem of Cape Cod. Based on the degree of salinity change, particularly in the lower sub-basins, the importance of salinity as an ecological factor, and the regional importance of tidal wetlands in terms of biodiversity, this will result in restoration of salinity penetration to a pre-dike condition. The selected action also includes an adaptive management plan designed to prevent widespread expansion of *Phragmites* (see EIS Appendix C), the non-native common reed, which could result in limited adverse impacts to surface water salinity if not addressed. Phragmites expansion can be addressed by encouraging the expansion of native competitors and by herbicide application, mechanical control, or hydrological (increased inundation and salinity) alterations. Overall, implementation of the selected action will improve the condition of surface water salinity, thereby providing current and future generations with better opportunities to experience water resources in more natural conditions in the Seashore. Therefore, no impairment will occur under the selected action.

### Water and Sediment Quality

Implementing the selected action would result in a permanent increase in tidal flushing that will greatly improve water quality in the estuary and in Wellfleet Harbor. This improvement to water quality is an important factor in achieving the desired transition from degraded freshwater marsh to a functioning estuarine wetland, which is ecologically critical in the geographic area of Cape Cod. Under the selected action, tidal restoration will substantially improve water and sediment quality by allowing increased flows of seawater, creating higher high tides and increased low tide drainage. Tidal restoration will also substantially decrease system residence times, which is a measure of the amount of time required to exchange water from a given area in the Herring River system with Wellfleet Harbor. Water and sediment quality improvements are integral for restoring the natural habitat conditions required for the re-establishment of native fish, shellfish, and other estuarine animals.

Due to restored salinities, aluminum and iron will no longer be leached from the soil to receiving waters in concentrations that stress aquatic life. While adverse impacts to water quality could initially result from renewed tidal flushing of acid sulfate soils, these adverse impacts would last only months, and with the great improvement of tidal flushing (minimum 24 times faster than current conditions), nutrients will be diluted and removed from the system with each tide cycle. Overall, released nutrients will benefit growth of salt marsh vegetation in the restored marsh. The gradual reintroduction of tidal

exchange will allow ammonium-nitrogen to be slowly released, thus avoiding nitrogen loading that could contribute to algal blooms in receiving waters. Any increased concentrations of released nutrients will likely be short-lived (probably months) and not persist beyond an initial adjustment period. Wellfleet Harbor is well-flushed, limiting the potential impacts of any temporary increases in nutrient loading. With small, incremental increases in tidal exchange, informed by appropriate water quality monitoring, the release of nutrients from the estuary would likely be small and would not result in persistent algae blooms in the harbor. Regular tidal flushing is also expected to substantially decrease fecal coliform concentrations in the Herring River compared to existing conditions, which will likely allow for removal of the river from the 303(d) list for impairment by pathogens, leading to the potential for additional areas of shellfish beds that could be reopened for harvest.

The selected alternative includes an adaptive management plan (see EIS Appendix C) to address summertime dissolved oxygen levels, which could remain low in ponded areas and obstructed ditches that are not regularly flushed by tidal waters. Ponded areas encourage mosquito hatches and low dissolved oxygen levels can harm fish. Under the adaptive management plan, the extent of standing water, dissolved oxygen, and other parameters will be monitored and ponding would be reduced by targeted excavation of silted-in channels to increase circulation and promote low-tide drainage. Any adverse impacts related to water and sediment quality will be limited to construction activities, and mitigated through the application of BMPs. These activities include dike construction and floodproofing of roads and other developed properties; absent the use of BMPs these activities could cause localized, temporary increases in turbidity or site contamination from materials used in construction.

Overall, based on the probable degree of long-term water quality improvements, the importance of water quality as an ecological factor and the regional importance of estuarine wetlands, the selected action will result in beneficial impacts to water and sediment quality. This will provide current and future generations with better opportunities to experience water resources in more natural conditions than currently exist in the Seashore and, therefore, there will be no impairment to water resources in the Seashore, with regard to water sediment and quality.

**SEDIMENT TRANSPORT AND SOILS**

Under the selected alternative, restored tidal range will lead to higher sediment transport and deposition onto the wetland surface, as sediment-carrying flood tides will again flood over creek banks and onto the marsh platform. The selected action will also result in estuary-wide, beneficial changes to hydric soils by increasing pore space, soil pH, and organic content. Restoration of sediment transport processes is important because those processes enhance accretion of sediment on subsided marsh plains, restore the dimension and pattern of tidal channels, and could potentially influence ecological processes and resources in the river and Wellfleet Harbor. The degree and rate of sediment mobilization will be largely determined by the amount of tidal influence and rate of incremental opening of the tide gates, which will be managed through an adaptive management strategy (See EIS Appendix C).

While there will be areas of increased erosion potential upstream of the dike due to changes in sediment mobilization, those areas are confined mostly to the future location of a more defined Herring River channel and will likely extend farther upstream in the Herring River. For areas downstream of the dike, the area of potential sediment mobilization during normal tidal conditions would increase by 75 percent (98 vs. 56 acres) over existing conditions and by 50 percent (230 vs. 153 acres) during coastal storm surge events resulting in beneficial impacts related to sediment transport and soils, including the formation of more natural river channels and the rebuilding of the natural marsh surface, which will

support native revegetation. Sediment mobilization could also result in adverse impacts in the form of sedimentation of shellfish beds downstream of the dike. These uncertain impacts would be mitigated by monitoring sediment deposition and taking management action to avoid adverse impacts. Adverse impacts related to soil disturbance and compaction are expected, but those impacts are expected to be of low intensity and short-term (i.e., the number of months that construction occurs), will be mitigated by the applications of BMPs, and will cease when construction activities end.

Overall, the selected action will result in mobilization of sediment that will permanently restore marsh surface elevation to conditions that approximate pre-dike natural conditions , resulting in beneficial changes to hydraulic soils. This will provide current and future generations with better opportunities to experience the marsh in more natural conditions than currently exist in the Seashore, and therefore there will be no impairment under the selected action.

**WETLAND HABITATS AND VEGETATION**

Under the selected alternative, re-introduction of tidal flows within the Herring River flood plain will result in the widespread restoration of degraded coastal wetlands to estuarine sub-tidal and inter-tidal habitats. This will increase the total regional acreage of functioning estuarine wetlands, which are ecologically critical. Over the long term, the selected action is expected to result in extensive restoration of salt marsh vegetative communities, primarily in the Lower Herring River, Middle Herring River, and Lower Pole Dike Creek sub-basins.

When the selected action is fully implemented, of the total 1,006 acres within the project area, approximately 868 acres will be restored as inter-tidal habitat. Of this, approximately:

- 585 acres would be subjected to regular water column salinity levels of 18 parts per thousand (ppt) and higher;
- 99 acres would be affected by salinity between 6 and 18 ppt;
- 98 acres would be affected by freshwater tidal flow with salinity consistently below 6 ppt; and
- 86 acres would be tidally influenced sub-tidal, open water habitat with a salinity gradient ranging from approximately 30 ppt in the downstream reaches to 0 ppt in the upper reaches.

This will dramatically increase the extent and quality of inter-tidal habitats, which under existing conditions, occupy only about 70 acres. Within the 585 acre area expected to experience higher salinity levels (18 ppt and above) and collectively referred to as "salt marsh," a range of saltwater dependent habitats are expected to develop.

Restoration of 868 acres of sub- and inter-tidal estuarine habitat under the selected action will result in the loss or substantial reduction of several existing upland and freshwater habitat types (which are widespread in other upland areas of Cape Cod). It is expected that when the project is fully implemented and vegetation and habitat changes reach a point of equilibrium, virtually all of the existing forest, woodland, dry shrubland, and heathland/old field habitat will be replaced with inter-tidal marsh. Existing non-tidal freshwater marsh will be largely replaced by tidally influenced freshwater marsh, although the specific vegetation community changes between these habitat types are difficult to predict and quantify. Approximately 67 acres of existing wet shrubland and 57 acres of varied freshwater and wetland-upland transition habitats will persist on the periphery of the inter-tidal area above the reach of

mean high spring tides. Exact vegetation changes within this zone will depend on the frequency and extent of storm driven and other extreme high tide events which are difficult to predict.

While implementation of the selected action has the potential to create conditions that would allow expansion of *Phragmites*, efforts will be made to control this non-native species through an adaptive management strategy designed to prevent its expansion (See EIS Appendix C). Additional adverse impacts are expected from construction activities, including dewatering and staging, on approximately 8 acres, but those impacts will be short-term and sites impacted by construction activities will be restored when construction is complete. A permanent loss of up to 9 acres of vegetation/wetland habitat will result under the selected action in order to accommodate elevation of the CYCC golf course (8.26 acres of total), and the footprint of new dikes or raised/relocated roads. However, these wetland losses will be effectively mitigated by the restoration of hundreds of acres of sub and inter-tidal habitat.

Overall, implementation of the selected action will result in a permanent, estuary-wide transition from a degraded freshwater marsh to a functioning estuarine wetland. This will provide current and future generations with better opportunities to experience the Seashore's wetland habitat and vegetation in more natural conditions than currently exist, and therefore there will be no impairment under the selected action.

**AQUATIC SPECIES**

Under the selected action, the total restored estuarine habitat within the Herring River system will occupy approximately 12-13 times more area than current conditions. The estuary will change from being a freshwater system upstream to a tide-influenced estuarine system. The restored estuarine waters and salt marsh will provide substantially more spawning and nursery habitat for both resident and migratory fish species as well as for estuarine macroinvertebrates, greatly increasing their abundance and use of the estuary compared to existing conditions. Estuary habitat is extremely important for a variety of aquatic species, providing spawning, nursery and feeding grounds for fish, macroinvertebrates, and shellfish. Some species migrate in and out of the system while others spend their entire life-cycle in the estuary. Prior to construction of the Chequessett Neck Road Dike, the expansive Herring River provided important habitat for a number fish and macroinvertebrate species. Additionally, the restored habitat will include approximately 11.5 miles of mainstem tidal creek for use by resident as well as migratory and anadromous species.

Under the selected action, salt water habitat, with salinity levels of approximately 18 to 30 ppt would occur throughout the Lower and Middle Herring River, Mill Creek, Lower Pole Dike Creek, and parts of the Duck Harbor sub-basins, encompassing about 65 acres of sub-tidal and 452 acres of intertidal habitat. Freshwater conditions would persist in most of the Upper Bound Brook sub-basins, however increased flow, tidal exchange, and water quality would expand and improve habitat for aquatic species using these habitats. Varying levels of brackish habitats would develop in the transitional sub-basins between the lower and upper portions of the system.

The new dike at Chequessett Neck Road would provide better fish passage for all fish including anadromous and catadromous species. This, combined with improved water quality and access to the head waters of the river, would likely enhance the river herring run size into the Herring River estuary. With increased salinity upstream of the dike, habitat for shellfish would also be enhanced.

Under the selected action, sedimentation and erosion downstream of the dike in Herring River and Wellfleet Harbor could pose some adverse impacts to shellfish. However, the dike is opened slowly so that all of the sediment is not mobilized at once or over a short period, adverse impacts would be avoided or minimized; this is likely to occur because the opening of the tide gates will be managed through an adaptive management strategy (See EIS Appendix C) designed to prevent rapid sediment mobilization.

Overall, under the selected alternative, the restored estuarine waters and salt marsh will provide substantially more spawning and nursery habitat for both resident and transient fish species as well as for estuarine macroinvertebrates, greatly increasing their abundance and use of the estuary compared to existing conditions. Current and future generations will have better opportunities to experience aquatic species in the Seashore in more natural ecological conditions than currently exist. Therefore, no impairment will occur under the selected action.

## FEDERAL AND STATE-LISTED RARE, THREATENED, AND ENDANGERED SPECIES

As described in the final EIS/EIR, the degraded conditions of the Herring River flood plain support several species listed as rare, threatened, or endangered by the United States Fish and Wildlife Service (USFWS) or the Massachusetts Natural Heritage and Endangered Species Program (NHESP). The majority of these species are dependent on freshwater and upland habitats and probably did not occur on a regular basis in the Herring River before construction of the Chequessett Neck Road Dike restricted tidal influence in 1909.

The Herring River flood plain supports populations of several state-listed species, including American bittern (*Botaurus lentiginosus*), least bittern (*Ixobrychus exilis*), northern harrier (*Circus cyaneus*), diamondback terrapin (*Malaclemys terrapin*), eastern box turtle (*Terrapene c. carolina*), and water-willow stem borer (*Papaipema sulphurata*). The Herring River may also contain individuals or population of federally listed red knot (*Calidris canutus rufa*) and northern long-eared at (*Myotis Septentrionalis*). Both the Endangered Species Act (ESA; 16 USC § 1531 et seq.) and the Massachusetts Endangered Species Act (MESA) (M.G.L c.131A and regulations 321 CMR 10.00) protect rare species and their habitats by regulating the "taking" of any plant or animal species listed as endangered, threatened, or species of concern.

### American and Least Bittern

Under the selected action, existing foraging, resting, or migratory habitat for American bitterns and least bitterns would be affected by restored tidal exchange. Existing emergent freshwater and brackish marsh habitat needed by bitterns for nesting will be both slightly reduced and largely relocated from the lower to the upper portions of the project area. Most existing emergent marsh habitat, especially in the Lower Herring River and other areas, that is subjected to salinity levels of approximately 18 ppt and higher would develop into salt marsh. In Upper Pole Dike Creek, Bound Brook, and the western parts of Duck Harbor sub-basins bittern nesting habitat will persist or increase as shrub and forested habitat transitions to emergent marsh. Under the selected action, a total of 197 acres of habitat is expected to develop which will be approximately evenly split between freshwater (99 acres) and brackish (98 acres) marsh. Restoration of inter-tidal salt marsh habitat will also provide approximately 585 acres for roosting, foraging, and migratory habitat.

Overall, the selected action is expected to have minimal effects on the quantity and quality of bittern nesting habitat and will substantially increase salt marsh habitat used for foraging, resting and other non-breeding behaviors. As the project is implemented, the development of suitable emergent marsh habitat will be monitored and data will be collected to document how and to what extent bitterns are using the Herring River system. The HRRC and any contracted personnel conducting this field work and data analysis will closely consult with NHESP, the Seashore, and other taxa experts as appropriate on all aspects of this monitoring.

Because the overall amount of habitat will remain similar to what currently exists, and because the populations of American bitterns and least bitterns are expected to remain within the Seashore and to thrive, current and future generations will be able to experience these species within the park. Therefore no impairment will occur under the selected action.

### Northern Harrier

The state threatened northern harrier, sometimes referred to as the marsh hawk, occurs throughout the project area and several pairs have been recorded as nesting within the Bound Brook sub-basin. Harriers establish nesting and feeding territories in wet meadows, grasslands, and coastal and inland marshes. Harriers construct their nests from grasses, weeds, and other emergent aquatic and upland vegetative material. Nests are typically on the ground among bushes and other low vegetation.

Current northern harrier nesting sites in the Upper Bound Brook sub-basin are located in cat-tail-dominated plant communities which have replaced the original salt marsh vegetation. Restoration of tidal flow under the selected action is expected to have a less pronounced effect in the Upper Bound Brook sub-basin, compared to downstream areas where salinity levels will be higher. However, existing freshwater marsh is expected to be reduced from 90 to approximately 49 acres in the Upper Bound Brook sub-basin and higher elevation portions of the lower Bound Brook sub-basin. Given that only one or two harrier nests were documented during the 2004-2006 survey, and the extensive adjacent areas available for roosting, foraging, and other functions, it is expected that an adequate quantity of emergent cattail habitat will persist throughout the Bound Brook area and that harriers will continue to nest in similar numbers. Thus any impact to northern harriers is expected to be minimal and no effects on the regional population are anticipated as a result of implementing the project.

Similar to the other state-listed species, monitoring will track nesting habitat change for northern harriers within the Bound Brook sub-basin as the restoration project is implemented. Nesting and foraging within the entire project area by harriers will also be evaluated. The HRRC and any contracted personnel conducting this field work and data analysis will closely consult with NHESP, the Seashore, and other taxa experts as appropriate on all aspects of this monitoring.

Under the selected action, current and future generations will continue to have opportunities to experience the Northern Harrier that are similar to current conditions. Therefore no impairment will occur under the selected action.

### Diamondback Terrapin

The state threatened diamondback terrapin, a marine turtle, uses brackish marsh habitats for foraging and sandy shoreline habitats for nesting. The brackish marshes along the periphery of Wellfleet Harbor support the northernmost population on the East Coast, although individuals have been found in Provincetown.

Over the short term, a small amount of salt marsh habitat occurring upstream of the Chequessett Neck Road Dike, which has recently been used by nesting terrapins, would likely be impacted as tidal range increases. Terrapins nest in sandy dunes and open habitat within upland areas adjacent to salt marshes, but not in salt marshes. In addition, terrapins would probably not be able to pass through the dike while it is being reconstructed and could be affected by construction noise, vibrations, and other activities. However, over the long term, tidal restoration is expected to restore hundreds of acres of nesting, nursery, wintering, and foraging habitat in the Lower Herring River, Mill Creek, Middle Herring River, Lower Pole Dike Creek sub-basins, and portions of Duck Harbor sub-basin, allowing diamondback terrapins to almost fully reoccupy their historic distribution within the Herring River flood plain. The larger tidal opening with lowered flow velocities through the new structure will make it easier for terrapins to move from Wellfleet Harbor up into the river. With full implementation of the selected action, the restored sub- and inter-tidal areas will provide approximately 769 acres of new terrapin habitat, thereby providing a large increase in area available to them within the greater Wellfleet Harbor system.

Under the selected action, restoration will provide at least 30 times more habitat for the terrapin and other estuarine-dependent species within the Herring River system than currently exist. This will result in increased opportunities for current and future generations to experience this species within the Seashore. Therefore, no impairment will occur under the preferred alternative

EASTERN BOX TURTLE

Although listed as a Species of Special Concern by the state, eastern box turtles are relatively common terrestrial reptiles on Cape Cod that use dry and moist woodland and freshwater marsh habitats. The box turtle shifts habitats seasonally to avoid excessive heat or cold. They frequent the edges of wetlands, especially during dry summer periods when they move into fresh surface water for hydration.

Restoration of tidal conditions throughout the Herring River flood plain are expected to adversely affect eastern box turtles by through conversion of existing habitat in areas that have dried out in response to diking of the river and drainage of salt marsh soils to more saline and/or wetter conditions that are less favorable for box turtles. Restored tidal influence may also limit the ability of box turtles to access freshwater for thermoregulation and hydration.

Despite the transition of approximately 88 acres of principal box turtle habitat within the area of regular tidal inundation, suitable occasional habitat will remain among approximately 123 acres of wet shrubland and varied non-tidal habitats located in the upper reaches of the project area. Additional areas will persist immediately adjacent to the project area above the reach of normal tides where more than 3,500 acres of box turtle habitat will remain unaffected and protected by the NPS. Because tidal restoration will be implemented slowly, with expected annual increases in tide range of several inches, subsequent habitat change is expected to be gradual, especially in the upper reaches where salinity will be low. Box turtles within the affected area are expected to be able to move landward and no impact on the overall population is anticipated.

As part of a proposed Habitat Management and Monitoring Plan the project will develop and implement a monitoring strategy to assess habitat use and movements by box turtles that results from tidal restoration. Prior to any reintroduction of tidal exchange, or any other restoration actions, baseline data will be collected to characterize the current population. Data will also be collected to document movements of turtles from the affected area to adjacent areas as the project is implemented. The HRRC

and any contracted personnel conducting this field work and data analysis will closely consult with NHESP, the Seashore, and other taxa experts as appropriate on all aspects of this monitoring.

Overall Eastern box turtle populations will remain in and close to the project area both during and after restoration. Current and future generations will continue to have the opportunity to experience abundant numbers of this species in the park. Therefore, no impairment will occur under the selected action.

### WATER-WILLOW STEM BORER

The state threatened water-willow stem borer is a globally rare, noctuid moth found only on the coastal plain of southeastern Massachusetts and Cape Cod. Water-willow stem borer larvae feed almost exclusively on water-willow (*Decodon verticillatus*), a freshwater wetland plant widely distributed throughout New England. With full implementation the of the selected action, restored tidal range and estuarine salinity levels are expected to reduce or eliminate much of the area currently or potentially occupied by water-willow and presumably used, or potentially available to, the stem borer. Water-willow, and many of the other plant species that define the wet shrubland and wet deciduous forest habitats, have very low salinity tolerances and thus large portions of these areas are expected to convert into inter-tidal emergent salt and brackish marshes as estuarine tidal range and salinity levels are restored. This change will be most pronounced in the Mid Herring River, Lower Pole Dike Creek, and Lower Bound Brook sub-basins, where salinities will consistently be 20 ppt and higher. Some existing stands of water-willow may persist in the Upper Pole Dike Creek, Upper Herring River, Upper Bound Brook sub-basins and the higher elevations of the 131-acre Duck Harbor sub-basin. However, under the selected action, 265 acres of existing water-willow habitat adjacent to the project area will remain undisturbed and available for continued use and potential colonization by the stem borer. Furthermore, Decodon is abundant along pond margins, vernal pools, and freshwater streams on outer Cape Cod; thus, tidal restoration in the Herring River project area is not expected to have a meaningful effect on the regional population.

As part of a proposed Habitat Management and Monitoring Plan to be submitted to NHESP, a monitoring strategy will be designed and implemented to track the response of water-willow and its occupancy by the stem borer to tidal restoration in the Herring River project area. Prior to the reintroduction of tidal exchange, or any implementation of other restoration actions, baseline data will be collected to update the Mello (2006) survey and define baseline conditions for the current extent of water-willow and occupancy by the water-willow stem borer throughout the project area and suitable locations in adjacent areas. As the project is implemented, data will continue to be collected to detect plant community changes, with special focus on the response of water-willow to increased tidal flow under a range of salinity levels. Areas adjacent to, but outside of, those directly affected by tidal flows will be studied to assess whether, and to what extent, stem borers may be colonizing new areas. The HRRC and any contracted personnel conducting this field work and data analysis will consult with NHESP, the Seashore, and other taxa experts as appropriate on all aspects of this monitoring.

While water-willow stem borers will be affected, these species will remain in the Seashore in a manner that can be experienced by future and current generations, and the selected action is not expected to affect the regional population. Therefore, no impairment would occur under the selected action.

### Red Knot

There are no records confirming the presence of red knot in the Herring River project area, but because they have been observed on Cape Cod, they are assumed to be present. In general, the habitat changes associated with restoration would benefit red knot. Under the selected action, a total of 572 acres of potential red knot habitat (salt marsh [tidal]) would be added to the project area. Current and future generations will have the same or better opportunities to experience red knot under the proposed action, and therefore no impairment will occur.

### Northern Long-Eared Bat

No recent records confirm the presence of the federally threatened northern long-eared bat in the Herring River estuary, although monitoring elsewhere on Cape Cod did result in observations of northern long-eared bats. In the absence of field work conducted in the project area, northern long-eared bats are assumed to present and USFWS mitigation recommendations will be implemented. These measures include monitoring for bats during planned forest management activities, avoiding tree removal within 0.25 miles of known, occupied hibernacula, and avoiding tree removal of known, occupied roost trees during pup season (June 1 - July 31).

Under the selected action, given appropriate monitoring and mitigation, a total of 337 acres of forested potential habitat (including wet deciduous forest, dry deciduous forest, pine woodland, and dry deciduous woodland) would be restored to intertidal marsh. These are common habitat types on Cape Cod, and it is not anticipated that this limited reduction in wooded habitat types would have detectable effects on individuals or populations of northern long-eared bats in terms of habitat availability. Also, incremental habitat restoration is not likely to result in direct effects on northern long-eared bats due to the slow pace of change and bat mobility.

Although there are no records to confirm the presence of the long-eared bat, the selected action will not change current opportunities to experience this species, and will preserve long-eared bat habitat, thus providing the potential for this species to appear in the park and be experienced by current and future generations. Therefore, no impairment would occur under the selected action.

## TERRESTRIAL WILDLIFE

The Herring River flood plain contains habitats for a wide array of avian, mammal, reptile, and amphibian species. Tidal restoration for the river will initiate changes to many of these habitats, increasing habitat availability for species using wetland habitat types, and reducing availability in the immediate project area for species that use upland habitat types. However, because these upland habitat types are available elsewhere in Cape Cod National Seashore and on Cape Cod, and because of the gradual pace of restoration, upland species are expected to relocate to suitable habitats without meaningful adverse effects on regional populations. Within the project area, species using wetland habitat types are expected to become more abundant.

Habitat for avian species that are common to shrub thickets and freshwater habitat will likely decrease in the Herring River flood plain as conditions change due to the tidal restoration. Many of these species are abundant nesters elsewhere on Cape Cod and southeastern Massachusetts. Tidal restoration will eventually alter habitat conditions for some of these species and may cause them to shift to appropriate habitats upstream in the Herring River system.

Shifts in avian community structure following tidal restoration and increases in open-water habitat generally include an overall increase in avian abundance and an accompanying transition from a community dominated by generalists and passerines to one dominated by waterfowl, shorebirds, and wading birds. A similar response is anticipated for most of the Herring River avian community following restoration. Several high priority tidal creek and salt marsh-dependent species such as salt marsh sharp-tailed sparrow, willet, American black duck, common and roseate tern, and several species of shorebirds and wading birds are expected to benefit from restoration of nesting (*Spartina* dominated habitat) and/or foraging opportunities (primarily estuarine fish). Other species, such as osprey, belted kingfisher, and marsh wren will benefit from the restoration of foraging habitat.

Most mammals in the area are generalists, highly adaptable, and likely to move to adjacent habitat that is unaffected by tidal restoration. It is expected that when the selected action has been completed, adequate habitat elements (e.g., suitable food, cover, and den sites) will remain for mammalian species. Gradual tidal restoration will allow these animals to readjust to the restored salt marsh system and shift their local range within and adjacent to the river and its flood plain. Although in the short term, medium and large species such as raccoon, skunk, muskrat, river otter, and white-tailed deer may be displaced from currently occupied habitat, restored salt, brackish, and freshwater marsh habitat may provide long-term benefits with improved water quality, more abundant and diverse prey species, and a more open, expansive habitat structure.

The most common group of mammals found in salt marsh habitats in the region are rodents, such as the meadow vole and white-footed mouse, which are an important prey-species for northern harriers and other raptors. Initial restoration would result in gradual flooding of habitat and landward migration of many species, but eventually habitats for voles, mice, and other rodents may be expanded. As tidal restoration progresses, many mammals would continue to forage on the invertebrates, fish, and marsh vegetation and would still use surrounding wooded uplands for den sites and refugia.

As with mammals, tidal restoration is expected to affect reptile and amphibian species as habitats transition and the populations migrate to suitable habitat.

During construction, wildlife species may temporarily avoid areas affected by construction noise and habitat disturbance. However, none of the potential construction sites provide unique or critical habitat, so wildlife is expected to relocate to adjacent undisturbed areas without suffering meaningful adverse impacts. Once construction is completed, wildlife species are expected to re-establish in the restored area.

While implementation of the selected action will result in displacement of some (primarily upland) wildlife, all of the wildlife mentioned above will continue to exist in the Seashore during restoration activities, and many species will have additional habitat following restoration, resulting in beneficial impacts over the long-term. Current and future generations will continue to be able to experience these species both during and after restoration activities are complete, and therefore no impairment will occur under the selected alternative.

**CULTURAL RESOURCES**

The selected action could result in adverse impacts to pre-contact and post-contact archeological sites, primarily through construction activities, as well as any other ground-disturbing activities, including borrow or construction staging areas. Consultation regarding the presence of ethnographic resources in

the Herring River estuary is ongoing under the selected action; however, no ethnographic resources are currently documented in the project area.

According to an archaeological reconnaissance report completed for the Massachusetts Wetlands Restoration Program and a Phase IA Archeological Assessment (Herbster and Heitert 2011), there are numerous archeological sites around the project area. These sites are located in areas both above and below potential tidal inundation. Native American pre-contact resources have the greatest potential to occur near shorelines, where natural resources would have been gathered and processed. Post-contact sites could include the remains of wharves, docks, mills, saltworks, and the Old Colony Railroad (Herbster and Heitert 2011). Although there are no listed historic (above-ground) structures in the Herring River estuary, a dike was located across Mill Creek near the confluence with the Herring River, likely as part of a historical gristmill. Some low-lying structures may need further evaluation for historic significance.

While the precise location and, therefore, the extent of effects to archaeological sites cannot be fully identified at this time because the design process is still ongoing, if and when the locations of sites are identified, potential impacts to archaeological sites will be assessed and any adverse effects will be resolved in accordance with the Programmatic Agreement (PA) that was developed by the NPS and the Massachusetts Historical Commission to guide the identification, evaluation, and protection processes for archaeological resources within the Herring River estuary. This PA defines the measures that must be carried out as the project is implemented to comply with the requirements of the NEPA and National Historic Preservation Act of 1966 processes and Massachusetts state regulations. As the project design process continues, NPS will provide plans and other documentation and consult with Massachusetts Historical Commission under the terms of the PA. The final PA is included as appendix I of the final EIS/EIR.

Modeled erosional patterns expected to occur as a result of increased tidal flows do not overlap with any archeologically sensitive areas or known sites along the margins of the APE, and only resources which cross the existing channels are likely to be affected. Considering the greatest level of erosion potential as it relates to archeological resources (sites and sensitive areas), the only archeological resources that could potentially be impacted by increased erosion are along High Toss Road, and at the intersection of Bound Brook Island Road and the former Cape Cod Railroad alignment. No areas of pre-contact sensitivity fall within modeled erosional zones under any of the modeling scenarios.

Although the dike and roadway are not considered historic resources, staging or stockpiling areas outside the construction footprint could potentially impact archeological sites or sensitive areas (Herbster and Heitert 2011). Flood proofing measures in the Mill Creek Sub-basin (in which the CYCC fairways are raised by filling and grading) will not result in an impact to archeological resources as prior disturbance has likely degraded or eliminated any archeological resources which may have been present. However, if flood proofing measures within the Mill Creek sub-basin include the use of upland areas for borrow material to raise the fairways, then there is the potential for archaeological resources to be impacted. Additional archeological assessment and/or survey would be required in areas proposed for fairway development or borrow pits prior to implementation. If archeological resources are discovered during construction, all work in the immediate vicinity of the discovery will be halted until the resources can be identified and documented and an appropriate mitigation strategy can be developed.

Currently, there are no known archaeological sites that would be impacted by implementation of the selected action; however, if any sites are identified in the future, those sites would be avoided to the extent practicable, and if avoidance is not possible, adverse effects to those sites would be documented and resolved in accordance with the PA. There is no indication that any potential sites that may be discovered in the future would be unique or represent on-of-a-kind resources. Current and future generations will be able to experience cultural resources in the Seashore during and after restoration in a similar manner as they currently can. Therefore, no impairment will occur under the selected action.

**SUMMARY**

The NPS has determined that the implementation of the NPS selected action (alternative D) will not constitute an impairment of the resources or values of the park. As described above, implementing the selected action is not anticipated to result in adverse impacts constituting impairment of resources or values whose conservation is necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park, key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park or identified as significant in the park's general management plans or other relevant NPS planning documents. This conclusion is based on the consideration of the park's purpose and significance, a thorough analysis of the environmental impacts described in the final EIS/EIR, relevant scientific studies, the comments provided by the public and others, and the professional judgment of the decision maker guided by the direction of the NPS *Management Policies 2006* (NPS 2006).