

4 Climate Change Impacts: Consequences for Cultural & Recreational Resources

While ecosystem and species protection are essential to Gateway, the many cultural, historic and recreational resources also provide important resources within the park. These resources exhibit vulnerabilities to climate change impacts.

Rapid and extreme changes between high and low temperature and humidity, termed “shocks,” can cause materials and surfaces to split, crackle, flake or dust. For example, the number of freeze-thaw cycles in a season puts pressure on outdoor structures (Colette, 2007). Temperature shocks may cause significant damage to historic buildings and paved recreational trails. While warmer average temperatures may mean milder winters, there may be a greater potential for sudden temperature increases leading to rapid thawing; these events would stress cultural resources.

Flooding creates rapidly moving waters which may damage buildings. At Gateway, severe flooding from extreme storm events will combine with sewage overflow. Due to poor water quality during post-flood drying, micro-organisms such as molds and fungi may thrive, causing building damage, stains and health hazards (Colette, 2007).

Weathering may also increase building damage. In the past, acid rain caused significant weathering to stone structures, such as statues, in New York City; some studies predict higher atmospheric CO₂ concentrations will result in even greater weathering to stone structures (Brimblecombe et al., 2008). This is especially threatening to Gateway’s historic forts.

Climate change threatens all units at Gateway; however, management will have to evaluate each resource individually to determine how to best protect resources from these threats.

1. Sandy Hook

Within the Sandy Hook Unit, major structures include Sandy Hook Light and Fort Hancock, including its gun batteries and Officer’s Row.

Sandy Hook Light House

Sandy Hook Light House is the oldest operating lighthouse in the United States. Sandy Hook Light was built on a stone foundation and has a brick exterior. Next to the lighthouse is the original keeper’s quarters building, a wood house (Maritime Heritage Program, 2007). Constructed in 1764, it was originally built 500 feet inland from the tip of Sandy Hook. Due to littoral drift, the peninsula has grown and the tip is now 1.5 miles from the shore. The fact that sediment deposits have enlarged the tip of Sandy Hook, effectively “moving” the Light inland, bodes well for this structure, and should protect it against sea level rise in the immediate future.

Fort Hancock

Fort Hancock is a major cultural and historical resource at the Sandy Hook Unit. Fort Hancock is listed on the National Register of Historic Landmarks and is home to a host of historic structures. Fort Hancock was an active military installation until 1974. The gun batteries, constructed between 1890 and 1945, attract significant visitor interest.

Updated continuously with the latest weapons throughout their active life, these batteries reflect developments in military technology during the 20th century. The public can also tour Battery Potter, built in 1895.

Officer's Row is a row of Colonial Revival style homes where military personnel lived while stationed at Fort Hancock. While not open for public visit, these homes can be viewed from the road as visitors drive, bike, or walk by. One home, the History House, has been restored for visitors.

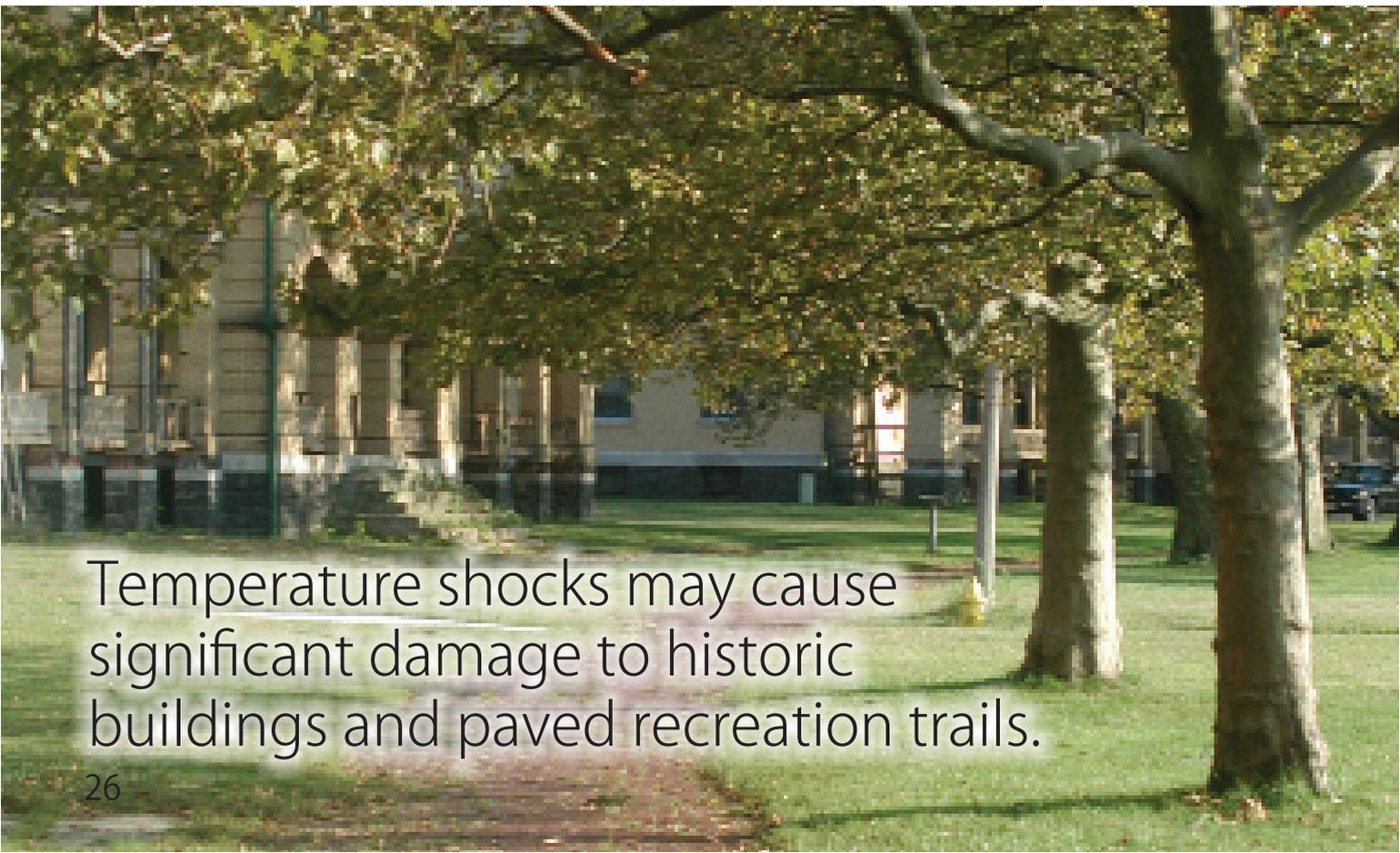
Recreational Resources at Sandy Hook

Apart from the rich cultural resources available at the Sandy Hook Unit, visitors also enjoy the recreational resources available on the site. Visitors can enjoy fishing, swimming, sunbathing and water sports on Sandy Hook's beaches. Sandy Hook also offers excellent locations for bird watching, including prime spots on Plum Island, the Spermaceti Cove boardwalk, the North Pond, the

Horseshoe Cove salt marsh and the fields at Fort Hancock. Beach access on Sandy Hook offers swimming, fishing and boating. Visitors also enjoy hiking, walking and biking along Sandy Hook's trails and a 5-mile multi-use path.

Impacts on the Sandy Hook Unit's Cultural Resources

Climate change impacts will primarily affect the cultural resources on Sandy Hook through sea level rise. The batteries and homes of Fort Hancock exhibit the greatest vulnerability to sea level rise, due to their location on the coast. In the long-run the ocean may inundate these historical resources. Extreme weather events also threaten Fort Hancock's Officer's Row; some of these buildings are already deteriorating due to the harsh, humid coastal climate and the effects of past storms (National Historic Landmarks Program website). Without proper maintenance and preparation, storm damage could speed up the deterioration of these structures. Due to its distance



Temperature shocks may cause significant damage to historic buildings and paved recreation trails.

from the coast, extreme storm events present the most likely environmental threat to Sandy Hook Light.

Sea level rise, storm events and associated increases in coastal erosion may also impact recreational resources located close to the water. Hartshorne Drive, the main access roadway to the Park, is particularly vulnerable due to its close proximity to the waterfront on both sides of the peninsula. Increased precipitation, particularly heavy rainfall events, may result in increased occurrences of flooding, which may damage pathways and building foundations. Further, more humid conditions caused by increased precipitation and warmer temperatures will likely accelerate damage to Sandy Hook's wooden structures. Finally, any impacts to Sandy Hook's ecosystems that result in species change or habitat loss may negatively impact visitors' enjoyment of bird watching opportunities.

2. Staten Island

Major cultural resources within the Staten Island unit include Fort Wadsworth, Miller Field and Hoffman and Swinburne Islands.

Fort Wadsworth

Fort Wadsworth includes Battery Weed, located directly on the waterfront at the Verrazano Narrows, and Fort Tompkins, constructed on the bluff above the Battery. Constructed during the Civil War, this historic military site never came under attack. Today, the historic stone structures fascinate visitors and rank among the best-preserved military forts of the nineteenth century.

Miller Field

Miller Field, located southwest of Fort Wadsworth, is a major recreational resource at Gateway. Originally a wetland, the area was converted to farmland before being transformed into a military air base. The National Park Service extensively

renovated the area when it acquired Miller Field in 1974. Today, Miller Field primarily hosts recreational sports. Approximately 80 leagues and 2,000 teams take advantage of the 187 acres of open space, sports fields, playgrounds and picnic areas, making it an important recreation resource within Gateway (NPNYHC, 2008) and New York City. Great Kills Park, on the Eastern shore of Staten Island, also offers a variety of recreational activities including swimming, fishing, boating, bird watching and a multi-use path for biking, walking and hiking.

Hoffman and Swinburne Islands

Hoffman and Swinburne Islands are artificial islands built out of landfill on top of Orchard Shoals, located about one mile south of Fort Wadsworth and two miles east of Miller Field. Swinburne Island, currently home to migrating harbor seals, as well as wading birds, gulls and cormorants, still bears the ruins of buildings used by the Merchant Marine during World War II. Both islands formerly housed quarantined immigrants carrying infectious diseases during the nineteenth and early twentieth centuries. Today, Hoffman Island is home to large colonies of egrets and herons. Gateway restricts the general public from accessing the islands; however, researchers and scientists may coordinate trips in order to monitor the islands' many species.

Impacts on the Staten Island Unit's Cultural Resources

Rising seas, and their resulting impact on Battery Weed, present the greatest concerns from climate change. The sea walls originally constructed to protect the fort area are already insufficient against the rising ocean. The potential for increased severe weather events, including storm surge and waves, also poses a threat to Battery Weed. Fort Thompson, located high on the bluff, is not threatened by sea level rise and is better protected from waves; nevertheless, it could still be damaged by extreme weather events.

Sea level rise will also affect Swinburne and Hoffman Islands; Gateway may wish to monitor the impact of rising seas on the islands' artificial walls and on the current species occupying the island. Miller Field, located immediately on Staten Island's eastern coast, may also face inundation from sea level rise and extreme storm events, damaging the sports facilities and recreational resources located there.

3. Jamaica Bay

Within Jamaica Bay, Floyd Bennett Field and Fort Tilden are important cultural resources.

Floyd Bennet Field

Floyd Bennett Field is both a historical landmark and an important recreational resource. The airfield, which opened in 1931, served as New York City's first municipal airport. Many famous pilots broke records from or passed through Floyd Bennett Field, including Charles Lindbergh, John Glenn Jr. and Amelia Earhart. Today, Floyd Bennett Field offers a large variety of recreational activities, including fishing, biking, bird watching and boating. The field also has educational facilities, a working hangar, a community garden and the "Ecology Village" camping program and facilities are located at the site.

Fort Tilden

Fort Tilden is the third in the series of forts constructed to protect the New York Harbor. Built in 1917, Fort Tilden first protected the city from naval attack during the two World Wars, prior to serving as a Nike nuclear missile site. Today, most of the military buildings have been stabilized or converted to other uses, but the Fort Tilden Historic District now offers opportunities for hiking, fishing and bird watching.

Other Jamaica Bay Cultural Resources

Jacob Riis Park is located on the former site of Naval Air Station Rockaway, adjacent to Fort Tilden. The Art Deco bath house at Riis Park is listed on the National Register of Historic Buildings and serves as an important example of the public works projects of the 1930s. Although strong, the building's brickwork has suffered extensive weathering due to gypsum formation and the harsh coastal conditions (Stokowski and Berkowitz, 1997).

Riis Park is an important recreation beach for the residents of New York City due to its close proximity to the city and easy accessibility by public transportation and car. Other resources in the Jamaica Bay unit include fishing at Canarsie Pier, as well as biking, horseback riding and nature study and bird watching at the Jamaica Bay Wildlife Refuge.

Impacts on the Jamaica Bay Unit's Cultural Resources

Sea level rise presents a significant threat to Floyd Bennett Field. The airfield was constructed on a small marsh island filled in and artificially raised 16 feet above high tide (Blakemore, 1981). Gateway has already improved the barrier surrounding Floyd Bennett Field to protect against erosion. While not immediately endangered, Gateway may wish to closely monitor sea level rise forecasts, to determine if protecting the field should have greater priority. Sea level rise, coastal erosion, and severe weather will also threaten Riis Park beach, necessitating greater expenditures in the future to maintain the current recreation area.



Gateway Cultural Resources

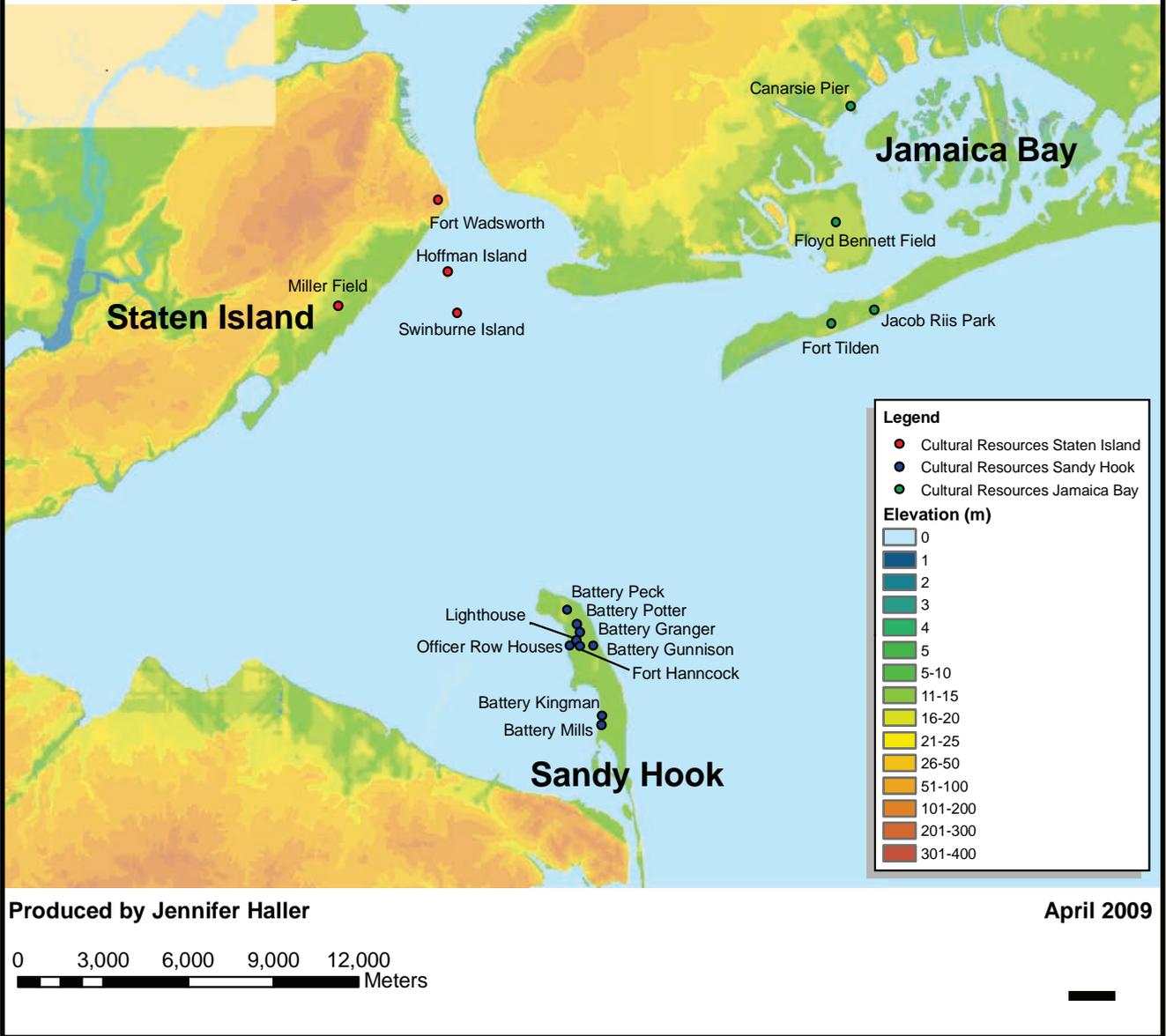


Figure 6. Elevation for key Cultural Resources at Gateway

This map shows potential impacts from sea level rise. As discussed in Section 2. Climate Change & Gateway, sea level rise may increase by 2 to 6.5 feet over the next century; these estimates remain uncertain. Nevertheless, Gateway's important cultural resources could be severely threatened by rising seas. Continuing to incorporate new climate science into planning at Gateway will help protect and preserve these resources over the long-term.