Chapter 4: Environmental Consequences

General Methodology for Analyzing Impacts

In accordance with the Council on Environmental Quality (CEQ) regulations, direct, indirect, and cumulative impacts are described (40 CFR 1502.16) and the significance of the impacts is assessed (40 CFR 1508.27). Where appropriate, mitigating measures for adverse impacts are also described and incorporated into the evaluation of impacts. The specific methods used to assess impacts for each resource may vary; therefore, these methodologies are described under each impact topic.

Geographic Area Evaluated for Impacts

The primary area of impact for the Gateway National Recreation Area (Gateway; the park) General Management Plan and Environmental Impact Statement (GMP/EIS) is the Jamaica Bay area of New York City (including in Queens and Brooklyn), Staten Island, and Sandy Hook in Monmouth County in New Jersey. The term "localized" is often used to describe impacts; generally this mean the impact would be confined to a small area of the park site.

Type of Impact

The types of impacts discussed in this GMP/EIS include the following:

Direct: Impacts that would occur as a result of the proposed action at the same time and place of implementation (40 CFR 1508.8).

Indirect: Impacts that would occur as a result of the proposed action but later in time or farther in distance from the action (40 CFR 1508.8).

Adverse: An impact that causes an unfavorable result to the resource when compared to the existing conditions.

Beneficial: An impact that would result in a positive change to the resource when compared to the existing conditions.

Cumulative Impact Analysis Methodology

In addition to direct and indirect impacts from the alternatives, the GMP/EIS evaluates cumulative impacts. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions" (40 CFR 1508.7). In other words, cumulative impacts to each resource occur when the impacts of unrelated actions or events are added to the impacts of whatever changes (actions) Gateway is evaluating in its alternatives. A cumulative impacts analysis is intended to give a better picture of the additive or total

impacts a given resource may experience when the impacts of unrelated actions or events are added to the predicted impacts of the alternative being evaluated. Table 4-1 lists and briefly describes other actions and events that were identified by the planning team as contributing to cumulative impacts in combination with the impacts of the alternatives evaluated in this GMP/EIS. This list of these other actions and events is organized by impact topic. The impacts of climate change are not traditional cumulative impacts as they are not from past, present or reasonably foreseeable future actions taken by an agency or person. However, to the extent that they have additive impacts on many of the resources at the park, they are most accurately analyzed in the cumulative impact section for those resources.

Table 4.1. Larger Actions Contributing to Cumulative Impacts.

Soils and Geology
Dredging and filling of Jamaica Bay and depositing fill, rubble, and other materials in the bay to build height has altered natural sediments. Sediment continues to be trapped in borrow pits used for these excavations.
Pollutants from wastewater treatment and urban runoff pollutes the waters of Jamaica Bay, which in turn pollutes benthic bay sediments.
Beneficial cumulative effects from restoration efforts at Jamaica Bay could help fill borrow pits and reduce pollutants.
Hardening of coastlines and sediment-trapping devices like jetties, seawalls, and groins have interrupted and stopped natural ocean sand-transport systems, resulting in erosion of both ocean and bayside coastlines at several park sites. This reduces a site's ability to withstand strong storm surge, flooding, inlets, and overwash without severe loss of sand and even loss of inland soils.
Sea level rise and possible increases in storm severity related to climate change would increase erosion of shorelines
Air Quality
The air basin that includes the park is polluted by cars, buses, and other mobile transportation sources in the New York City and northern New Jersey area; this would continue regardless of any park action.
Stationary sources, including upwind power plants, contribute pollutants that also affect visibility at the park.
Water Resources
Urban populations have diverted surface waters for use; urban development has reduced infiltration to groundwater and channelized runoff.
Freshwater into Jamaica Bay comes primarily from wastewater treatment plants and combined sewage and stormwater outfalls and is high in pollutants such as chlorine, heavy metals, pathogens, and unwanted nutrients.
Plans to improve water quality, including storage of combined sewer outflow, would improve water quality over existing conditions.
Dredging in Jamaica Bay has altered tides and depth and has decreased natural bay flushing.
Increasing sea-level rise, possible increased storm intensity, or extreme precipitation events linked to climate change can increase salinity onshore or in groundwater and carry polluted surface water over a wider area. Increasing temperature could increase evaporative losses.
Wetlands, Floodplains and Flooding
Location in a low-lying area of New York City means much of the park is exposed to flooding during coastal storms.
Storm surge and intensity of coastal storms may be increasing at least in part because of climate change. Scientists agree that climate change is accelerating; its effects could be to continue to increase the intensity, storm surge, and flooding effects of coastal storms.
Dredging, development of Jamaica Bay, and unknown factors have resulted in loss of saltmarsh habitat; excess nitrogen from wastewater effluent decreases saltmarsh vegetation productivity; and dense monocultures of invasive species outcompete native saltmarsh plant species.

Table 4.1. Larger Actions Contributing to Cumulative Impacts (continued).

Restoration efforts in Jamaica Bay have improved water quality, with associated improvements in wetland quality.
Sea-level rise would amplify tidal cycles and inundate saltmarsh along the shores and on islands in Jamaica Bay.
Marine Resources
Coastal urbanization, ocean dumping and waste disposal, port development, agricultural practices, transportation, mining, and non-point pollution have degraded marine resources in the vicinity of the park.
Altered sand transport has reduced available vegetation habitat.
Extensive recreational use of coastal open space sites disturbs intertidal wildlife and eliminates habitat for marine plant and animal life; any additional proposed development in the coastal zone or plans for additional recreational use would contribute additional adverse impacts.
Sea level rise inundates coastal habitat, displaces marine vegetation and wildlife; possible increases in storm intensity can destroy nests of marine wildlife
Vegetation
The historic use of fill, garbage, and discarded building materials to create higher-elevation land created an unnatural habitat for native species in many sites now on park land.
Alteration of the soils, hydrology, and water quality in Jamaica Bay has eliminated eelgrass and changed saltmarsh plant species. Although these same impacts continue, restoration of island habitat in Jamaica Bay benefits saltmarsh.
Accelerated sea-level rise and possibly increased storm surge would swamp saltmarsh, making resultant species changes likely; increasing temperature changes ranges of some vegetation; fluctuations in climate favor invasive species with displacement of native species possible.
Altered sand transport has reduced available vegetation habitat, particularly for coastal or intertidal species.
Wildlife
The urbanization of the New York City area eliminated habitat for many wildlife species. Habitat continues to be scarce, especially large contiguous habitat or habitat that is undisturbed by human activity or presence.
Sea-level rise and other factors have resulted in loss or degradation of saltmarsh habitat, an impact that is expected to worsen as sea-level rise accelerates.
Invasive species have degraded wildlife habitat quality.
Increased storm surge that may be associated with climate change could drown beach-nesting species; increasing temperatures favor invasive species and cause mistiming between migrating species and the availability of their food resources.
Species of Special Concern
Urbanization and development of habitat in the New York City area and along migration routes have reduced population sizes for most listed species. These impacts may worsen as development increases, particularly along migration routes.
Human uses, including for products like dredge soils or to receive wastewater effluent or other pollutants, and the introduction of invasive species, including feral predators, have worsened the quality of existing habitat. This is expected to continue, although restoration efforts at Jamaica Bay would improve habitat quality for saltmarsh species of concern.
Possible increasing storm surge and sea-level rise could inundate nests or habitat used by species of special concern. These effects are likely to worsen as sea-level rise accelerates.
Historic Structures and Districts
Historic land uses have buried and destroyed structures and remnants.
Severe storms and flooding have damaged historic structures; these and other climate change effects could worsen from sea level rise, particularly for coastal structures.
Development has resulted in loss of historic structures in the New York City area.

Table 4.1. Larger Actions Contributing to Cumulative Impacts (continued).

Archeological Resources
Past development, grading, and filling for structures/infrastructure and maintenance activities have likely altered or destroyed archeological resources.
Erosion, waves, wind, etc. have damaged archeological resources. These effects have increased because of rising sea levels, possibly from greater storm intensity, and may continue to worsen.
Future development activity by other agencies/parties--recreational facilities/amenities, environmental restoration/enhancement, miscellaneous development—have potential to impact archeological resources, both negatively and positively.
Museum Collections
Past storm events have threatened the park's museum collection.
Visitor Use and Experience
Noise from airplanes, construction, and city streets disrupt the visitor experience; light pollution from adjacent urban areas degrade the night sky.
New York City is restoring habitat, stabilizing shorelines, and adding new and expanded parks along its waterfront; this could draw more visitors and increase the quality of the visitor experience at Gateway, particularly in the Jamaica Bay Unit.
Urbanized development means nearby open spaces are well used; however, new and expanding residential development would add potential visitors but could diminish the experience of the night sky, quiet areas, or visitors seeking solitude.
Storm surge and intensity have resulted in damaged park facilities and closures; these effects may worsen.
Social and Economic Environment
Implementing the Vision 2020 plan (NYCDCP 2011) could change spending patterns and increase job opportunities, particularly in transportation and warehousing, which are 5–8 percent of employment in communities adjacent to the park.
Transportation
Substantial growth in the New York City area has put pressure on existing transportation systems; a major infrastructure rehabilitation in 1988 improved systems, and funding for continued maintenance and rehabilitation is expected to continue, with beneficial cumulative impacts on transportation.
City waterways are often difficult to reach because of bridges and elevated highways, and congestion-reducing ferry systems are largely unavailable because of inaccessibility. The New York City Department of Transportation (NYCDOT) is partnering with other agencies to provide improvements to ferry structures, parking, and bridges to improve access.
New York City has built numerous bike lanes and facilities and the NYCDOT is partnering with other agencies to provide improvements to ferry structures, parking, and bridges to improve access, with beneficial cumulative impacts.
In Staten Island, commuters use bridges and ferries for access. Ferry access is expected to increase because National Parks of New York Harbor Conservancy (NPNYHC) is proposing a ferry link to include Fort Wadsworth.
Some bike routes exist to link neighborhoods. These links would incorporate multimodal connections between neighborhoods and between as well as between neighborhoods and park sites if alternative B or C is selected.
In the Sandy Hook Unit, bridges have been built to provide access, including access for pedestrians and bikes. However, current bridge access is often congested and stalled when the unit is closed after capacity is reached. Monmouth County implements elements of its closure plan to mitigate impacts.
Hurricane Sandy damage included to damage to roads in Sandy Hook and other park sites. This kind of damage may increase as sea-level rise and storm intensity accelerate, which may occur.
Park Management, Operations, and Facilities
Climate change and storm surge, heat waves, and possible increases in intense wind could damage buildings further.

In defining the contribution of each alternative to cumulative impacts, the following terminology is used:

Imperceptible:
The incremental effect contributed by the alternative to the overall cumulative impact is such a small increment that it is impossible or extremely difficult to discern.

Noticeable:
The incremental effect contributed by the alternative, while evident and observable, is still relatively small in proportion to the overall cumulative impact.

Appreciable:
The incremental effect contributed by the alternative constitutes a large portion of the overall cumulative impact.

Assessing Impacts Using CEQ Criteria

The impacts of the alternatives are assessed using the CEQ definition of "significantly" (1508.27), which requires consideration of both context and intensity:

(a) Context – This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

(b) Intensity – This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

(1) Impacts that may be both beneficial and adverse. A significant effect may exist even if the federal agency believes that on balance the effect would be beneficial.

(2) The degree to which the proposed action affects public health or safety.

(3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, parklands, prime farmlands, wetland, wild and scenic rivers, or ecologically critical areas.

(4) The degree to which the effects on the quality of the human environment are likely to be highly controversial.

(5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

(6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

(7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

(8) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

(9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

(10) Whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment.

Context depends on comparative or surrounding information to help give impacts meaning. Comparisons can include geography, population size, uniqueness of the resource, affected individuals, agency mandates, and more. For example, the impact of a proposal to cut 10 acres of trees in a 100,000-acre lodgepole pine forest managed by an agency with a "use" mandate is different than cutting 10 acres of the only remaining 15 acres of old growth sequoia managed by an agency with a "conservation" mandate.

The National Park Service (NPS) is an agency with a "conservation" mandate and identifies fundamental resources and values in its general management plans, defined as those resources or values that are critical to achieving a park's purpose or maintaining its significance. These resources and values collectively capture the essence of the park and provide overall context for evaluating the relative severity of an impact; e.g., the degree to which an alternative would help or hurt these resources would be important in assessing whether impacts of that alternative are significant.

Fundamental resources identified for Gateway are described in chapter 1 of this GMP/EIS. For each impact topic analyzed, an assessment of the potential significance of the impacts according to context and intensity is provided in the "Conclusion" section that follows the discussion of the impacts under each alternative. In addition to the overall context of the park's purpose and significance, resource-specific context is presented in the "Methods" section under each resource topic and applies across all alternatives. Intensity of the impacts is discussed by considering the relevant factors from the list under CEQ definition item b, "Intensity," above. Intensity factors that do not apply to a given resource topic and/or alternative are not discussed.

Natural Resources

Soils and Geology

Geology at the park is not expected to be affected by any actions in any of the GMP/EIS alternatives; however, soils or coastal processes may be. Neither soils nor coastal processes are named as fundamental resources or values by Gateway, but soils are important to all ecosystems and coastal processes and are an essential piece of beach, dune, and maritime-influenced shrublands and forests.

Laws and Policies

The National Park Service (NPS) has several guiding principles with respect to geology and soils, as outlined in the "Geologic Resource Management" section of the NPS *Management Policies* 2006 (NPS 2006a). These include the following: (1) assess the impacts of natural processes and human activities on geologic resources, (2) maintain and restore the integrity of existing geologic resources, (3) integrate geologic resource management into NPS operations and planning, and (4) interpret geologic resources for park visitors.
It is NPS policy not to intervene or to permit intervention into natural geologic processes except under the following circumstances:

- It is directed by Congress.

- It is considered necessary in the case of emergencies that threaten human life and property.

- There is no other feasible way to protect natural resources, park facilities, or historic properties, or intervention is necessary to restore impacted conditions and processes, such as restoring habitat for threatened or endangered species.

Management action is taken by NPS superintendents to prevent or at least minimize adverse, potentially irreversible impacts on soils. Soil conservation and soil amendment practices may be implemented to reduce impacts. When soil excavation is an unavoidable part of an approved facility development project, the NPS minimizes soil excavation, erosion, and off-site soil migration during and after the development activity.

Methods

This is a primarily qualitative analysis of the beneficial or adverse effects on soils or coastal processes using NPS and other reports for guidance.

Resource-specific contexts for assessing the impacts of the alternatives on soil resources and coastal processes include the following:

- Impacts from development, the primary proposed action that changes among alternatives, would be local.

- Soils over many areas of the park have been highly altered by dredging, covering with fill, or other manipulation.

- Soils are not considered unique for the most part and are not named as a fundamental resource of the park.

- The submerged lands of Jamaica Bay and natural areas at Floyd Bennett Field (among others) are considered fundamental resources.

Alternative A: No Action

The no-action alternative would, for the most part, continue current management practices for the foreseeable future. Exceptions to this statement include cleanup and repair efforts related to Hurricane Sandy and any approved projects or plans the park would implement.

Impacts of Alternative A

Soils

This section (impacts of the no-action alternative) focuses on the impacts of current management actions that could be altered if an action alternative is selected. Sources of impact on soils under current management that could change in the action alternatives include the historical filling of wetlands at Floyd Bennett Field, development of parking lots and buildings, and trails and camping facilities in many park sites. Equestrian use at Bergen Beach would also change in action alternatives; currently, equestrian use likely results in increased nutrients to soils at this park site. Continuing to keep wetlands at Floyd Bennett Field filled or runways at Floyd Bennett Field paved, covering soils with development of roads and other facilities across park sites, etc. do have the potential for continued, ongoing adverse impacts on soils.

Development and visitor use, including foot traffic, over-sand vehicle use, or bike or other vehicle use on unpaved trails or roads can compact soils, which causes a number of changes generally considered adverse. When it is compacted, the amount of open pore space in soils decreases, reducing water and air movement through the soil and worsening conditions for vegetation and healthy root systems (Iowa State University Extension 2009). If they are compressed but not paved, compacted soils are more susceptible to erosion and loss, particularly on steeper slopes. On flat land, compacted soils can create drainage and flooding problems. Paving soils can help in preserving deeper layers, although the loss of surface soils may be particularly detrimental to its future ability (if paved surfaces are removed, for example) to support vegetation. This is because the surface is where root systems are most likely to grow, where gas exchange takes place and water is stored, and where naturally occurring nutrients are most available.

Conversely, continuing current park management practices of keeping areas like Breezy Point Tip or the holly forest relatively free from human disturbance can have localized benefits to soils by reducing foot traffic and the potential for compaction. Generally, foot traffic from visitor use would be most likely to adversely affect soils with large naturally occurring pore space for water or air storage, such as wetland soils containing peat, which are highly susceptible to compaction (Van Asselen, Karssenberg, and Stouthamer 2011). Sandy soils are far less likely to be permanently compressed from foot traffic, especially if they are regularly covered and redistributed by tidal flows (NPS 2010e).

Ongoing efforts at Great Kills Park to clean up contaminated soils (refer to the "Health and Safety" section of "Visitor Use and Experience" in chapter 3) and continued partnering with New York City to improve water quality in Jamaica Bay would benefit soils at these park sites.

Coastal Processes

The park is conducting beach nourishment in at least two park sites, Sandy Hook and Plumb Beach. At Sandy Hook, sand is taken from areas offshore of where it is accumulating on the north end and is carried via a pipeline to the south end. Although erosion at the south end is to some degree a function of the direct north–south orientation of Sandy Hook and parallel longshore transport of sand, it is also partially human caused (by the seawall and groins to the south of the park site). Continuing to deposit sand from the northern end of Sandy Hook (where it is naturally accreting because of its northeast orientation and intersection with northward littoral drift of sand) would maintain beaches in the south. This is primarily a benefit for recreational or facilities resources at the park rather than the sediment itself, but to the extent that coastal erosion is exacerbated by groins and the seawall to the south, is also a benefit for coastal processes at Sandy Hook. It would also be an adverse impact on the accretion area, because it alters natural coastal processes that lead to the accumulation of sand.

Beach nourishment and shore stabilization efforts at Plumb Beach are also directed not at soils or natural coastal processes, but at ensuring the Belt Parkway remains intact in the face of future shoreline erosion from strong waves and storms. However, as described in the "Affected Environment" chapter, longshore transport of sand to Plumb Beach has been stopped in part by human activities related to the Rockaway Inlet and a navigation channel to Sheepshead Bay. To the extent that the stabilization and beach nourishment projects offset the adverse effects of these actions, they are beneficial to restoring the natural coastal processes at this park site. Because they also contribute to unnatural coastal processes, they are also adverse. In either case, impacts are localized but expected to be in effect throughout the lifetime of the GMP.

Cumulative Impacts

Efforts by New York City (in addition to its partnership with the NPS) to improve water quality in Jamaica Bay via projects described in its waterfront agenda (NYCDCP 2011) would in turn improve the quality of benthic soils. Adverse cumulative impacts to soils include those

from urban development and current use. Hardening of the shoreline to accommodate development exacerbates erosion and loss of soils, and pollutant streams from wastewater effluent and other sources continue to contaminate bay soils. In addition, sediment is trapped in deep pits that were excavated in the bay bottom to provide fill for development in the bay's fringing wetlands (Rafferty, Castagna, and Adamo 2011).

Hydrodynamic modeling indicates that there is little deposition of sediment within dredged navigation channels; however, deep pits, such as Grassy Bay, may serve as sinks for fine sediments (Wilson and Flagg 2008, as cited in Rafferty, Castagna, and Adamo 2011) that could otherwise be transported to the marsh surface. Inorganic sediments are moved by tides through the inlet and deposited in the western bay. During storm events, sediments are subsequently transported to the eastern portion of the bay, including Grassy Bay (Renfro et al. 2010, as cited in Rafferty, Castagna, and Adamo 2011).

Sediment supply to marshes may be insufficient to maintain marsh elevation in the face of natural subsidence and accelerated sea-level rise. In response to the loss of saltmarsh habitat island, the park has conducted an experimental 2-acre restoration at Big Egg Marsh (beginning in 2003) and applied findings to a larger project with several partners to restore saltmarsh at Elders Point (Rafferty, Castagna, and Adamo 2011).

Columbia University summarized findings on climate change for the area and reported that it is expected to bring with it accelerated sea-level rise, heavy rainfall and prolonged drought, and possible increases in storm frequency and intensity.

Columbia University summarized findings on climate change for the area and reported that it is expected to bring with it accelerated sea-level rise, heavy rainfall and prolonged drought, and possible increases in storm frequency and intensity. Severe winter nor'easters are predicted to occur more frequently than hurricanes (Columbia University 2011). From 1932 until 2011, the average sea-level rise at Sandy Hook, for example, was 1.54 inches per decade. This rate is expected to double in the 21st century (Horton 2007, as cited in Columbia University 2011). Ocean levels are expected to rise 2 to 5 inches by the 2020s, 7 to 12 inches by the 2050s, and as much as 23 inches by the 2080s. The New York City panel on climate change has characterized sea-level rise as "extremely" likely, more frequent and damaging coastal storms as "very" likely, and brief, intense rainstorms alternating with droughts as "more likely than not" (New York Academy of Sciences 2010).

The increases in sea level and possibly increases in the intensity and frequency of storms would be expected to have substantial impacts on the park's maritime resources, including sediment budgets and the movement of sand. Marsh soils, including those on Jamaica Bay islands, would likely be submerged if the rate of sea-level rise outpaces that of sediment deposition.

As noted in the "Affected Environment" chapter, when sediment budgets are positive, the coastline accretes either in the direction of longshore transport or laterally. When it is negative, erosion occurs and the beach can form steep scarps or be lost (see description of coastal processes for Plumb Beach for example). Groins and jetties that are positioned updrift of the longshore transport of sand capture it before it has a chance to nourish park beaches at Sandy Hook and at the park sites on the Rockaway barrier spit. A long wastewater effluent pipeline also stops sand transport at the Great Kills Park site, and development associated with the Rockaway Inlet has cut off transport to Plumb Beach. While these structures have greatly affected the supply of sediment to park beaches, the source of

material to both Sandy Hook and to sites on the Rockaway barrier spit is also diminishing. This leaves the coast more vulnerable to the strong waves and storm surge (short-term high water due primarily to wind-induced piling up of water along the shore), with flooding, overwash, breaching, and loss of sand from dunes and even more upland areas. These changes took place during in 2012, with extensive flooding, loss of beach and dunes, and movement of sand inland and across Sandy Hook spit, for example.

The vulnerability to continued flooding and erosion from storms as sea level rises is calculated using a coastal vulnerability index. The index includes consideration of several factors for each coastal area, including geomorphology, coastal slope, relative sea-level rise rate, mean significant wave height, mean tidal range, and the sediment budget. Coastal vulnerability index values calculated by a team of U.S. Geological Survey scientists (USGS 2005) indicated the following: 24 percent of the park's coast is highly vulnerable (all the areas considered highly vulnerable were on the ocean side of Sandy Hook); 24 percent is highly vulnerable; 28 percent is moderately vulnerable; and 24 percent is considered of low vulnerability. Nearly all land considered of low vulnerability lies along the Staten Island coast between Fort Wadsworth and Miller Field. It is possible or even likely that these numbers are already outdated although no new CVI has been calculated for the park's coastline since 2005.

Given the combined substantial and adverse cumulative impacts of declining sediment sources, human-built interruptions of sediment transport processes, sea-level rise, and possibly increasing storm intensity, it is unlikely that continuing to supply beach sand to southern Sandy Hook or to Plumb Beach in alternative A will have more than a noticeable offsetting effect into the 2020s and an imperceptible effect later in the 21st century.

Although past and current practices of using Jamaica Bay to receive wastewater, untreated sewage and stormwater, and non-point contaminants from the urbanized watershed in which it sits, as well as dredging and filling and hardening of shorelines for development, have worsened soil erosion and quality, continuing efforts by New York City, the NPS, and their partners as described in alternative A to improve water quality will also noticeably benefit benthic and saltmarsh soils.

The vulnerability to continued flooding and erosion from storms as sea level rises is calculated using a coastal vulnerability index. The index includes consideration of several factors for each coastal area, including geomorphology, coastal slope, relative sea-level rise rate, mean significant wave height, mean tidal range, and the sediment budget.

Conclusion

The no-action alternative would continue to keep hardened surfaces for trails, roads, and other development, including covered surfaces such as at Floyd Bennett Field, in place, with adverse effects on soils from compaction and reduced infiltration. Beach nourishment projects would result in both beneficial localized impacts on areas affected by human-built interruptions of sand transport and adverse effects on natural coastal processes from borrow locations. Soils are not named as a fundamental resource at the park, but beach and dune systems at several park sites are named as fundamental resources. Adverse or beneficial impacts on park soils from implementing alternative A would not be considered significant. Although beach nourishment does improve the availability of sediment, it is not a natural process and the benefit is therefore not likely to be a significant one. The contribution of impacts from alternative A to cumulative adverse impacts on soils would not likely be more than imperceptible in the long term, with the exception of continuing efforts to improve water quality in Jamaica Bay, an action that may produce noticeable cumulative benefits for benthic soils in Jamaica Bay.

Common to Both Action Alternatives

Impacts of Alternatives B and C

Floyd Bennett Field

Both action alternatives envision locating the Jamaica Bay Science and Resilience Institute (JBSRI) somewhere near Jamaica Bay and likely on park lands, which would support protection projects and similar urban ecology projects. The location is yet unknown, but could be at Floyd Bennett Field. If so, preliminary work envisions it located on an approximately 20-acre site on the northeast side of Floyd Bennett Field, allowing it to take advantage of existing buildings for reuse, renovation, or potentially for expansion (Happold 2012). The institute would be a campus-like collection of buildings, with possible temporary housing or food service for visiting researchers, research and lab facilities, and docks and related infrastructure for a small boat fleet. Should the wetlands center also be approved (as proposed in alternatives B and C, although size and layout differ), it and the JBSRI would potentially be co-located to share resources, dock facilities, parking, and road access.

Although the degree of development of visitor facilities at Floyd Bennett Field would differ under alternatives B and C, the impacts on soils would not. This is because any adverse impacts from construction of facilities would not affect any natural soils at the site.

Soils at Floyd Bennett Field are characterized in an early document as varying from "dredge fill" or urban rubble composed of coal, metals, crushed brick, and cinders, to more natural mudflats, marshes, and sand dunes (Friedberg et al. 1980). Soil borings also indicated the presence of municipal wastes and garbage fill. Floyd Bennett Field was built over nearly forty small and larger islands, creeks, and lagoons, including the larger Barren Island. The organic or marsh layer underneath the surface fills, rubble, or wastes varied in depth, but was exposed along the shorelines (Friedberg et al. 1980). Although originally soil sampling found no contaminants, the use of the site and nearby Flatbush Avenue for garbage disposal as well as more recent sampling indicate that contamination in some parts of the site may be an issue (WWT 2011). Soils at Plumb and Bergen Beach were found to have poor load-bearing qualities, as would any area at Floyd Bennett Field filled with municipal waste, garbage fill, or similar. The report also noted that although surface soils over much of the site could carry the structural load of a single-story, light frame building, heavier loads would require piles or other treatment to stabilize them.

The Wildfowl and Wetlands Trust Ltd. study (WWT 2011) indicated additional information from soil samples was required, but that virtually the entire site could be underlain by contaminated fill or garbage incapable of sustaining new structures. The 1980 sampling found that much of the central part of Floyd Bennett Field is composed of dredge fill. In this area, alternatives B and C propose continuing the current maintained grassland wildlife area and hiking trails, as well as increasing the density and/or type of camping over much of the North Forty. Some of the North Forty (the western portion) is also underlain with rubble or other urban materials. Reuse of existing structures in the Hangar B area for a variety of visitor, interpretive, educational, and recreational uses, including a new wetlands center and

the JBSRI, would be likely under both alternatives B and C. The 1980 soil testing indicated that soils in most of this already paved and developed area are composed of dredge fills. In the vicinity of Raptor Point and the North Forty is an area designated as a site for constructed wetlands whose soils are urban rubble. Garbage fill was found to the north of Dead Horse Bay, in an area near the Ryan Visitor Center and proposed for undefined future development by park alternatives.

Generally, except for the excavation of parts of the North Forty area to create fresh- and saltwater wetlands, impacts on soils at Floyd Bennett Field would remain the same as they are currently. It is possible that where additional visitor, recreational, or JBSRI facilities are proposed on undeveloped sites in the North Forty or at Dead Horse Bay, soils could be affected. However, because this additional development is proposed on sites already covered in urban rubble, dredge fill, or other unnatural soils, impacts on natural soils would be negligible or nonexistent. If contaminated materials are removed and clean fill used instead, relative benefits to visitors but not to natural soils could result. A small amount of Jamaica Bay benthic soil would need to be dredged to install the wetlands center marina. Impacts would likely be adverse and localized.

The potential for erosion was also assessed in the 1980 study. Plumb Beach, the south edge of the site west of the Marine Bridge, and the south shore of Bergen Beach were all found to have highest potential for shoreline erosion.

Both alternatives include implementing a proposal to control erosion with added groins and an offshore reef at Plumb Beach; provisions to work with neighboring landowners at Jacob Riis Park and Great Kills Park to restore sediment transport processes; and the control of beach erosion and maintenance of natural beach and dune habitats at Plumb Beach, Bergen Beach, Miller Field, Fort Wadsworth, and Sandy Hook. Each of these actions would have beneficial impacts on sediment budgets at these park sites, with the restoration of sediment transport particularly widespread and beneficial because it returns a natural process.

Alternative B: Discovering Gateway – NPS Preferred Alternative

Impacts of Alternative B

Jamaica Bay Unit

Floyd Bennett Field

As noted in the analysis of impacts common to both action alternatives, although Floyd Bennett Field would not be as developed under alternative C as under alternative B, the impacts on soils would be virtually the same. This is because no natural soils (i.e., only dredged fills and urban rubble or similar nonnatural soils) would be affected.

Both alternatives also include creating wetlands and wetland connections, although less so under alternative B than C. Alternative B calls for the softening of shorelines, restoring a connection between Jamaica Bay and former wetlands at Floyd Bennett Field, and the

Although returning 100+ acres of Floyd Bennett Field to natural conditions would affect only a small percentage of this park site, and a smaller still percentage of habitat modified by humans in Jamaica Bay, it is still a potentially important beneficial impact because natural areas at Floyd Bennett Field are considered fundamental.

creation of at least 100 acres of estuarine, marine, self-sustaining saltwater wetland, and constructed freshwater wetland habitats, returning a substantial amount of soil to its natural state. The submerged lands of Jamaica Bay and natural areas at Floyd Bennett Field are considered fundamental resources of the park. Although returning 100+ acres of Floyd Bennett Field to natural conditions would affect only a small percentage of this park site, and a smaller still percentage of habitat modified by humans in Jamaica Bay, it is still a potentially important beneficial impact because natural areas at Floyd Bennett Field are considered fundamental.

Park Sites on the Rockaway Peninsula

Soils at Fort Tilden and Jacob Riis Park are a combination Hooksan sands, loamy sands, and pavement or construction debris. The soils at these park sites are deep, well drained, and windblown, with wind moving sand into large, generally sparsely vegetated dunes (NRCS et al. 2001). Much of the sand has been deposited by longshore transport and reworked by wind and water until it is fine grained.

Fort Tilden and Jacob Riis Park are located on the Rockaway barrier spit. They are part of a coastline that is covered by beach groins attempting to slow and trap sediment traveling in the longshore current from east to west. There are 48 stone and concrete groins in the shoreline from Jacob Riis to Fort Tilden, with 11 at Fort Tilden (Psuty et al. 2009). The beach narrows, and the foredune is more affected from east to west along the Fort Tilden shoreline because of these structures, although foredune topography continues throughout Fort Tilden. A long, high groin at the eastern end of Jacob Riis Park has produced a sand-starved beach for much of that park site, making it mobile and subject to loss of sand during storms.

Alternative B would include new lodging and a variety of camping opportunities to be developed at the parade ground and in Fort Tilden's backcountry environments. The parade ground would become the hub for lodging and activities that support camping, community uses, and recreational uses, including hiking along an enhanced set of trails at the site. The dunes at Fort Tilden (which have been overwashed and eroded by Hurricane Sandy) would be restored and remain in relatively natural condition subject to natural coastal processes, although Riis Landing on the Jamaica Bay side of this park site would be built up into a visitor service area that uses existing infrastructure and building stock. Tent, cabin, and pod camping would be located in the more inland parts of Fort Tilden, including on disturbed open areas and in shrublands.

No new visitor uses or facilities that might affect soils in the Breezy Point Tip area are anticipated.

Impacts on soils from reusing existing facilities at Jacob Riis Park or Fort Tilden would be negligible; however, the development of new facilities would require excavation, grading, and stockpiling and would result in erosion and soil loss from the site. Fill material or stabilizing piles or other structures for heavier or taller buildings may be needed in sandy soils. Deeper excavation for the water skills park would also be required. Combined, the

construction of these new trails, camping areas, structures, and recreation facilities could result in the loss of a high percentage of existing undeveloped soils at both park sites, an adverse localized impact. This would be somewhat offset by efforts to restore and stabilize dunes on the coastal side of both parks and by the use of removable facilities, such as tent platforms and camping pods, when they are available. Benthic soils, likely to be sandy in nature, may need to be dredged to expand the Riis Landing ferry terminal. If so, impacts would be adverse but localized.

Alternative B also includes a provision to partner with New York City and other landowners to improve coastal resiliency and help restore natural coastal processes such as the longshore transport of sand at Jacob Riis Park. If natural coastal processes are restored here by removing groins, jetties, riprap, or bulkheads, it could result in substantial benefits for not only this park site, but also at Fort Tilden and even Breezy Point because they are downdrift of Jacob Riis Park. Benefits include reducing these park sites' vulnerability to degradation and soil loss from projected possible increased winds and storm surge associated with climate change. This is because a positive or balanced sediment budget can be a primary, or even the primary, factor in determining differences in coastal vulnerability index values along the coast (Psuty and Silveira 2010; USGS Woods Hole Science Center 2004).

Alternative B also includes a provision to partner with New York City and other landowners to improve coastal resiliency and help restore natural coastal processes such as the longshore transport of sand at Jacob Riis Park.

Pennsylvania Avenue and Fountain Avenue Parks

The 110-acre Pennsylvania Avenue Landfill and the 297-acre Fountain Avenue site on the Jamaica Bay shoreline were used from 1956 to 1983 for construction waste and demolition debris until they were closed by the New York State Department of Environment Conservation (NYCDEP 2010). Both landfills have been capped and planted with grass, shrubs, and trees. The city's design for the landfills includes increasing the diversity of native plant species and, if possible, introducing rare or even locally extirpated species. Soils at the base of each landfill are sand overlying the original tidal marsh soils. A cap of fill, geocomposite, and a 12-inch protection layer covered with up to 2 feet of topsoil covers both landfills. Methane is currently pumped from the landfills and flared; leachate from the landfills is collected and pumped to a disposal site. The soil that forms the top layer is generally a loam or sandy loam where it is available for plant growth. Alternative B calls for opening both landfill sites to visitors and developing them with a wide range of recreation facilities and community gathering spaces, including a new community gathering area and a trail system. A larger dock to provide water access would be built at the Fountain Avenue Landfill. The possibility of using some of each site to generate solar power is also part of this alternative. Although these facilities would require the removal of existing topsoil, this soil is nonnative and is essentially clean fill deposited by the city as part of the remediation effort. Because of this, impacts would be minimal. These sites are not coastal, and no impact on coastal processes would occur from activities proposed under alternative B.

Other Park Sites in the Jamaica Bay Unit

The following improvements and additions are part of alternative B for park sites in the Jamaica Bay Unit other than those described above: visitor amenities such as bathrooms, food trucks, spectator seating at Plumb Beach, a new nature trail at Bergen Beach, expanded

picnic and open spaces at several sites (Bergen Beach, Canarsie Pier, Spring Creek, etc.); new small-scale visitor facilities at Spring Creek and Frank Charles Memorial Park sites; a new network of trails at Jamaica Bay Wildlife Refuge; and possible backcountry camping on Canarsie Pol. Many of these would have no effect on soils, but creating new trails or clearing and grading for a picnic area might. Camping on Canarsie Pol is unlikely to affect soils in any noticeable way because it is anticipated that this would be backcountry tent camping that would happen infrequently. To the extent that natural soils are graded or removed for any of these small-scale amenities, localized adverse impacts on soils would occur. If the removed soils are artificial fills or urban rubble, no impacts on native soils would take place. No impacts on coastal processes from any of these actions would be expected.

Staten Island Unit

Fort Wadsworth

Alternative B includes proposed camping and lodging at Fort Wadsworth near the shoreline and near the cultural sites at this location, as well as additional built trails for visitors to experience a wider range of recreational opportunities. Alternative B also includes creating a water trail around Swinburne and Hoffman Islands and a possible dock at Hoffman, as well as preserving natural beach or dune habitats at Fort Wadsworth. Impacts from these facilities on natural soils would be minimal because the beach and both islands are products of fill materials. None of these actions would affect coastal processes at Fort Wadsworth.

Great Kills Park

Sediment was dredged from the Great Kills bay to create the current boat basin, and was deposited in the surrounding upland. Some of the artificial upland reestablished a connection between the mainland and Crookes Point. Recently, portions of the Great Kills Park area have been closed to visitor use because of the discovery of radon, presumably from medical waste in fill and waste disposed of at this site. Alternative B proposes expanding current pathways, adding water-based recreation and some introductory camping opportunities, and rebuilding the marina (damaged by Hurricane Sandy) into a water-based recreation facility in a different portion of the harbor. Ferry service may be added. The impact of onshore facilities on natural soils would be minimal, both because facilities are limited and because soils are mostly fills from the dredged harbor and other sources. Impacts from rebuilding and relocating the marina and adding infrastructure and facilities to support a water-based recreation facility have the potential to result in the dredging and displacement of natural marsh or estuarine soils from the harbor. However, because soils here are already severely altered from dredging to create the harbor, the relative impact of additional dredging is likely to be inconsequential.

Both alternatives B and C include a provision to work with neighboring landowners and partners to implement solutions to improve the resiliency of beach and dune habitat at Great Kills Park and Crooke's Point. To the extent that this includes removing or modifying groins and a sewage outfall pipe to restore natural longshore transport of sediment, benefits to natural coastal processes at these park sites could be substantial and localized, as well as consistent with NPS *Management Policies* 2006 (NPS 2006a).

Miller Field

Activities that may affect soils at Miller Field include improving the current network of trails through the swamp white oak forest and providing signs and clear delineation of the trail. The park would also create a kayak launch site at the ocean and a trail that minimizes foot traffic on beach and dune habitat created. The improved trails could stop or slow erosion in the forest, an important localized benefit for soils in this rare vegetative community, and in the dunes. Creating a kayak launch area has the potential for minimal adverse impact on beach sediments. Improvements to the sports playing fields at Miller Field could also help stabilize soil erosion and loss. Each of these beneficial or adverse effects would be small scale and localized.

Alternative B also calls for increasing the resiliency of the shoreline at Miller Field. Currently, the shoreline is maintained by two groins, a constructed dike, and placement of artificial fill. Removing these structures and restoring natural coastal processes may result in the loss of this beach and dune area, an adverse impact on beach soils if it occurs.

Sandy Hook Unit

Although many new recreational and visitor uses are proposed in this alternative for Fort Hancock, most would not affect natural soils because these uses would take place inside buildings or make use of existing facilities. A possible exception is the expansion of ferry and water taxi use, which, to the extent it requires the removal of benthic soils, would have an adverse and localized impact.

On the bayside of Sandy Hook (such as near the Horseshoe Cove area) and eastward into the upland portion of this park site, alternative B would increase camping opportunities, trail networks, and water-based recreation. Each of these could have adverse localized impacts on soils, including those more characteristic of saltmarsh habitat if located near Horseshoe Cove. However, alternative B also calls for increasing sand nourishment on the bayside to help in reducing erosion and supporting restoration efforts, and controlling beach and dune erosion. On the ocean side, additional camping options would be created, shade structures increased, and rebuilding with sustainable facilities would occur as needed. Beach centers would be rebuilt making maximum use of portable facilities to avoid impacts from storms. Current management of coastal sands via a slurry system described under alternative A would continue under alternative B. Adverse impacts from new facilities would be likely to be adverse but minimal, but benefits from restoring sediment availability on the bayside could be more widespread and substantial.

Cumulative Impacts

Impacts of the other actions that contribute to cumulative impacts (i.e., those not related to alternative B) on soils and geology are the same as described under alternative A. Under alternative B, localized adverse impacts from soil loss related to new development would occur at several park sites, but would add only an imperceptible increment to the overall adverse cumulative impacts from past dredging, filling, and other soil manipulation at these

sites. However, restoring marsh soils to 100+ acres of Floyd Bennett Field would contribute a noticeable beneficial increment to the overall cumulative impacts on soils. Alternative B could also contribute a noticeable beneficial increment to help offset adverse cumulative impacts on natural coastal processes through partnerships and discussions with neighbors to remove barriers to longshore transport of sand at Jacob Riis Park, Fort Tilden, and Great Kills Park.

Conclusion

Although building new facilities could remove most remaining open land at Jacob Riis, this still amounts to a small area here or at Fort Tilden; although soil loss would be adverse, it would not be considered significant because soils are not a fundamental resource of the park. Development at Floyd Bennett Field would not be expected to affect any natural soils. Restoring dunes at park sites, including Jacob Riis Park, Fort Tilden, Great Kills Park, and Miller Field, and particularly any successful effort to remove groins, jetties, or other structures that inhibit natural sand transport and deposition, would have areawide beneficial impacts as well as being consistent with NPS *Management Policies* 2006 (NPS 2006a). Because of this and because beach and dune systems at several park sites are considered fundamental resources, benefits may be considered significant. Although dunes and beaches at Sandy Hook, including on the bayside, are considered fundamental resources at the park, adding sand does not restore a natural coastal process and benefits would be unlikely to be considered significant.

Although returning 100+ acres of Floyd Bennett Field to natural conditions would affect only a small percentage of this park site, and a smaller still percentage of habitat modified by humans in Jamaica Bay, it is still a potentially significant beneficial impact on both these named fundamental resources.

Alternative C: Experiencing Preserved Places

Impacts of Alternative C

Jamaica Bay Unit

Floyd Bennett Field

As noted above, although Floyd Bennett Field would not be as developed under alternative C as under alternative B, the impacts on soils from development would be virtually the same. This is because no natural soils (i.e., only dredged fills and urban rubble or similar nonnatural soils) would be affected.

Alternative C would build additional freshwater wetlands and connect a larger area of Floyd Bennett Field to the bay to create saltmarsh than alternative B. Under both alternatives B and C, wetlands would be created in the North Forty and Mill Basin area to the west of Raptor Point. A visitor center in the northern portion of this area on the shore would make use of an existing concrete shelter and foundation. This alternative, like alternative B, would

soften shorelines and restore the connection with Jamaica Bay. Over time, this would return soils to an area greater than 100 acres of combined saltmarsh, estuarine, and freshwater habitat, a substantial benefit for marsh soils in submerged lands of Jamaica Bay, considered a fundamental resource by the park.

Park Sites on the Rockaway Peninsula

Alternative C would result in less facility development at Jacob Riis and Fort Tilden than alternative B, with some visitor amenities provided on a seasonal basis using mobile facilities. Some camping in the backcountry of Fort Tilden would be offered, as would lodging in the area's parade ground. Like under alternative B, trails through the backcountry would be developed.

Although the degree of development at open areas of these park sites would be less than alternative B, the impact from alternative C would still be considered adverse and localized. Soils may be graded to accommodate portable booths on the parade ground rather than being excavated for more permanent facilities. Instead of cabins built in the backcountry, the park may only allow pack-in/pack-out tent platforms. These small losses would be offset by dune restoration efforts, and by coastal and upland habitat protection and restoration. Like under alternative B, the NPS would work closely with neighboring landowners to restore coastal processes at Jacob Riis Park, an action that could result in widespread and important benefits for beach sands.

Pennsylvania Avenue and Fountain Avenue Parks

Impacts on soils from actions proposed at the former landfill sites would be the same as under alternative B, even though this alternative proposes using only one for visitors rather than both. This is because the soil in these areas is nonnative and is essentially clean fill deposited by the city as part of the remediation effort. Because of this, impacts would be minimal. In addition, these sites are not coastal, and no impact on coastal processes would occur from activities proposed in alternative C.

Other Park Sites in the Jamaica Bay Unit

Alternative C improvements for visitor uses at other park sites in this unit would generally be less intense than under alternative B. Many of these would have no effect on soils, but creating new trails or clearing and grading for picnic areas or open spaces. An exception to this may be at Plumb Beach, where observation decks, trails, outdoor education, and other facilities are proposed under alternative C. Although the removal of equestrian use from Bergen Beach would result in localized benefits to soil quality, the relocation to Fort Tilden could have similar adverse impacts on soils at this park site by adding unwanted nutrients. Camping would not be allowed on Canarsie Pol in this alternative, and so the minimal adverse impacts associated with this action in alternative B would not occur. To the extent that natural soils are graded or removed for any of these small-scale amenities, localized adverse impacts on soils would occur. If the removed soils are artificial fills or urban rubble, no impacts on native soils would take place. No impacts on coastal processes

Like alternative B, alternative C includes a provision to work with neighboring landowners and partners to implement solutions to improve the resiliency of beach and dune habitat at Great Kills Park and Crooke's Point.

from any of these actions would be expected. Conversely, several of these park sites would have improved protection of dunes and beach habitat (Plumb Beach, Bergen Beach, Breezy Point Tip) or other coastal habitat (Spring Creek, Jamaica Bay Wildlife Refuge, Breezy Point). Collectively, these efforts could provide widespread benefits for beach and dune sands or wetland soils.

Staten Island Unit

Fort Wadsworth

Camping and lodging are not part of alternative C at this park site, nor is access to Hoffmann Island. Because this reflects current conditions, there would be no impact on soils from development relative to the no-action alternative.

Great Kills Park

As in alternative B, alternative C proposes some introductory camping opportunities and rebuilding the marina (damaged by Hurricane Sandy) into a water-based recreation facility in a different portion of the harbor. Other trails and amenities are not part of alternative C; however, since soils at this park site are not natural, differences in impacts from development between the two action alternatives would be inconsequential. Impacts from rebuilding and relocating the marina and adding infrastructure and facilities to support a water-based recreation facility have the potential to result in the dredging and displacement of natural marsh or estuarine soils from the harbor. However, because soils here are already severely altered from dredging to create the harbor, the relative impact on natural soils of additional dredging would likely be minimal.

Like alternative B, alternative C includes a provision to work with neighboring landowners and partners to implement solutions to improve the resiliency of beach and dune habitat at Great Kills Park and Crooke's Point. To the extent that this includes removing or modifying groins and a sewage outfall pipe to restore natural longshore transport of sediment, benefits to natural coastal processes at these park sites could be substantial, as well as consistent with NPS *Management Policies* 2006 (NPS 2006a).

Miller Field

Activities and impacts at Miller Field would be the same as for alternative B, with a number of localized beneficial and adverse effects possible.

Sandy Hook Unit

Fewer new recreational and visitor uses are proposed in this alternative for Fort Hancock than under alternative B, with localized adverse impacts on soils possible from an improved trail system. Like under alternative B, it is possible that all maintenance facilities in Sandy Hook would be relocated to an alternate building or buildings. If these are existing structures, no impacts on soils would occur. If it requires a new building or buildings, impacts

on soils would likely be adverse and local, although a new building on dredged fill or other similar material placed by humans would have no impact on natural soils.

On the bayside of Sandy Hook (such as near the Horseshoe Cove area) and eastward into the upland portion of this park site, alternative C would increase day-use recreation opportunities, including new trails, boardwalks, blinds, outdoor programming, etc. Each of these could have adverse localized impacts on soils, including those more characteristic of saltmarsh habitat if located near Horseshoe Cove. On the ocean side, fewer visitor use facilities than under alternative B would be built. Beach centers would be rebuilt only using portable construction, with fewer amenities than under alternative B. More intensive habitat protection and monitoring of beach and dune habitats would occur and rare habitats such as the holly forest, saltmarshes, and dunes would be highly protected. Impacts from new facilities would likely be adverse but minimal, whereas increased protection of habitats could have localized benefits for natural soils.

Cumulative Impacts

Cumulative effects would be the same as those described above for alternative B.

Conclusion

Under alternative C, the adverse impacts from increased development at park sites in all three units would not be considered significant because localized development at Floyd Bennett Field would not be expected to affect any natural soils and because soils are not a fundamental resource. Efforts to restore and/or stabilize dunes would primarily benefit facilities, but could offer some benefits to coastal soils by increasing the supply. These benefits are unlikely to be significant because they nourish but do not restore natural sand transport processes. On the other hand, benefits from restoring sand transport processes at Jacob Riis Park could also restore them at Fort Tilden or even Breezy Point, and restoring transport processes at Great Kills could restore important mudflat or beach soils. Overall benefits may be widespread, and because beach and dune systems are named as fundamental resources, may be considered significant.

Although returning 100+ acres of Floyd Bennett Field to natural conditions would affect only a small percentage of this park site, and a smaller still percentage of habitat modified by humans in Jamaica Bay, it is still a potentially significant beneficial impact on both these named fundamental resources.

Efforts to restore and/or stabilize dunes would primarily benefit facilities, but could offer some benefits to coastal soils by increasing the supply. These benefits are unlikely to be significant because they nourish but do not restore natural sand transport processes.

Air Quality

Air quality is an integrating resource that can affect numerous resources and values in the park. Clean air is important to the visiting public and essential to supporting healthy ecosystems. Air pollution can impact human health and jeopardize park experience when it reaches unhealthy levels. Ozone and fine particulate (particulate matter less than or equal to 2.5 microns [PM2.5]) concentrations can exceed national health standards at times and can cause respiratory irritation in park visitors and staff. Aerosols can deposit in soils or bodies of water, causing acidification and increases in unwanted nutrients. Clean, clear air is also

important to enjoying park views, which can be obscured by haze, a combination of fine particles and gaseous air pollution in the atmosphere.

Laws and Policies

In the Clean Air Act, Congress set a national goal "to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic or historic values" (42 USC 7470[2]). This goal applies to all units of the national park system.

The act includes special provisions for 48 units, called Class I areas. Under the Clean Air Act, all other national park system areas are designated as Class II, including Gateway. Although the most stringent protections are provided to Class I areas, the legislation also aims to limit the level of additional pollution allowed in Class II areas, and potential impacts to these areas are to be considered.

The "Air Quality" section in chapter 3 of this GMP/EIS notes that the region that includes the park is in non-attainment status for nitrogen oxides (NOx), ozone, and PM2.5. According to section 176(c) of the Clean Air Act, any project sited in a non-attainment area must satisfy the general conformity rule of the Clean Air Act. Conformity ensures that projects do not cause or contribute to a new air quality standard violation, increase the frequency or severity of an existing violation, or delay timely attainment of a standard or any required interim emission-reduction milestone. To the extent that any alternative proposes actions that would result in increases in emissions, compliance would need to include a conformity determination.

Methods

This is a primarily qualitative analysis of the beneficial or adverse effects on air quality, with a focus on the indicators the NPS considers important (ozone, deposition, and visibility) and those with National Ambient Air Quality Standards (NAAQS) or attainment considerations. Standardized reference information on the types of impacts associated with mobile or stationary sources was consulted. Quantitative estimates are based on standardized U.S. Department of Transportation references for average emissions.

Resource-specific context factors for assessing the impacts of the alternatives on air quality include the following:

- Air quality in Class II parks is managed to protect natural and cultural resources, visitor and employee health, and visitor experience to the same desired condition as Class I parks.

- No air quality factor is named as a fundamental resource or value at Gateway; nor are viewsheds or visitor or employee health. Natural areas at some park sites and nature observation are named as fundamental resources or values.

- Current conditions for the three primary factors (ozone, deposition, and visibility) considered by the NPS to determine whether desired natural resource–based air quality conditions exist all indicate that concern is warranted.

- Gateway is located in an urban environment and its air quality reflects this; because of this, the park is unable to maintain or make significant changes to NPS desired conditions or meet NAAQS on its own.

Alternative A: No Action

The no-action alternative would for the most part continue current management practices for the foreseeable future. Exceptions to this statement include cleanup and repair efforts related to Hurricane Sandy and any approved projects or plans the park would implement.

Impacts of Alternative A

Mobile Source Emissions

Currently, emissions from activities in the park include those from automobiles, buses, and boats at the marinas, as well as from power generated for park needs off site and generators as needed at the park. The "Transportation" section in chapter 3 of this GMP/EIS (see "Regional Transportation Overview") describes regional options for accessing the park, which include some ferry, bus, and indirect subway connections (via bus to subway stations). Limited park shuttles to transport visitors to the beach at Sandy Hook, for example, exist, as do some bike paths and paved and unpaved walking routes. Generally, connections between park sites are unavailable and parking in many sites is limited. Most visitors arrive and explore park sites by car.

A 2003 study (NPS 2003e) found that highway and non-road vehicles at the park emit 45 tons of NOx, 226 tons of volatile organic compounds, 13 tons of particulates and 926 tons of CO per year. The majority of VOCs was from offroad vehicles driven primarily by park staff; the majority of CO was from highway vehicles. Of these, NOx and CO levels are high enough that they would be of concern under current NPS Air Resources Division (ARD) direction (NPS ARD 2011). (Emissions of volatile organic compounds [VOCs], methane, and some precursors to ozone are traditionally reported for mobile sources as total HC [EPA 2003]). The Jamaica Bay Unit accounted for the largest portion of the emissions of each pollutant. As noted in the "Affected Environment" chapter, CO concentrations do not remain in the atmosphere for long and are usually limited to locations near crowded intersections, heavily traveled and congested roads, parking lots, and garages (NYCPC 2012b). The Jamaica Bay Transportation Studies (FHWA 2006) support this finding, noting that, with assumptions regarding reasonably foreseeable changes in environmental protection agency (EPA) regulations and compliance with those regulations, 1-hour CO concentrations would decrease from their current 6.3 parts per million (ppm) to 6.0 ppm in 2025. The same document predicts that 8-hour CO concentrations would also decrease from their current 4.4 ppm to 4.2 ppm in 2025. The NAAQS for CO are 35 ppm for the 1-hour and 9 ppm for the 8-hour standard. Air quality impacts from mobile sources on CO under current levels of car and bus uses would

be therefore be localized and temporary and would continue to be well below federal standards. However, NOx contributes to ozone formation, which is not meeting NPS ARD-recommended desired future conditions and is out of compliance with the federal 1-hour standard. NOx concentrations at locations near to the park were measured at levels lower than the annual or 1-hour standards (see Table 3-1).

Emissions from Facilities Construction

The no-action alternative would include the implementation of an approved 2010 project to construct two terminal groins at the east and west limits of beach fill at Plumb Beach (NPS 2010f). The groins would be rubble mound structures designed to withstand up to a 100-year storm wave force. The environmental assessment for this project (NPS 2010f) indicates that heavy equipment would be used for the project and that CO and other pollutants would be emitted for a short time. Emissions would not exceed any NAAQS threshold.

Emissions from Hurricane Sandy Damage Repair or Restoration

Repair and restoration efforts resulting from Hurricane Sandy could also result in emissions from construction or deconstruction. For example, several roads and parking lots will need to be regraded and repaved, lifesaving stations and beach centers at Sandy Hook may be replaced or repaired, the Canarsie Pier restaurant building will be torn down, and culturally important buildings such as the Jacob Riis bathhouse may be restored or structurally stabilized. Each of these would result in temporary impacts from pollutants such as CO, HC, and particulates from heavy equipment use.

Other Emissions

The park emits pollutants as part of its day to day operations. A 2003 study (EPA and NPS, 2003) found non-mobile emissions (see above for mobile emissions) to total 3 tons of SO_2, 10 tons of NOx, less than one ton of volatile organic compounds or particulates and less than 6 tons of CO. Sources include space and water heating, generators, fuel storage tanks, fireplaces and wastewater treatment.

In addition to these criteria pollutants, the park greenhouse gas emissions were calculated as 3.8 tons of CO_2. Sources included direct combustion and purchased electricity.

Planting trees as part of the MillionTreesNYC program would increase the capacity of the park's vegetation to act as a carbon dioxide (CO_2) sink, reducing its contribution to greenhouse gases and its carbon footprint, a potentially widespread beneficial impact. For example, another national park system unit in California (Point Reyes National Seashore) predicted that the adverse impacts from the park's contributing over 8,000 tons of greenhouse gases each year from operations (including its need for power and heat from the local utility) would be offset by more than 30,000 tons of absorption of CO_2 by park trees and other vegetation, with a net benefit of over 20,000 tons of CO_2 equivalent per year (NPS 2009g). Figures for Gateway's contributions of greenhouse gases and its potential for offsetting adverse effects on air quality by planting trees are unknown.

Cumulative Impacts

The reporting of current conditions in the New York City/New Jersey area in the "Affected Environment" chapter is a summary of the impacts of cumulative actions in the area. These are primarily from mobile sources, although VOCs and other precursors to smog, or of aerosols of nitrogen and sulfur that fall as acid rain or increase unwanted nutrients in water bodies, can come from large stationary sources like power plants or industrial facilities much farther away. The park also contributes an imperceptible amount to cumulative air impacts from day-to-day operations that would be unchanged in any GMP/EIS alternative. The combination of these sources has resulted in levels of ozone, wet deposition of sulfur, and impacts on visibility that are of concern to the NPS in its assessment of natural resource–based air quality and the ability of Gateway to meet standards in section 4.7.1 of the NPS *Management Policies* 2006 (NPS 2006a). Ozone and small particulate (PM 2.5) concentrations also exceed NAAQS in the area, which is in non-attainment status for both. These conditions suggest that cumulative impacts from all sources not related to actions in the GMP/EIS are substantial and adverse. The impacts from the no-action alternative would primarily be short term or localized or both and would add an imperceptible adverse impact to these overall adverse cumulative impacts. Planting trees could improve air quality by reducing CO2, an unknown but likely imperceptible beneficial offset of the adverse cumulative impacts.

Conclusion

The no-action alternative would result in no change to current emissions from mobile sources, and short-term localized increases in emissions from construction-related activities, an adverse impact on air quality. The emissions of NOx and CO from mobile sources at the park would be high under alternative A. CO disperses quickly and modeling shows that it would decrease as increasingly strict regulations are put in place. Although NOx levels would be higher than advised by the NPS ARD, the region is in compliance for all NOx standards and that contributed by park visitors is a small portion of the overall NOx in the air basin. Park operations also result is a very small amount of criteria pollutants and greenhouse gas emissions. For these reasons and because air quality is not identified as a fundamental resource at the park, the impacts of alternative A on air quality would not be considered significant. Although cumulative impacts on air quality are substantial and adverse, the contribution from either mobile or construction sources under this alternative would not add more than an imperceptible adverse increment, and planting trees would add an imperceptible beneficial increment.

Common to Both Action Alternatives

Impacts of Alternatives B and C

Emissions from Facilities Construction

Both action alternatives envision the JBSRI, which would support protection projects and similar urban ecology projects, being established somewhere near Jamaica Bay and likely on park lands. The location is yet unknown, but it could be at Floyd Bennett Field. If so,

preliminary work envisions it located on an approximately 20-acre site on the east side of Floyd Bennett Field, allowing it to take advantage of existing buildings for reuse, renovation, or potentially for expansion (Happold Consulting 2012). The institute would be a campus-like collection of buildings, with possible temporary housing or food service for visiting researchers, research and lab facilities, and docks and related infrastructure for a small boat fleet. Should the wetlands center also be approved (as proposed in alternatives B and C), it and the JBSRI would potentially be co-located to share resources, dock facilities, parking, and road access. Some construction of access, parking, and dock facilities or renovating or expanding buildings could occur at Floyd Bennett Field, with associated emissions (including HC, particulates [particularly from diesel engines], and CO) from heavy equipment. These emissions would be localized and temporary, lasting only until construction is complete.

Other Emissions

Both alternatives would implement measures to reduce greenhouse gases such as modernizing the NPS fleet of vehicles, purchasing renewable energy, reducing miles traveled and other changes listed on page 56. These measures would reduce the parks emissions of CO2, a beneficial impact.

Alternative B: Discovering Gateway – NPS Preferred Alternative

Impacts of Alternative B

Mobile Source Emissions

Alternative B would include additional public transportation and options for bikes, water access, pedestrian walkways, and shuttles. These changes are described in more detail in the "Transportation" section in this chapter of the GMP/EIS, but would include, for example, a multimodal transportation hub at Floyd Bennett Field. In part, the purpose of this hub would be to facilitate the development of the wetlands center at Floyd Bennett Field, because this new center would be the focus of outdoor classrooms, educational exhibits, and interpretive media, and would be the starting point for many visitors to experience the Jamaica Bay Unit. Camping, a proposed hotel, multiple community and visitor activity areas, water-based recreation, and other attractions would be particular draws for this area.

These additions would be likely to increase visitor numbers at Floyd Bennett Field. Some of these visitors would arrive by car and add to the emissions totals identified in alternative A. However, alternative B is particularly focused on creating public transportation or alternative transportation options and maintaining a series of links across park sites. These would include the presence of alternative transportation hubs at Floyd Bennett Field, Jamaica Bay Wildlife Refuge, and Canarsie Pier as well as newly created bike or pedestrian connections between Floyd Bennett Field and Plumb Beach or Bergen Beach, between Canarsie Pier and adjacent communities, between neighborhoods and the Spring Creek park site, and between Jacob Riis park and other NPS and city park sites. Water transportation would be improved by designating canoe and kayak routes around Jamaica Bay, rebuilding Great Kills Marina for private boat use, and offering or linking to ferries from Manhattan to Staten Island or

to Jacob Riis, Sandy Hook, or Great Kills, or between the Jamaica Bay Wildlife Refuge and the wetlands center at Floyd Bennett Field. Public transportation by shuttle may be offered between some park sites, such as from Fort Tilden to Breezy Point Tip, and would continue to link visitors to Sandy Hook when parking lots are full. The Sandy Hook shuttle would be expanded to carry visitors between Sandy Hook sites. Each of these options could result in the decrease of car-related emissions, because visitors would be much more likely either to not use a car at all or to park at Floyd Bennett Field or other large lots and travel around park sites on foot or by bike, boat, or shuttle. This could result in substantial and widespread reductions in park visitor–related emissions from cars.

As noted in the "Methods" section in this chapter, air quality is not named as a fundamental resource at the park, but is important in providing crisp, clear views for natural observation, for example. Current air quality conditions at the park are poor for several indicators, including all three monitored and evaluated by the NPS: ozone, wet deposition, and visibility. However, the air basin is a shared resource and impacts on it come from regional sources. As noted in the alternative A cumulative impacts discussion, cars driving in the park add only an imperceptible amount. Therefore, although the park would be making major changes to its input to the regional air quality scenario from mobile sources, the air quality itself would not change perceptibly as a result. Reductions in mobile source emissions at the park would be beneficial and widespread across the park compared to current park emissions.

Emissions from Facilities Construction

Alternatives B and C would both include the creation of a wetlands center at Floyd Bennett Field, but this alternative proposes additional visitor facilities, such as an education center, trails and boardwalks, outdoor classrooms, observation facilities, and a wide range of accommodations not part of alternative C. Some of these facilities may be located inside existing buildings, which would require rehabilitation before they are reused. The Jamaica Bay Vision Report (Happold Consulting 2012) proposes that the wetlands center be located on a 100-acre portion of the North Forty area of Floyd Bennett Field, although further studies would be conducted to determine the final acreage. The center would include paths, outdoor educational opportunities, and a visitor center. The report also describes the creation of connections between Floyd Bennett Field and Jamaica Bay to facilitate a restored and self-sustaining saltwater wetlands area, as well as a freshwater wetland constructed farther inland. These would each require the use of heavy equipment for excavating, grading, and construction. Even very intense construction, such as of a water treatment facility, that would require 30 to 50 trips by heavy-duty trucks every day, would result in between 0.25 and 0.5 ton of HC, 1.3 and 2.3 tons of CO, and 6 and 10 tons of NOx for the entire six-month construction period (NPS 2004h). These are considered small amounts by the NPS ARD, and are temporary and localized adverse impacts.

A similar but slightly lesser level of effort may be required for other actions in alternative B; for example, the proposed construction of a community gathering space at one of the two former landfill sites on Jamaica Bay that the park would develop for visitor uses, or rebuilding beach centers at Sandy Hook. The size and complexity of these projects would define the time each would take to build and the associated construction-related air

impacts. Alternative B would use portable facilities and other sustainable design techniques that would minimize the need for permanent construction and related air quality impacts. Overall, impacts on air quality from emissions from heavy equipment would not be likely to exceed those noted previously for an intense, six-month construction effort and would be temporary and local.

Building transportation hubs or physical connections between park sites, or between park sites and local communities, would also require some construction effort, with resulting short-term localized impacts on air quality. Similarly, alternative B calls for new visitor facilities, including camping at Floyd Bennett Field, Fort Tilden, and Canarsie Pol; amenities like bathrooms, food trucks, launching areas, and/or nature trails at Plumb Beach; and the new landfill park sites, as well as similar physical connections between other park sites. Each of these would potentially require grading, excavating, and construction using heavy equipment, with associated short-term localized impacts on air quality from emissions.

Cumulative Impacts

Impacts of the other actions that contribute to cumulative impacts (i.e., those not related to alternative B) to air quality are the same as described under alternative A. The park would potentially greatly diminish its contribution to greenhouse gases by planting trees and would provide benefits from reduced mobile emissions in alternative B, thereby offsetting the cumulative degradation of air quality from regional sources; however, the change would be imperceptible because impacts from those sources would be much larger than could be compensated for by the potential benefits from alternative B. The temporary and localized impacts from construction would add a short-term imperceptible adverse increment to cumulative impacts on regional air quality.

Conclusion

Reductions in mobile sources from cars at the park would occur as visitors increasingly use alternative transportation and physical connections between park sites for bikes, boats, and pedestrian travel. This would be a substantial, widespread benefit compared to existing mobile source emissions from the park, but would be an imperceptible contributing benefit to current air quality in the park and region and would therefore not be considered significant. Actions taken by the park to reduce greenhouse gas emissions would also be beneficial but not significant for the same reasons. Increased short-term adverse impacts from construction compared to alternative A would occur, including those from any expansion of buildings or new buildings for the JBSRI, but these would be localized and imperceptible compared to current conditions and would not be considered significant.

Alternative C: Experiencing Preserved Places

Impacts of Alternative C

Mobile Sources

This alternative would include most of the same hubs, connections between park sites, and alternative transportation paths and opportunities as alternative B. However, some

actions under this alternative would differ from those under alternative B. For example, at Floyd Bennett Field, camping would be more concentrated and require less space and less transportation, and would also have fewer visitors. Facilities would be less oriented toward a wide range of accommodations and more toward carrying capacity, green design, and a secluded visitor experience. Visitor facilities would be located in pockets surrounded by larger undeveloped or restored areas. In addition, the entrance and circulation at Floyd Bennett Field would be changed to better accommodate flow. Equestrian facilities would be relocated away from Bergen Beach and moved to either Floyd Bennett Field or Fort Tilden, with an accompanying change in vehicular patterns. The location of an anaerobic digester at Floyd Bennett Field (see "Facility Emissions") and a potential natural gas power generation plant or similar facility at one of the landfills along Jamaica Bay would likewise change traffic patterns. Substantially fewer facilities at Fort Tilden would mean that increases in traffic there would be less likely than under alternative B. Concentrating maintenance functions at Fort Tilden for the Rockaway Peninsula park sites and at a central location (or locations) for Sandy Hook would also cause small-scale changes in staff traffic patterns. Each of these differences would result in very small localized changes in air emissions compared to alternative B. Given the same alternative transportation and connection options as in that alternative, the beneficial impacts of alternative C compared to no action for emissions related to mobile sources in the park would be nearly the same as for alternative B compared to no action: widespread and beneficial.

Facility Emissions

A notable difference between alternatives B and C is the proposed use of an anaerobic digester to reduce compostable wastes and generate biofuels under this alternative. Building this kind of facility would require additional environmental review and permitting, with a much better idea of size, feed material, location and therefore of air quality emissions and impact. For the GMP/EIS, description of impacts is programmatic and qualitative.

An anaerobic digester is most commonly used to reduce solid waste and create burnable biogas from animal manure. However, it can also use vegetation (yard waste) and food waste. The air emissions from a digester are typically primarily a combination of methane and CO2, with other gases such as nitrogen, hydrogen, hydrogen sulfide, and oxygen in far lesser amounts (SENES Consultants Limited 2009). Hydrogen sulfide, which has a "rotten egg" smell, is primarily emitted during startup periods with a digester. It is associated in higher concentrations with a feedstock of agricultural materials, including animal waste, which would not be used at the park. CO2 is also a greenhouse gas, but the facility could be designed to burn off CO2 before it is released (SENES Consultants Limited 2009). Methane, which is naturally produced from the decomposition of organic matter, could be used as a cooking fuel as is or upgraded to the same natural gas that is used to heat homes. A portion of the methane would be burned as fuel to run the digester. However, methane is also a powerful greenhouse gas, considered 23 times more potent in its contribution to global warming than CO2. Facilities can be designed to capture emissions; for example, housing the digester in a building provides a second roof to help keep odors or other pollutants from leaking into the surrounding area.

Reductions in mobile sources from cars at the park would occur as visitors increasingly use alternative transportation and physical connections between park sites for bikes, boats, and pedestrian travel.

This alternative also proposes examining the option of drawing methane from one of the two former landfills along Jamaica Bay to create fuels or burn for a renewable energy source, or building a field of solar panels to generate power. Similar to the digester, additional environmental review and permitting would be required with site specific air quality information before this kind of facility could be built. Methane is produced along with other gases (landfill gas) from landfills, and landfills are considered the third-largest source of methane emissions in the country (EPA 2013). The gas can be flared, used directly in thermal applications, or used in a boiler for power generation. The EPA has indicated an interest in landfill gas energy to help use rather than emit methane (because it is a greenhouse gas), to generate renewable energy, and to reduce local air pollution. Developing a landfill gas facility to use methane at the landfill would have a localized beneficial impact on air quality. Solar panels would also have a beneficial impact by reducing emissions from a fossil-fuel burning facility somewhere in the region. Depending on the current source of energy and the location where solar-generated power would be used, benefits could be part of the air basin in which the park is located or farther away.

Visitor-related facilities would be slightly reduced in scale compared to alternative B. For example, camping at Floyd Bennett Field and Fort Tilden would be downsized and concentrated. Beach centers at Sandy Hook would make the maximum use of portable facilities and have the fewest amenities of any alternative. Construction-related air emissions would still occur, but would be lower than under alternative B.

Cumulative Impacts

Impacts of the other actions that contribute to cumulative impacts (i.e., those not related to alternative C) on air quality are the same as described under alternative A. Although the park would potentially greatly diminish its contribution and provide benefits to offset the cumulative degradation of air quality from regional sources, the change would be imperceptible because impacts from those sources would be much larger than could be compensated for by the potential benefits from alternative C. Benefits from alternative C would include removing methane and CO2 with an anaerobic digester and methane recovery plant and so would be greater than benefits under alternative B; however, they would still be imperceptible compared to the substantial adverse cumulative impacts on the air basin. The temporary and localized impacts from construction would add a short-term imperceptible adverse increment to impacts on regional air quality.

Conclusion

Reductions in mobile sources from cars at the park would occur as visitors increasingly use alternative transportation and physical connections between park sites for bikes, boats, and pedestrian travel. This would be a substantial, widespread benefit compared to existing mobile source emissions from the park, but would be an imperceptible benefit to regional air quality conditions. Additional reductions to greenhouse gases from actions taken to reduce direct and indirect combustion under either alternative would also occur. Additional substantial localized benefits from proposed methane recovery projects (including the

anaerobic digester and landfill methane recovery project) or solar panels offsetting the park's greenhouse gas emissions would also be likely. Increased short-term adverse impacts from construction compared to alternative A would occur, but emissions from this source would be slightly lower under this alternative than under alternative B. Impacts from construction would be localized and imperceptible compared to current conditions. Although some of these adverse or beneficial effects would be important, they would not be considered significant because air quality is not an identified fundamental resource and changes to air quality would not noticeably improve or degrade air quality conditions in the park because of cumulative impacts from other sources.

Water Resources

Dredging, shoreline development, urbanized watersheds, and pollution from sewer and wastewater treatment outflows have adversely impacted the hydrology, bathymetry, water quality, and sediment quality of water resources at Gateway.

Water resources include groundwater aquifers and surface waters such as bays, ponds, streams, and wetlands (see the "Water Resources" section in chapter 3). Dredging, shoreline development, urbanized watersheds, and pollution from sewer and wastewater treatment outflows have adversely impacted the hydrology, bathymetry, water quality, and sediment quality of water resources at Gateway. Pollution can degrade water quality and diminish the opportunities for fishing, water-based recreation, and visitor enjoyment. Gateway's wetlands ameliorate some of these effects through functions such as floodwater attenuation, trapping sediments and pollutants, and recycling nutrients.

Laws and Policies

Surface water and groundwater are managed by the NPS as integral components of park aquatic and terrestrial ecosystems. Water resources are legally regulated and protected under provisions of the Clean Water Act, including sections 305(b) and 303(d), which establish state water quality monitoring and reporting standards; section 402, which regulates pollution and sediment in runoff; and section 404, which regulates dredge and fill activities that affect wetlands. The NPS has several guiding principles with respect to water resources, as outlined in the "Water Resource" section of the NPS *Management Policies* 2006 (NPS 2006a). These include considering a watershed approach to managing water resources, minimizing human disturbances that adversely affect surface waters and groundwater, and working with appropriate agencies to obtain the highest possible standards available under the Clean Water Act. NPS policy also encourages developing cooperative agreements with other agencies as appropriate to help maintain or restore the quality of park water resources.

Methods

This is a primarily qualitative analysis of the beneficial or adverse effects on water resources. Sources of information used to assess impacts on water resources under the proposed alternatives include state water quality monitoring reports and regional watershed planning documents, including the Hudson–Raritan Estuary Comprehensive Restoration Plan (USACE and PA 2009) and the Jamaica Bay Watershed Protection Plan (NYCDEP 2012).
Resource-specific context factors for assessing the impacts of the alternatives on water resources include the following:

- Jamaica Bay waters, including inlets, submerged lands, and Dead Horse Bay, are named as a fundamental resource at Gateway.

- The quality of water resources is related to the condition of wetlands, particularly saltmarshes, which are an important component of the natural areas at Breezy Point Tip, Floyd Bennett Field, Great Kills, Jamaica Bay Wildlife Refuge, and Sandy Hook. These natural areas are named fundamental resources at Gateway.

- Water resources affect the quality and availability of water-based recreation (e.g., swimming, fishing, and self-propelled watercraft), a named fundamental park value.

Alternative A: No Action

Impacts of Alternative A

Under the no-action alternative, Gateway would continue providing data on water quality and subaqueous sediments to regulatory authorities under existing water resources monitoring programs. The desired future conditions identified by the park for water quality in Jamaica Bay include eliminating and/or controlling pollutant sources, attaining water quality levels that support visitor contact recreation and aquatic ecosystem restoration and controlling invasive exotic aquatic species (NPS 2010b). Gateway would continue to collaborate with local, state, and federal officials as needed to address these and other common management goals concerning water quality and surface waters, including for wetlands. Current projects in Jamaica Bay include those to restore saltmarshes and protect fringe wetlands, coastal flooding and shoreline stabilization projects, and ongoing programs to conduct scientific research and collect water quality monitoring data. Inter-agency planning and coordination for restoring Jamaica Bay with agencies including the USACE and EPA has been ongoing for decades. The results of collaborative partnerships and programs would be expected to have widespread and long-term beneficial impacts on Gateway water resources by addressing the underlying causes of adverse impacts.

Protection and restoration of wetlands throughout the park is expected to provide widespread beneficial impacts because of the water quality functions wetlands perform, including trapping sediment and pollutants and recycling excess nutrients. A more detailed discussion of these impacts is provided in the “Wetlands and Floodplains” section of this chapter.

Continued visitor use could result in erosion of soils, with localized and usually inconsequential impacts on water quality. Specific areas in the Jamaica Bay Unit that would experience such impacts include Plumb Beach, where the dune system is impacted by foot traffic, and Bergen Beach, which would have continuing equestrian use under the no-action alternative. At the Staten Island Unit, access to beaches and dunes at Fort Wadsworth and Miller Field would continue to be unmanaged. Elsewhere in the park, fewer or no adverse impacts would be expected to occur in areas currently managed as designated trails, boardwalks, or restricted access areas.

Cumulative Impacts

Collaborative projects and programs, including water quality monitoring and improvement, shoreline stabilization projects, and wetland restoration, are examples of actions with potential cumulative benefits to water resources.

The water resources at Gateway are connected to the larger Hudson–Raritan Estuary system, which includes Jamaica, Sandy Hook, Raritan, and Upper and Lower New York Bays; the Atlantic Ocean; and freshwater rivers and streams including the Hudson and Raritan Rivers and their tributaries. As such, the analysis of cumulative impacts takes into account the geographic area of the Hudson–Raritan Estuary system, including inputs contributed by the surrounding urbanized watersheds. Cumulative impacts also consider the effects of historical and ongoing land uses in the area surrounding Gateway, as well as the policies and actions of other managing stakeholders in the area, including New York City, the U.S. Army Corps of Engineers (USACE), and the states of New York and New Jersey.

The New Jersey Coastal Plain aquifer system lies beneath the Sandy Hook and Staten Island Units, and the Brooklyn–Queens aquifer system underlies the Jamaica Bay Unit. Gateway provides opportunities for groundwater recharge because of its open spaces, natural habitats, and soils with coarse particles that allow for rapid movement of water into the soil (NRCS et al. 2001), an imperceptible beneficial impact on the region's groundwater resources given the geographic scope of the aquifers and their contributing watersheds.

Adverse impacts on surface waters (including wetlands; see the impacts section for wetlands and floodplains), subaqueous sediments, and water quality in Gateway are the result of numerous regional factors (see the "Wetlands and Floodplains" section in this chapter). Urban development is associated with hardened shorelines, impervious surfaces, and channelized runoff (USACE and PA 2009; NYCDEP 2007). Most natural tributaries, especially at Jamaica Bay and Staten Island, have been filled and diverted for urban development. Most runoff now consists of outflows from water treatment plants, CSOs, and stormwater runoff (USACE and PA 2009).

Dredging of bay sediments to maintain channels for shipping and commerce creates deep pits or channels that act as a sediment sink and alter water flows, including amplifying tidal ranges and decreasing natural flushing rates (USACE and PA 2009; Swanson and Wilson 2008). The average depth of Jamaica Bay has increased from 11 feet (historical) to 16 feet and water volume increased 350 percent from dredging (NYCDEP 1994, as cited in NYCDEP 2007). High tides in Jamaica have risen by 1 to 1.6 feet over the past century, resulting in water levels over saltmarshes that are 56–78 percent greater than the regional sea-level rise (Swanson and Wilson 2008). The hydrological changes in Jamaica Bay from urban development and dredging have resulted in altered sediment transport dynamics and contributed to decreased water quality (USACE and PA 2009). Increased sediment loads and channelized urban runoff result in increased scouring that erodes dunes, saltmarshes, and other coastal habitats (USACE and PA 2009).

Pollution of surface waters can degrade the natural functioning of aquatic and terrestrial ecosystems and diminish the utility of park waters for visitor use and enjoyment (NPS 2006a). Landfill leaching, stormwater runoff, and outflows from wastewater treatment plants and CSOs, including the 240–340 million gallons per day of treated sewage effluent that flow into Jamaica Bay alone, carry chlorine, heavy metals, nutrients, silica, pharmaceuticals, soaps, floating debris, chemicals, pathogens, personal care products, pharmaceuticals, detergents, pesticides, trace organics that have endocrine-disrupting properties, and other contaminants into Gateway's surface waters, especially Jamaica Bay (NPCA 2007a; USACE and PA 2009; NYCDEP 2007; JBWPPAC 2007; Furlong et al. 2010). Contaminants dissolved or suspended in water adhere to organic compounds and settle into sediments, where they persist and are difficult to remove. Many chemicals that taint sediments are readily absorbed into animal fat cells, accumulating to dangerous levels and prompting consumption advisories for some of the region's fish and shellfish species (USACE and PA 2009).

An estimated 36,600 pounds per day of nitrogen are discharged into Jamaica Bay from water pollution control plant (WPCP) outflows, accounting for 95 percent of the nitrogen load (NYCDEP 2007). Excess nutrient loading, a condition known as eutrophication, stimulates the growth of invasive plants, causes phytoplankton and algae blooms (NYCDEP 2007), and is linked to saltmarsh loss through decreased root production and sediment accretion rates and increased soil organic matter decomposition (Rafferty, Castagna, and Adamo 2011). High nutrient loads also contribute to low dissolved oxygen (DO) levels in Jamaica Bay, which occasionally fall below the 5.0 milligrams per liter (mg/L), the threshold specified by state water quality standards for waters suitable for recreation and fishing. The current trend in DO levels is increasing overall (NYCDEP 2007).

Climate change can add to the adverse impacts on water resources at Gateway through mean sea-level rise and possibly from increased duration, intensity, and frequency of storms. Extreme precipitation events linked to climate change will likely exacerbate the problem of overflowing wastewater and sewage systems, which carry most of the pollution to Jamaica Bay and other Gateway surface waters. Poor water quality reduces ecosystem resilience to climate change (Columbia University 2011).

Adverse cumulative impacts are partially offset by collaborative projects and local and regional environmental policy initiatives in which Gateway plays a role. New York City's 10-year economic development plan, called Vision 2020, is accompanied by the New York City Waterfront Action Agenda, which outlines 130 key projects, including several projects in Jamaica Bay to improve water quality and restore degraded wetlands. One project in Jamaica Bay involves the installation of nitrogen-control technologies at wastewater treatment plants, which is expected to reduce the nitrogen load by 50 percent over 10 years. Considering that treatment plant outflows contribute 95 percent of the nitrogen to Jamaica Bay, this project would provide an appreciable benefit to reduce the specific problem of eutrophication in Jamaica Bay. Another project to build combined sewer outflow (CSO) storage facilities will, once completed, retain CSOs until they can be treated instead of allowing them to flow into Jamaica Bay when outflow volume exceeds the capacity of existing treatment plants.

The Jamaica Bay Watershed Protection Plan aims to create and restore saltmarshes in Jamaica Bay, establish natural areas as watershed buffers, upgrade technologies at wastewater treatment plants, and manage runoff from impervious surfaces (NYCDEP 2012). Other opportunities to address pervasive water quality issues are proposed in the Hudson–Raritan Estuary Comprehensive Restoration Plan (USACE and PA 2009). The implementation of these plans could provide widespread beneficial cumulative impacts for Jamaica Bay water quality. To the extent that the NPS is involved as a partner, beneficial impacts from these efforts could be considered part of the no-action alternative.

Conclusion

The no-action alternative would result in substantial widespread beneficial impacts on water quality throughout the park from continued collaboration and input to coordinated research, restoration of wetlands, and minimizing input of pollutants. Because these improvements would affect Jamaica Bay waters and the quality of water important to many of the park natural areas and recreational experiences, all of which are named as fundamental resources of the park, benefits would be significant. An imperceptible benefit to groundwater resources would occur from maintaining open spaces and natural areas that facilitate groundwater recharge to underlying aquifers. Cumulative impacts on water resources are significant and adverse and would include those from channelized runoff and impervious surfaces from the urbanized watershed, degraded water quality from pollution and nutrient loading, dredging and shoreline hardening that contribute to hydrological changes in the bays, and the effects of sea-level rise and possibly increasingly intense storms related to climate change. Collaborative efforts by the park with other agencies to improve water quality in the region, including improved wastewater treatment technologies, more effective stormwater management strategies, and mitigation of coastal erosion, would noticeably offset these adverse impacts.

Common to Both Action Alternatives

Impacts of Alternatives B and C

Under both action alternatives, Gateway would work with partners to increasingly support a cooperative stewardship approach to promote holistic management of federal, state, and city wetland and water resources. In support of this approach, a research institute would be established, tentatively called the JBSRI, which may be located in Gateway. The JBSRI would coordinate and implement specific studies and monitoring programs to improve understanding of the important ecosystem processes in and around Jamaica Bay and presumably work to jointly achieve restoration and rehabilitation goals. The resulting beneficial impacts of more effective public policy and increased scientific understanding would be substantial.

Under the new cooperative stewardship approach, Gateway would work with its partners to develop and fund projects that would enable the park to achieve objectives for water quality and sediment resources in Jamaica Bay as defined in the park's in-depth assessment of current conditions (NPS 2010b). These objectives include improving water quality to support

desired wildlife habitat conditions and visitor recreational opportunities, as well as reducing chemical contamination (in water and sediments) such that less than 1 percent of the aquatic animal species will experience adverse biological effects in response to exposure. Under both action alternatives, protection of natural habitats and wetlands would be improved through restoration projects, invasive species management, and other unspecified measures. Wetlands provide water quality improvement functions by retaining nutrients and pollutants that can be recycled or attenuated by biogeochemical processes through their residence time in the wetland system.

Projects that would help meet these objectives include the following:

- Improving water quality by reducing or eliminating pollution from wastewater treatment plants and CSOs by implementing technologies that remove excess nutrients (especially nitrogen), pharmaceutically active compounds, pathogens, and other contaminants (this would also help reduce long-term accumulation of contaminants in sediments)

- Filling borrow pits to a depth that would improve estuary-wide DO levels, especially where anoxic or hypoxic conditions exist

- Using clean dredged materials to cover and contain contaminated sediments, and removing and treating (remediating) sediments from contamination "hotspots"

The implementation of these projects and others by the JBSRI and its partner agencies could result in substantial improvements in water quality in Jamaica Bay, which could then benefit saltmarsh and other habitats. These wetlands could continue the cycle by providing additional water quality benefits by removing silt, bacteria, or pollutants. As noted previously, a coordinated approach to research and applied restoration has offered substantial beneficial impacts across Jamaica Bay; adding partners and improving joint research and application to restoring water quality in the bay would increase these benefits.

At Floyd Bennett Field, both alternatives would result in the creation of more than 100 acres of wetland, marine, and estuarine habitat. Alternative C calls for more restored wetland area at Floyd Bennett Field and increased protection of natural areas compared to alternative B. Under both alternatives, the new wetlands could offer localized benefits for water quality.

Alternatives B and C would provide more visitor facilities and amenities at Floyd Bennett Field and the Pennsylvania Avenue and Fountain Avenue Parks, as well as at other park sites. The construction of new facilities would involve repurposing existing buildings to the extent possible, or using sites with previously disturbed or artificial soils, including historical dredged fill material and landfill cap material. Localized impacts from construction activities would likely include some stockpiling of soils and runoff during precipitation events, with increases in turbidity and localized short-term adverse impacts on bay water quality. These could be minimized by implementing standard construction best management practices. Dredging sediments to create a complex of freshwater wetlands and saltmarshes associated with the wetlands center and the proposed marina associated with the JBSRI at Floyd Bennett Field would cause short-term localized adverse impacts by increasing suspended sediments during construction.

Visitor use would be expected to increase under both alternatives and could cause localized adverse impacts on water quality from increased turbidity from erosion and increased pollution (e.g., from improperly discarded trash). Localized adverse impacts from increased erosion and pollution could occur where increased camping opportunities are provided at Floyd Bennett Field, Fort Tilden, Fort Wadsworth, Great Kills, and Horseshoe Cove (alternatives B and C), and at Canarsie Pol and Sandy Hook oceanside beach areas (alternative B only). Localized adverse impacts from erosion could also occur where new trails and boardwalks would be established throughout all three units of the park. In areas where visitor use is not currently managed or controlled, such as the dune system at Plumb Beach and the swamp white oak forest at Miller Field, establishing designated trails and restricting access to sensitive environmental areas would reduce erosion caused by visitors, a localized beneficial impact on water resources from reducing a source of turbidity.

Alternative B: Discovering Gateway – NPS Preferred Alternative

Impacts of Alternative B

The degree of development in the coastal flood zone under this alternative would be greater than that under alternative C, and facilities would be more likely to be permanent at park sites like Fort Tilden, Jacob Riis Park, and Sandy Hook. Development is associated with impervious surfaces that accelerate erosion and channel pollutants through runoff, an adverse impact on water resources. Under alternative B, equestrian use at Bergen Beach would be restricted to designated trails to protect natural areas, including wetlands, a localized beneficial impact on water quality from reducing erosion and protecting wetland functions. Camping would be increased at Canarsie Pol and Sandy Hook oceanside beach areas, possibly resulting in localized adverse impacts on water quality from increased erosion and pollution. Other impacts would be as described under "Common to Both Action Alternatives."

Cumulative Impacts

The sources of other impacts (i.e., not part of alternative B) would remain the same as those described under the no-action alternative.

Under alternative B, cooperative stewardship and the establishment of the JBSRI would add appreciably to existing benefits by generating more effective public policy approaches and increased scientific understanding, setting a precedent for future management of natural resources (including water resources) at Gateway and throughout the region. Additional benefits under alternative B from increased creation and restoration of wetlands would add imperceptible benefits to water quality.

Conclusion

Under both action alternatives, Gateway would work with partners to support a cooperative stewardship approach to promote holistic management of federal, state, and city wetland and water resources, protection of natural habitats and wetlands, and shoreline protection

and erosion control projects that would provide widespread beneficial impacts. Because the waters of Jamaica Bay are fundamental resources and this holistic approach would potentially be precedent setting, benefits for the waters of Jamaica Bay would be considered significant. Such benefits would include increased water quality and clarity, improved coastal resiliency, and more natural sediment transport dynamics. These potentially significant benefits would be further enhanced by the creation of 100+ acres of wetlands at Floyd Bennett Field and actions that would be taken under alternative B to control visitor use in unmanaged areas, which would result in widespread improvements in resource conditions. Alternative B would also result in some adverse impacts on water resources from the development of additional visitor facilities and amenities; increased visitor use, including camping and a wider network of trails; and construction activities needed to create wetlands at Floyd Bennett Field. These adverse impacts would be localized, limited in extent, and minimized through site planning and design and the implementation of erosion control measures. Adverse cumulative impacts on water resources from actions outside the park include channelized runoff and impervious surfaces from the urbanized watershed, degraded water quality from pollution and nutrient loading, dredging and shoreline hardening that contribute to hydrological changes in the bays, and the effects of sea-level rise and possibly increasingly intense storms related to climate change. The combination of these cumulative adverse impacts on water resources at the park would be considered significant. Collaborative efforts to improve water quality, restore saltmarshes, control runoff, and mitigate coastal erosion under the JBSRI would contribute scientific understanding to inform effective public policy and natural resource management practices, adding an appreciable beneficial increment to the cumulative adverse impacts. Additional imperceptible benefits under alternatives B and C from increased protection of natural habitats, creation and restoration of wetlands, and implementation of erosion control and shoreline stabilization projects would also occur.

Alternative C: Experiencing Preserved Places

Impacts of Alternative C

A slightly greater degree of natural area protection, a slightly larger area of created and restored wetlands, more removal of impervious surfaces from coastal resiliency projects, and fewer permanent visitor facilities distinguishes alternative C from alternative B. In addition, equestrian use at Bergen Beach would be eliminated or relocated to another area of the park and the existing trails would be removed. These differences between alternatives would not be great enough to alter the outcome of the impacts analysis. Therefore, beneficial and adverse impacts under alternative C would be the same as described under alternative B.

Cumulative Impacts

Cumulative impacts under alternative C would be the same as described under alternative B because the slight differences between alternatives with respect to water resources (i.e., impacts on water quality and sediment contamination) would not be great enough to influence the impacts analysis.

Conclusion

Impact analysis conclusions would be the same as described under alternative B.

Wetlands, Floodplains and Flooding

Wetlands and floodplains are both located in low-lying areas of the park. Floodplains are only periodically covered with water, but wetlands can be submerged most or all of the time. Some wetland habitats in the park (high saltmarsh for example) are only covered at high tide or spring tide.

Although both floodplains and wetlands can provide important habitat, floodplains at the park are primarily coastal habitats whose values are described in the other natural resources sections (such as "Vegetation," "Marine Resources," and "Wildlife") of this GMP/EIS. This analysis focuses on the hazards associated with development in the floodplain and on adverse or beneficial impacts on wetlands as an ecosystem.

Wetlands at Gateway provide open spaces for recreation and opportunities for science education, contribute to outstanding natural beauty and scenic views, and perform a variety of ecosystem services. Wetlands are habitat for fish, wildlife, and unique plants, they protect coastlines by reducing erosion and storing floodwaters, and they improve water quality by removing sediments and contaminants (NRCS et al. 2001). Because up to 95 percent of the region's freshwater and estuarine wetlands have been lost since colonial times, protection of wetland resources at Gateway is a top priority for federal, state, and local stakeholders.

Because up to 95 percent of the region's freshwater and estuarine wetlands have been lost since colonial times, protection of wetland resources at Gateway is a top priority for federal, state, and local stakeholders.

Laws and Policies

NPS *Management Policies* 2006 (NPS 2006a) section 4.6.4 directs parks to manage for the preservation of floodplain values and minimize potentially hazardous conditions associated with flooding. The NPS and all federal agencies are also required to comply with Executive Order 11988, "Floodplain Management," which is geared toward these same floodplain values and increased flood risk. Agencies are to avoid locating facilities in floodplains and the NPS must prepare a statement of findings that documents when it is not practicable to relocate a proposed facility. Non-structural measures to reduce hazards are encouraged.

The "Wetlands" section of the NPS *Management Policies* 2006 (NPS 2006a) includes the following: (1) provide leadership and take action to prevent the destruction, loss, or degradation of wetlands; (2) preserve and enhance the natural and beneficial values of wetlands; and (3) avoid direct and indirect support of new construction in wetlands unless there are no practicable alternatives and the proposed action includes all practicable measures to minimize harm to wetlands. Other legislation and NPS mandates include requirements of Executive Order 11990, "Protection of Wetlands"; the Clean Water Act; the Rivers and Harbors Appropriation Act of 1899; and the procedures described in Director's Order 77-1: *Wetland Protection* (NPS 2002). Specific provisions of the Clean Water Act applicable to wetlands include section 404, which regulates the discharge of dredge or fill material into wetlands, and section 319, which protects wetlands through the establishment

of state and federal programs to identify and mitigate non-point source pollution that impairs the water quality functions of wetlands. Management goals include implementing a "no net loss of wetlands" policy, restoring natural wetland characteristics and functions to the extent practicable, and enhancing natural wetland values through educational, recreational, or scientific purposes (NPS 2006a).

Methods

Impacts on floodplains and wetlands are described qualitatively in this analysis for the most part, although information on the extent of coastal flooding associated with storms and potentially occurring from stronger storms in the face of Hurricane Sandy and climate change is taken from published literature (when available), NPS and National Oceanic and Atmospheric Administration (NOAA) websites, NPS Incident Management Team reports, and in the absence of these sources, from newspapers and magazines. The latter are used primarily to evaluate effects from Hurricane Sandy, because the impacts of this storm have not yet been assessed in the peer-reviewed scientific literature.

Sources of information used to assess impacts on wetlands include Gateway natural resource inventories and assessments and regional watershed planning documents, including the Hudson–Raritan Estuary Comprehensive Restoration Plan (USACE and PA 2009) and the Jamaica Bay Watershed Protection Plan (NYCDEP 2007).

Resource-specific context factors for assessing the impacts of the alternatives on wetlands and floodplains include the following:

- Floodplains are not identified as a fundamental resource or value.

- The vast majority of floodplains at the park are coastal in nature.

- Wetlands are an important component of the natural areas at Breezy Point Tip, Floyd Bennett Field, Great Kills, Jamaica Bay Wildlife Refuge, and Sandy Hook; these natural areas are fundamental Gateway resources.

- Wetlands provide functions and values that protect the quality of other fundamental park resources (e.g., the waters of Jamaica Bay) and values (e.g., nature observation, water-based activities, and direct sensory experience with natural elements).

- Policies and management actions of other local and regional stakeholders (e.g., USACE and New York City) engaged in watershed protection and wetland restoration affect Gateway wetland resources.

- Wetland conditions inside the park are substantially affected by development and alterations outside the park.

Alternative A: No Action

Impacts of Alternative A

Floodplains

Much of the park is low in elevation and coastal, which in combination with the area's complex coastal geometry and bathymetry, shallow continental shelf, and funneling effects of Long Island and the coast of New Jersey for wind and water, means the park is at risk from flooding from strong storm surge. Although coastal flooding from strong storms is most likely and potentially most damaging, flooding and overflow of the marsh and back-bay areas of the park and rivers in the region can add to flooding risk (Colle, Rojowsky, and Buonaiuto 2010).

As demonstrated by Hurricane Sandy (technically a cyclone) in October 2012, storm surge, which is a combination of waves, tides, and the effect of intense wind blowing water such that it piles up along the shore, can result in water that reaches much further inland than under normal tidal conditions. At the park, storm surge was measured at 13 feet at Sandy Hook. The New York City Office of Emergency Management has predicted that hurricane storm surge could be much higher, on the order of 30 feet in some parts of the city (NYCOEM 2013).

Although the frequency of intense storms may be increasing due to climate change (see cumulative impacts), no trend in "regular" storms has been noted in the New York City area (Zhang et al. 2000, as cited in Colle, Rojowsky, and Buonaiuto 2010). Storm surge in the area usually varies from 0.5 to 1 meter, although more severe storms that occur periodically can result in storm surges greater than 1.5 meters. In the no-action alternative, current levels of protection from coastal flooding would continue, and approved projects such as stabilization efforts at Plumb Beach or repair and strengthening of coastal areas using funds to repair damage from Hurricane Sandy would be implemented. These efforts include beach nourishment at several sites along Sandy Hook, at Great Kills Park, and at sites on the Rockaway Peninsula, as well as a sand slurry transfer system from North to South Sandy Hook and from offshore to Plumb Beach. The park also has offshore groins at Fort Tilden and other park sites, a reef of tires offshore of Plumb Beach to slow waves, and a sand dike stabilizing Miller Field. The Plumb Beach project, which would be implemented regardless of which GMP alternative is selected, includes installing groins and a new rock reef to reduce wave speed and energy striking the coast. These actions help in providing sand to park sites or in stabilizing it, which diminishes the effect of strong waves, storm surge, and wind during storms and reduces coastal flooding, particularly if sand develops into foredunes. Continuing these efforts would help in minimizing the flooding damage of most storms, a long-term beneficial effect.

In the Jamaica Bay Wildlife Refuge, a collaborative NPS and New York Department of Environmental Conservation pilot restoration project at Big Egg Marsh and subsequent monitoring from 2003 to 2008 have provided valuable information to ensure success for subsequent restoration efforts at Gateway.

Wetlands

Under the no-action alternative, Gateway would continue managing wetland resources under existing guidance provided by the park's enabling legislation, the existing GMP (NPS 1979d), and other implementation plans. Current fully funded and approved programs to protect and restore wetlands would continue, many under existing partnerships and collaborations. Other wetland management activities would take place as funding allows to meet regulatory requirements or NPS policy goals.

Gateway would continue to collaborate with local, state, and federal officials as needed and work with New York Department of Environmental Conservation to address common management goals concerning wetlands, including saltmarsh restoration projects in Jamaica Bay and the protection of fringe wetlands to improve coastal resiliency.

In the Jamaica Bay Wildlife Refuge, a collaborative NPS and New York Department of Environmental Conservation pilot restoration project at Big Egg Marsh and subsequent monitoring from 2003 to 2008 have provided valuable information to ensure success for subsequent restoration efforts at Gateway (Rafferty, Castagna, and Adamo 2011; NPCA 2007a). Subsequent projects completed under the Hudson–Raritan Estuary Comprehensive Restoration Plan include 125 acres of saltmarsh island restoration at Yellow Bar Hassock, Elders West Marsh Island, and Elders East Marsh Island. Current projects to restore Black Wall and Rulers Bar Islands began in August 2012 (USACE 2012b). The completed restoration projects in Jamaica Bay demonstrated that saltmarsh vegetation can be successfully restored and set a precedent for continued collaborative partnerships for improving environmental conditions in the vicinity of Gateway; however, decades of research and monitoring may be necessary to determine whether functions such as food web support and carbon sequestration will fully develop in the created saltmarshes (Rafferty, Castagna, and Adamo 2011). Research and monitoring may also reveal whether Jamaica Bay saltmarshes will be able to withstand the additional impacts of sea-level rise associated with climate change (Rafferty, Castagna, and Adamo 2011).

The results of the current collaboration with New York City have had and would be expected to continue to have widespread and long-term beneficial impacts on Gateway wetland resources. Other direct beneficial impacts of continuing park management would be localized and include limiting visitor access to protected areas and removing invasive vegetation as availability of staff and funding allow.

Cumulative Impacts

Floodplains

Because of the development in the urban core and surrounding area, the effect of storms is greater than it would be given the topography and natural winds and currents. This exposes more people and property to damage, but also hardens shorelines and prevents the deposition of sand and other sediment, which could build protective foredunes and positively affect the shoreline position and the impact of storm surge.

Climate change, including sea-level rise, will also result in increased coastal flooding. The rate of sea-level rise was around 0.3–0.4 inch per decade before the Industrial Revolution, but in the 20th century averaged 1.2 inches per decade (Horton, Gornitz, and Bowman 2010). From 1932 until 2011, sea-level rise at Sandy Hook averaged 1.54 inches per decade. The 20th century average is predicted to double in the 21st century, with projections of an increase of 2–5 inches during the GMP's 15- to 20-year timeframe (Columbia University 2011). In addition to sea level rise, which the New York City panel on climate change as characterized sea-level rise as "extremely" likely, more frequent and damaging coastal storms are considered "very" likely, and brief, intense rainstorms alternating with droughts as "more likely than not" (New York Academy of Sciences 2010). The combination is expected to result in increases in storm surge and coastal flooding.

For example, the former 10-year flood is expected to occur every 8 years by the 2020s and as often as once every 3 years by the 2050s. The former 100-year flood is expected to occur every 65–80 years in the 2020s, with flood height increasing from its current predicted 8.6 feet to 9 feet. The 500-year flood is expected to occur every 382–450 years by the 2020s and flood heights are expected to increase from 10.7 feet to up to 11.2 feet (Horton, Gornitz, and Bowman 2010). The damage from these flood heights depends on the elevation of the land where they strike and other factors such as the tidal conditions and tidal range.

Although efforts by the park to protect its resources and assets from the effects of coastal flooding would continue to provide noticeable benefits at many park sites under this alternative, the "very likely" increasing strength of storms and sea-level rise are likely to make these benefits imperceptible later in the 21st century.

Wetlands

The wetlands and water resources at Gateway are connected to the larger Hudson–Raritan Estuary system, which includes Jamaica, Sandy Hook, Raritan, and Upper and Lower New York Bays; the Atlantic Ocean; and freshwater rivers and streams, including the Hudson and Raritan Rivers and their tributaries. Because of the connection, the analysis area for cumulative impacts to Gateway wetlands covers this entire system, including inputs contributed by the surrounding watersheds. Cumulative impacts also consider the effects of historic and ongoing land uses in the area surrounding Gateway, as well as the policies and actions of other managing stakeholders in the area including New York City, USACE, and the states of New York and New Jersey.

Adverse impacts on wetlands in this larger area are largely due to the same factors as discussed in detail in the "Water Resources" section of this chapter. Urban development is associated with hardened shorelines, impervious surfaces, and channelized runoff. Dredging of bay sediments to maintain channels for shipping and commerce created deep pits or channels that act as a sediment sink and alter water flows, including amplified tidal ranges and decreased natural flushing rates. In Jamaica Bay, historic dredging or filling and other unknown causes have resulted in the loss of land area in the form of marsh islands at an alarming rate. Even excluding acreage directly affected by dredge and fill, only 876 acres of an original land mass of 2,347 acres of marsh islands in Jamaica Bay remained as of 2003 (NPS

2010b). Filling of saltmarshes and creeks to create Floyd Bennett Field cut off the west end of the bay. Over the years, more of the adjacent saltmarsh was filled by major trash dumps, the John F. Kennedy International Airport, housing, and the artificial upland that became the Jamaica Bay Wildlife Refuge. A conservative estimate of the quantity of sediments dredged from Jamaica Bay is 93 million cubic yards (NPS 2010b). The hydrological changes in Jamaica Bay from urban development and dredging have resulted in altered water volume, flushing time, and sediment transport dynamics and contributed to decreased water quality.

Increased sediment loads and channelized urban runoff result in increased scouring that erodes saltmarsh sediments. Saltmarsh sediment accretion rates are linked to the amount of root biomass in saltmarsh plants, particularly cordgrass species. Excess nitrogen, 95 percent of which comes from wastewater treatment plant outflows to Jamaica Bay, decreases root production in cordgrass, resulting in reduced sediment accretion rates. Increased nitrogen also increases soil decomposition, further diminishing the capacity of saltmarshes to develop soil and accumulate peat (undecomposed organic matter).

Excess nitrogen and other nutrients fuel algae blooms, which results in increased production of labile carbon. Labile carbon contributed by algae blooms and direct inputs from water treatment plant outflows causes increased sulfate reduction in marsh sediments. Sulfate reduction produces sulfide as a byproduct, which is toxic to cordgrass at high concentrations and can cause stunted growth or mortality. Another threat to native saltmarsh vegetation is nonnative species invasion. *Phragmites* and Japanese knotweed, for example, form dense monocultures in disturbed wetlands, outcompeting the native cordgrass species that are crucial for maintaining saltmarsh ecological functions (JBWPPAC 2007).

As a result of the combination of factors above and as yet unknown reasons scientists are researching now, 526 acres of saltmarsh disappeared from Jamaica Bay over a 20-year period between 1974 and 1994, averaging 26 acres per year. Over the next 5 years (1994 to 1999), marsh loss accelerated to a rate of 44 acres per year, totaling 220 acres (NYDEC n.d.d). Calculations over a broader period estimate an average loss rate of 33 acres per year from 1989 to 2003 (Gateway and JBWPPAC 2007).

Uncertainty remains as to the degree to which climate change factors such as sea-level rise and extreme weather events will contribute to saltmarsh loss (Columbia University 2011). Sediment accretion, a process important to the development and maintenance of saltmarshes, can be reduced by higher sea levels and more intense storms that accelerate erosion. Sea-level rise and changing tidal cycles also cause changes in water levels and salinity that influence vegetation composition, reducing the sediment accretion rate in such altered ecosystems (Columbia University 2011).

Sea-level rise adds to the effect of amplified tidal cycles in Jamaica Bay, which has been linked to dredging, shoreline development, and other engineering modifications of the bay. The resulting excess inundation has degraded or destroyed saltmarshes and other low-elevation coastal habitats (Swanson and Wilson 2008). However, saltmarsh loss rates are much lower in areas adjacent to Jamaica Bay (i.e., Hempstead Bay, Great South Bay,

and Moriches Bay) where the magnitude of sea-level rise is similar, but tidal cycles have not been affected to the same degree and there is less urban development (Swanson and Wilson 2008). This suggests that the cumulative effects of human alterations to the bay and surrounding watershed are more important factors in saltmarsh loss than the relative contribution of mean sea-level rise.

These substantial adverse cumulative impacts are partially offset by the collaborative restoration projects between NPS and other agencies, primarily New York City, described as part of the no-action alternative. Additional partnerships and collaborative approaches include the following:

- New York City's 10-year economic development plan, called Vision 2020, accompanied by the New York City Waterfront Action Agenda, which outlines 130 key projects, including several projects in Jamaica Bay to improve water quality and restore degraded wetlands

- Funding for the Hudson–Raritan Estuary Comprehensive Restoration Plan, which identifies opportunities to restore saltmarshes in and around Jamaica and Sandy Hook Bays as well as projects to address pervasive water quality issues that threaten wetlands in the region (USACE and PA 2009)

- The Jamaica Bay Watershed Protection Plan, which aims to create and restore saltmarshes in Jamaica Bay and establish natural areas as buffer areas around the periphery of the bay and watershed (NYCDEP 2012)

Gateway's role in these wider efforts includes making park land available for wetland restoration and research and providing resources for monitoring, actions that are also part of alternatives B and C.

The current management direction and programs implemented as the result of collaborative partnerships are having a noticeable beneficial impact on wetlands. The current rate of saltmarsh loss has slowed to 19 acres per year (Rafferty, Castagna, and Adamo 2011) from its peak of 44 acres per year from 1994 through 1999 (NYDEC 2013b). The contribution of the park actions in restoring saltmarsh through demonstration projects has had a noticeable or even an appreciable beneficial contributing impact to the slowing rate of loss. However, saltmarsh continues to disappear and the current level of effort will not be wholly adequate for maintaining the resource condition of wetlands in Jamaica Bay at Gateway over the long term because of the regional scope and magnitude of adverse effects.

Conclusion

The benefits in reducing the risk of damage from coastal flooding resulting from beach nourishment and other sand stabilizing efforts would continue, particularly if they result in the formation of protective and stable foredunes. These actions would provide localized benefits at many park sites. To the extent that adding sediment offsets impacts on both natural and cultural resources considered fundamental to the park, the benefits could

be considered significant. Although these benefits would be noticeable in offsetting the adverse effects of climate change at many park sites, the possibly increasing strength of storms and sea-level rise would likely make these benefits imperceptible later in the 21st century.

The no-action alternative would result in short-term widespread beneficial improvements in wetland resource conditions throughout the park primarily from coordinated efforts by the park with New York Department of Environmental Conservation to restore marsh habitat in Jamaica Bay. Although wetlands are not called out as a unique or fundamental resource, they are an important component of the Jamaica Bay ecosystem and habitat at Sandy Hook, both of which are named as fundamental resources as natural areas of the park. The impacts of continuing this coordinated effort to help restore saltmarsh and water quality of the bay would therefore likely be considered significant. Actions in alternative A would have a noticeable or even appreciable beneficial effect in offsetting the significant adverse cumulative impacts of regional and global factors (e.g., poor water quality, pollution, altered hydrology and sediment transport dynamics, sea-level rise).

Common to Both Action Alternatives

Impacts of Alternatives B and C

Floodplains

Alternatives B and C both propose to increase visitor and recreational facilities and amenities in the coastal zone, particularly at Floyd Bennett Field, Fort Tilden, and Jacob Riis Park. Both also propose rebuilding facilities in the coastal zone at Sandy Hook and Great Kills Park. Regular storms may not result in flooding of these facilities, but storms of the intensity and strength of Hurricane Sandy would. However, before a final decision is made as to the type and extent of renovating existing facilities or building new amenities, the park would conduct a risk assessment and cost/benefit analysis to determine whether the sites are in the coastal floodplain and therefore subject to damage from flooding. The park would avoid making major investments where hurricane or strong storms could affect those investments. Hurricane Sandy resulted in extensive flooding and damage at Fort Tilden and Jacob Riis Park, and overwashed and eroded protective dunes. Although future storms may differ from Hurricane Sandy, e.g., not come from the same direction, proceed along the same route, or be combined with a high tide, the effects of Hurricane Sandy illustrate the kind of damage a major storm can cause. Besides flooding of facilities, dunes at other park sites where less development is proposed in alternatives B or C, such as at Sandy Hook or Great Kills Park, were also overwashed and eroded. Facilities and infrastructure for beach centers at Sandy Hook were heavily damaged and both alternatives B and C proposed rebuilding these centers to some degree. The marina at Great Kills Park was damaged by Hurricane Sandy, and both alternatives also propose rebuilding it and even increasing recreation options here. Placing or rebuilding these facilities in the coastal zone exposes them to greater risk of damage from coastal flooding, a localized but potentially substantial adverse impact. The site specific cost benefit analysis before implementing either alternative in the coastal zone would reduce this impact.

Both alternatives B and C also propose a suite of dune protection and beach erosion or restoration measures. For example, although risk of erosion and associated increases in damage to the Belt Parkway from flooding threaten Plumb Beach, all alternatives would stabilize this erosion with added groins and an offshore reef. Creating a connection to Jamaica Bay at Floyd Bennett Field and softening the shoreline to help restore saltmarsh vegetation could absorb some bay flooding during a storm, with localized benefits at this park site. Both alternatives include provisions to work with neighboring landowners at Jacob Riis Park and at Great Kills Park to restore sediment transport processes, actions that could result in net positive sediment budgets and benefits in reducing flooding associated with storms. Both alternatives propose protecting dunes in some park sites, such as at Fort Tilden, until monitoring indicates they are fully able to withstand human use impacts. Both alternatives propose the control of beach erosion and maintenance of natural beach and dune habitats at a number of park sites, including Plumb Beach, Bergen Beach, Fort Wadsworth, and Sandy Hook. Both work with partners to restore natural resources along the shoreline and to restore and maintain beach and dune habitat at Miller Field. Each of these could result in substantial localized benefits by lowering the risk of damage from coastal storms through building or maintaining protective foredunes or sand supplies at beaches.

Wetlands

Under both action alternatives, Gateway would work with a wider range of agency, private, non-governmental organization (NGO), and academic partners to support a cooperative stewardship approach to promote holistic management of federal, state, and city wetland and water resources at Jamaica Bay. In support of this approach, a research institute would be established—tentatively called the JBSRI—that could be located in Gateway. The institute would coordinate and implement specific studies and monitoring programs to improve understanding of the important ecosystem processes in and around Jamaica Bay and ensure achievement of restoration goals. The resulting indirect beneficial impacts of more effective public policy and increased scientific understanding establish could be widespread and regionally important for wetlands.

Following the concept of management zoning for park planning, most wetlands would be located in the Natural Zone in both alternative B and C, which prioritizes the preservation of natural resources in Gateway's open, undeveloped areas. Public access would be restricted to the Sensitive Resources Subzone, which includes vulnerable wetlands requiring the highest level of protection, as well as candidate sites for restoration projects and scientific investigations. Some wetlands may be located in other zones, such as the Recreation Zone, but would still be managed in accordance with the park's natural resources protection mandate. Management zoning would provide an indirect beneficial impact by allowing resource managers to prioritize goals and allocate funding to maximize the potential for Gateway wetlands to provide natural, educational, and recreational benefits.

Both action alternatives also include the construction of a wetlands center in the North Forty section of Floyd Bennett Field that would include new visitor facilities and a complex of constructed and restored habitats, including an estimated 14 acres of freshwater marsh and 34 acres of saltmarsh, as well as open marine, estuarine, and freshwater environments

to total over 100 acres (WWT Consulting 2012). The wetlands center would provide an important opportunity for students and visitors to learn about problems facing wetlands as well as stewardship opportunities. This would increase environmental awareness and public support for initiatives to protect wetland habitats and may result in enhancements for them and the ecological functions and values they provide, a potential widespread beneficial impact. The associated wetland creation and restoration projects would provide direct localized benefits to the wetland complex at Floyd Bennett Field. Increasing the quantity of freshwater wetlands would improve habitat diversity. Saltmarsh restoration would improve the fragmented condition of the existing saltmarsh complex and restore degraded functions, improving the resiliency of the tidal wetland ecosystem in the face of climate change and the continued effects of ongoing adverse impacts.

Projects to restore natural sediment transport dynamics or create a positive sediment budget would also assist wetlands because erosion and sediment loss are two additional factors that contribute to saltmarsh loss and degraded wetland conditions.

Both alternatives include unspecified actions that would help to protect fringe wetlands at Bergen Beach and the shorelines around Canarsie Pier and Frank Charles Memorial and Hamilton Beach Parks, with potential substantial localized benefits to wetlands at these small park sites. It is also possible that improvements to these and other park sites where wetlands exist now would bring trampling of vegetation by increased visitors, an adverse impact.

At the Jamaica Bay Wildlife Refuge, West Pond would remain breached and the effects would be monitored. The West Pond breach represents a localized change in conditions with respect to wetlands and surface waters. Instead of retaining a brackish pond, the West Pond site currently mixes freely with the waters of Jamaica Bay. Although rare vegetative communities grow on the edge of East Pond, the primary wetland value of West Pond is for wildlife and is evaluated in that section. Localized benefits from open mixing with the waters of Jamaica Bay likely are currently occurring for saltmarsh vegetation. Because freshwater wetlands are rarer, however, it is likely that more substantial benefits to wetlands would result from studying how to recreate and then restore those supplied by West Pond before the breach, particularly if this is done in a more holistic, baywide approach.

In each alternative, management would also increase efforts to control invasive vegetation in park sites (including Spring Creek, Great Kills Park) where they are an issue. *Phragmites* and Japanese knotweed are of particular concern because of their ability to form dense monocultures in disturbed wetlands, outcompeting the native cordgrass species that are crucial for maintaining and restoring Gateway's disappearing saltmarshes (JBWPPAC 2007). Beneficial impacts would be localized. Addressing invasive species issues would improve the success of protection and restoration efforts by eliminating one of the factors that contributes to degraded wetland resource conditions in the park.

Projects to restore natural sediment transport dynamics or create a positive sediment budget would also assist wetlands because erosion and sediment loss are two additional factors that contribute to saltmarsh loss and degraded wetland conditions. Such projects would be expected to have a widespread beneficial impact on wetlands over the long term as hydrological conditions and sediment accretion improve over time.

Alternative B: Discovering Gateway – NPS Preferred Alternative

Impacts of Alternative B

The degree of development in the coastal flood zone under this alternative would be greater than under alternative C and facilities would be more likely to be permanent at park sites like Fort Tilden, Jacob Riis Park, and Sandy Hook. This means they would be more susceptible to flooding from coastal storms, an adverse localized impact as described in the "Impacts of the Action Alternatives" section. Because facilities would be less movable than under alternative C, impacts from the risk of damage in the coastal zone would potentially be worse under alternative B. In addition, the application of findings from a cost/benefit analysis before making investments in facilities or amenities in the coastal flood plain would help in avoid storm or flood-related damage under either alternative.

Both action alternatives would attempt to control beach erosion and maintain natural beach habitats at several park sites. Although the method of protection is not specified, it could include beach nourishment, creating berms, planting dunes, or even the use of groins, sand fences, or other sand capturing methods. The methods may vary between action alternatives, but the specifics are unknown at this time and benefits are assumed to be equal under alternatives B and C.

At the Staten Island and Sandy Hook Units, the current management direction would be followed to maintain wetland resource conditions. In the Jamaica Bay Unit, improving water quality and protecting and restoring natural habitats would be prioritized, and the wetlands center facilities would be developed to maximize visitor experience. Unspecified protection measures with localized beneficial impacts could include invasive species removal, planting native species, and controlling erosion.

The management direction under alternative B would result in numerous projects that would provide local direct beneficial impacts on wetlands by removing or mitigating factors such as erosion and invasive species that degrade wetland functions. At Plumb Beach, access to natural areas would be controlled to protect wetlands and other habitats. Equestrian use at Bergen Beach would be restricted to designated trails to protect natural areas including wetlands. Actions such as removing invasive species and planting native species would have an immediate benefit by restoring natural wetland functions and values. Other benefits would be seen over time, for example, after visitor access and use is controlled at Bergen Beach and the Plumb Beach wetlands naturally recover from the impacts of trampling.

The management direction under alternative B would result in numerous projects that would provide local direct beneficial impacts on wetlands by removing or mitigating factors such as erosion and invasive species that degrade wetland functions.

Cumulative Impacts

Floodplains

The cumulative impacts of outside forces such as urban development and sea-level rise would be the same for alternative B as for the no-action alternative. Development or repair of facilities in the park's coastal zone would add imperceptibly to the cumulative risk of flooding, and efforts to increase sediment budget, build or stabilize dunes, or control erosion and loss along park shorelines could noticeably offset this risk, particularly during

the lifetime of the GMP. The potential increasing strength of storms and sea-level rise would likely make these benefits imperceptible later in the 21st century.

Wetlands

The adverse cumulative impacts of regional and global factors (e.g., poor water quality, pollution, altered hydrology and sediment transport dynamics, and sea-level rise) under alternative B would be the same as described under the no-action alternative. At a localized scale, actions under alternative B would noticeably offset cumulative adverse impacts on wetland resources by maintaining, improving, and creating wetlands. Over the long term, the combination of collaborative stewardship, increased scientific understanding to inform management actions and public policy provided by the JBSRI, and increased opportunity for environmental education and awareness provided by the wetlands center have the potential for appreciable beneficial impacts on wetlands throughout the region. Expected benefits include reduced rate of saltmarsh loss, increased area of created and restored wetlands, improved scientific understanding, and evolving environmental policies that would ameliorate and potentially eliminate the factors contributing to current wetland degradation.

Conclusion

Adding or repairing facilities in the coastal zone at several park sites in both alternatives B and C would expose them to continued risk of damage and loss from coastal flooding. To the extent that these efforts maintain fundamental or otherwise important park assets in an area where they are subject to repeated damage and loss from coastal flooding, they could be considered significant and adverse. Dune protection, beach erosion control, and efforts to create a positive sediment budget at several coastal park sites, particularly to restore natural sand transport processes and build protective foredunes, could have substantial beneficial localized impacts by lowering the risk of damage from coastal flooding. If the buildings or resources that these efforts protect are fundamental or otherwise important to the park, benefits could be considered significant. Conducting a site specific cost-benefit analysis before moving forward with restoring or building new facilities or amenities in a coastal zone and applying the findings could also avoid significant adverse impacts from flooding.

Building partnerships to manage area wetlands holistically could result in significant widespread benefits for wetlands in either action alternative, in part because wetlands are rare and important in the functioning of entire ecosystems like Jamaica Bay, but also because of the precedent-setting nature of a holistic management approach. Zoning areas with wetlands to allow managers to allocate funds and staff to protect or restore them, creating educational and stewardship opportunities at a new wetlands center, and creating both saltmarsh and freshwater wetlands at Floyd Bennett Field could each have substantial and potentially significant localized beneficial impacts on wetlands at the park. Protecting fringe wetlands or removing invasive vegetation from marshes at several smaller park sites could have localized substantial benefits. Because invasive plant species substantially alter hydrology and available habitat, particularly for rare freshwater wetlands, efforts to remove them could have localized significant benefits.

The cumulative impacts on flooding or wetlands from outside forces such as urban development and sea-level rise would be the same under alternative B as under the no-action alternative. Development or repair of facilities in the park's coastal zone would add imperceptibly to the cumulative risk of flooding, and efforts to increase sediment budget, build or stabilize dunes, or control erosion and loss along park shorelines could noticeably offset this risk, particularly during the lifetime of the GMP. The potential increasing strength of storms and sea-level rise would likely make these benefits imperceptible later in the 21st century. Over time, a noticeable beneficial impact on wetland resources at Gateway would be realized through concurrent restoration, collaborative stewardship, and increased scientific understanding of wetlands.

In sum, alternative B would have significant beneficial impacts to wetlands and both significant benefits from reducing flood risk and significant adverse impacts from continuing to build or restore structures in the floodplain, which could be reduced by applying findings of cost benefit analysis. The relative contribution to adverse cumulative impacts would be imperceptible; the contribution to beneficial cumulative impacts would be noticeable in the short term but less perceptible as the effects of climate change increase later in the 21st century.

Alternative C: Experiencing Preserved Places

Impacts of Alternative C

Floodplains

Alternative C proposes less development in the coastal areas of park sites than alternative B, and at Jacob Riis Park, Fort Tilden, and Sandy Hook, would require facilities and support infrastructure to be portable. This change could result in a substantially lower risk of damage from localized coastal flooding than under alternative B; however, locating or relocating any visitor-related facilities in the coastal zone could result in substantial adverse impacts from flooding. Applying the findings of cost/benefit analysis before deciding on the type and extent of these amenities could reduce the impact. This alternative would also increase efforts to restore coastal habitat at Sandy Hook, including dune habitat, and would seek to provide more intensive coastal habitat enhancements at Plumb Beach and Bergen Beach. To the extent that these efforts increase foredune stability or sediment supply, they would have localized benefits compared to other alternatives.

Wetlands

Alternative C would provide the highest levels of preservation and restoration of natural habitats, including wetlands. Beneficial impacts on wetland resources at Gateway would be similar to those under alternative B but greater in magnitude and more widespread because zoning under alternative C would call for the greatest proportion of wetlands in the Sensitive Resources Subzone. Management prescriptions in this subzone include restricting public access to restoration sites, research areas, and protected areas.

In the Jamaica Bay Unit, additional localized beneficial impacts from creating a larger saltmarsh and freshwater wetland area at Floyd Bennett Field, as well as more intense restoration efforts at Plumb Beach and Bergen Beach, would occur under alternative C. Equestrian use would be discontinued at Bergen Beach and trails restored, eliminating a source of unwanted nutrients to Jamaica Bay from this park site. These nutrients can contribute to algae blooms and anoxic water conditions. Leaving West Pond breached could improve opportunities for increasing saltmarsh habitat through natural development or restoration projects, a beneficial impact.

Instead of following the current management direction at the Sandy Hook Unit, Gateway would pursue more opportunities to restore wetlands, conduct research and monitoring, control or restrict access to sensitive habitat areas, aggressively control invasive vegetation, and address specific erosion concerns, a potentially substantial benefit for wetlands at this park unit.

Cumulative Impacts

Floodplains

The cumulative impacts of outside forces such as urban development and sea-level rise would be the same under alternative C as under the no-action alternative. The development or repair of facilities in the park's coastal zone would add imperceptibly to the cumulative risk of flooding, and efforts to increase sediment budget, build or stabilize dunes, or control erosion and loss along park shorelines could noticeably offset this risk, particularly during the lifetime of the GMP. The potential increasing strength of storms and sea-level rise would likely make these benefits imperceptible later in the 21st century.

Wetlands

Cumulative impacts of outside forces would be the same as described under alternative B. Local beneficial impacts on wetlands under alternative C would be more widespread throughout the park because of the increased area designated for wetland creation, restoration, and protection throughout all three park units as compared to alternative B. The long-term appreciable offsetting beneficial contribution to cumulative impacts on wetlands from collaborative stewardship, JBSRI, and the wetlands center would be the same as under alternative B.

Conclusion

Adding or repairing facilities in the coastal zone at several park sites in both alternatives B and C would expose them to continued risk of damage and loss from coastal flooding. To the extent that these efforts maintain fundamental or otherwise important park assets in an area where they are subject to repeated damage and loss from coastal flooding, they could be considered significant and adverse. Increasing protection efforts under alternative C and reducing the permanence of developed facilities would lower the risk of damage from flooding, but impacts would still be accurately characterized as adverse and localized,

although less likely to be considered significant. Applying findings of a site specific cost benefit analysis before deciding how to move forward would also reduce the impact of flooding on park investments. Dune protection, beach erosion control, and efforts to create a positive sediment budget at several coastal park sites, particularly to restore natural sand transport processes and build protective foredunes, could have substantial beneficial localized impacts by lowering the risk of damage from coastal flooding. Similarly, if the buildings or resources these efforts protect are fundamental or otherwise important to the park, benefits could be considered significant.

Building partnerships to manage area wetlands holistically could result in significant widespread benefits. Zoning areas with wetlands to allow managers to allocate funds and staff to protect or restore them, creating educational and stewardship opportunities at a new wetlands center, and creating both saltmarsh and freshwater wetlands at Floyd Bennett Field could each have substantial and potentially significant beneficial impacts on wetlands at the park. The benefits from creating these wetlands would be greater under alternative C than under alternative B because of the proposed additional area. Protecting fringe wetlands or removing invasive vegetation from marshes at several smaller park sites could have localized substantial benefits. Adding sand or otherwise creating a positive sediment budget could reduce shoreline erosion and sediment loss from saltmarsh habitats, a beneficial impact. Beneficial impacts on wetlands under alternative C would be more widespread throughout the park than under alternative B because of the increased area designated for wetland creation, restoration, and protection throughout all three park units. Over time, a noticeable beneficial contribution to cumulative impacts on wetland resources at Gateway would be realized through concurrent restoration, collaborative stewardship, and increased scientific understanding of wetlands.

In sum, alternative C would have significant beneficial impacts to wetlands and both significant benefits from reducing flood risk and localized adverse impacts from continuing to place or restore structures in the floodplain. The relative contribution to adverse cumulative impacts would be imperceptible; the contribution to beneficial cumulative impacts would be noticeable in the short term but less perceptible as the effects of climate change increase later in the 21st century.

Marine Resources

For the purposes of this GMP/EIS, marine resources at the park are defined as those in the oceans, onshore in beaches and other intertidal areas, and in foredunes. This section assesses impacts on these systems as a whole, rather than assessing impacts on individual components, which are addressed in other sections of the GMP/EIS such as the “Coastal Processes” section of “Soils and Geology,” “Vegetation,” “Wetlands and Floodplains,” “Wildlife,” “Water Resources,” and “Species of Special Concern.” Water quality of marine resources, particularly of Jamaica Bay, is addressed in the “Water Resources” section of this GMP/EIS. While actions in the GMP/EIS alternatives may affect one of these components in a substantial way, they must affect the entire system of marine resources to be considered significant in this section.

Laws and Policies

Laws that govern resources in the marine environment include the Marine Mammals Protection Act. This law was enacted in 1972, and prohibits the taking of marine mammals or the import, export, or sale of any marine mammal, part, or product in the United States.

The Migratory Bird Treaty Act of 1918 prohibits killing, capturing, buying or selling, or importing or exporting migratory birds, eggs, feathers, or other parts. Harassment or habitat modification resulting in the direct loss of birds, eggs, or nests is also prohibited.

The NOAA–Fisheries is responsible for implementing the U.S. Endangered Species Act for listed marine species. The NPS is required to consult with NOAA–Fisheries if an action it proposes would "take" an individual of a listed marine species. "Take" includes harming, harassing, hunting, trapping, or capturing an individual or even significantly modifying a species' habitat.

The park's enabling legislation allows fishing and shellfishing (460 cc-2(f)), although the current superintendent's compendium closes much of the park managed waters to shellfishing because of concerns over health and safety. As noted above, consumption advisories for some fish and shellfish taken in the New York Bay and adjacent areas are in effect.

Other laws and policies regulate how the NPS manages its vegetation and wildlife, and are discussed in the corresponding sections of the GMP/EIS.

Methods

This is a primarily qualitative analysis of the beneficial or adverse effects on marine resources using NPS and other agency reports and the scientific literature for information. Resource-specific contexts for assessing the impacts of the alternatives on marine resources include the following:

- Beach and dune systems at Bergen Beach, Breezy Point Tip, Great Kills Park, Jacob Riis Park, Fort Tilden, Plumb Beach, and Sandy Hook are considered fundamental resources.

- The region in which the park is located is situated such that it funnels migratory species from both the east to the west and from the south to the north into the New York Bight and New York Bay.

Alternative A: No Action

Impacts of Alternative A

Zoning maps of park sites show the Marine Zone is applied to the waters of Jamaica Bay and to 0.25 mile offshore of most coastal park sites (Miller Field is an exception). The management prescription in this zone is as follows:

- Protect and enhance the ocean and bay environments.
- Provide opportunities for water-based visitor use and recreation.
- Regulate activities to protect elements of the natural environment, prevent visitor conflicts, and enhance public safety.

The degree of visitor use, and the corresponding need for management, is expected to vary seasonally in the marine zone.

Current park management of this zone off ocean coasts is minimal, although interest in the offshore and nearshore environment has recently increased and the park is inventorying benthic (submerged and/or bottom-dwelling) and nektonic (free-swimming) marine life off its shores. This means impacts of current management on these resources are largely unknown, although some shoreline erosion from passing boats, disturbance of coastal wildlife from visitors, and crushing of intertidal vegetation and invertebrates likely does take place at park sites. Because of consumption advisories, shellfishing is not allowed. Fishing is permitted at the park, but data on the impact of recreational fishing to the population is unavailable.

Management of Jamaica Bay is aimed at protection and enhancement of the bay, including restoration of saltmarsh islands and improving water quality. Although a wealth of information exists about Jamaica Bay, new scientific insights are needed to clarify important ecosystem processes and achieve restoration goals. For example, the rate of loss of marsh island habitat is substantially higher than can be attributed to the urban development, water quality degradation, and dredge and fill of the marsh that has historically taken place (see "Wetlands and Floodplains" and "Water Resources" sections for more information). The causes for this disproportionately rapid rate of loss are largely unknown. Currently, the NPS works with other agencies, including the USACE and New York City, to experiment with building the height of some select marsh islands to restore saltmarsh habitat. The park also conducts coordinated research to some extent with its agency, academic, and NGO partners.

In 2010, the park completed an in-depth assessment of current conditions in Jamaica Bay and defined its objectives for each resource (NPS 2010b). These objectives include eliminating or controlling pollution sources, monitoring aquatic and saltmarsh wildlife to determine success of these efforts, softening the shoreline, restoring island saltmarsh habitat, reestablishing aquatic species such as eelgrass, oysters, Atlantic bay scallops and diverse finfish populations. The study was clear that each of these goals was only possible to reach if the park was able to conduct collaborative research, obtain funding, and ensure problem solving between all agency, private business, NGO, and academic partners. This kind of effort is part of both alternatives B and C.

The park historically conducted or currently conducts beach nourishment efforts at several park sites, including at Jacob Riis Park, Great Kills Park, Plumb Beach, and parts of Sandy Hook. It also requires a clean source of sediment to conduct marsh island restoration in Jamaica Bay. The source of sand for some of these efforts is the Ambrose Channel, the main shipping channel from the New York Bight that leads into New York Harbor. An environmental assessment prepared by the USACE (2012a) to evaluate impacts from dredging in this area found the following impacts on marine resources:

- Short-term direct impacts on immobile wildlife and some slower-moving invertebrates, such as shellfish and crustaceans, from crushing and covering with dredged material

- Short-term impacts on fish and mobile wildlife from increased suspension of solids and turbidity, noise, and disturbance

- Possible harm through inadvertent capture of feeding or swimming sea turtles in dredges; short-term loss of food resources for turtles

- Direct loss of eggs or larvae from essential fish habitat fish species or temporary changes in habitat from turbidity, noise, and vibrations

- Possible long-term changes in the bathymetry and hydrodynamics of the seafloor in the dredge area

Each of these impacts was assessed as negligible or minor, and most were short term. In addition to impacts at the borrow site, the deposition of sand at beach sites in the park could have adverse localized impacts to intertidal plants and animals through burial and suffocation. These impacts could be substantial at a specific location.

All alternatives, including the no-action alternative, also include the implementation of an approved project to stabilize erosion at Plumb Beach. An environmental assessment to evaluate the project (USACE 2010) described the proposed action as including beach fill to create a dune and berm. Two groins would be built on the east and west limits of the beach fill to continue renourishment of the beach. A 200-foot rubble mound offshore would act as a reef to slow waves and reduce the speed of longshore transport of sediment placed at the site. Although the source of initial nourishment was not identified, impacts such as those described above for marine resources at the borrow site are likely. Impacts on marine resources under NPS management at the Plumb Beach site were evaluated, and are summarized as follows:

- Benefits to topography by creating a more uniform and less steep slope offshore of Plumb Beach

- Temporary and localized increases in turbidity during construction

- Direct impacts from dredging for slow-moving or immobile marine organisms in the vicinity of the groins or rock reef; long-term benefits from increased habitat stability

- Temporary impacts from turbidity and noise on mobile marine species, including essential fish habitat species; long-term benefits from increasing benthic food supply

- Possible loss of individual horseshoe crabs or habitat during construction, but beneficial impacts from increasing habitat

- Temporary disturbance and possible displacement of birds and small mammals

In addition to the factors identified above, extensive recreational use of Gateway beaches has resulted in disturbance of coastal wildlife, such as nesting birds, and has increased demand for parking, access, and other facilities that could further disturb wildlife or eliminate habitat (USFWS 1997a). Invasive species, including Japanese sand sedge, are rapidly colonizing beaches and dunes, outcompeting and resulting in the loss of native species.

Marine, Beach, and Foredune Habitat at Park Sites

The saltmarsh habitats of Jamaica Bay are also intertidal, but as noted above are discussed in other sections of this GMP/EIS, including "Wetlands and Floodplains."

Description and analysis of impacts, both beneficial and adverse, on coastal sediment budgets under current management are part of the "Soils and Geology" section of the GMP/EIS; description and analysis of the impacts on existing facilities in the coastal zone from storms are contained in the "Wetlands and Floodplains" section.

Intertidal mudflat habitat occurs on islands in Jamaica Bay, at the Jamaica Bay Wildlife Refuge, and to a much lesser degree at Floyd Bennett Field and Great Kills Park. This habitat is important as a feeding ground for shorebirds and for horseshoe crab spawning and feeding. Atlantic ribbed mussels and other shellfish also use intertidal mudflats. Northern Atlantic upper ocean beach is a beach or foredune association sparsely populated with beach grasses and is home to several rare plants such as seabeach knotweed and seabeach amaranth. It also supports nesting by several rare or listed shorebirds, including piping plovers, least terns, common terns, and black skimmers. Although this association is found in many park sites, it is particularly prevalent at Breezy Point Tip and Sandy Hook. These beach areas are often intermingled with or backed by the foredune communities, listed by Edinger et al. (2008b) as northern beachgrass dune, beachgrass/panicgrass dune grassland, overwash dune grassland, and North Atlantic coastal plain vine dune associations. Northern beachgrass dune is relatively common at the park, and is interspersed with patches of overwash dune grassland habitats. Beachgrass/panicgrass dune grassland is rarer, found in the park only at the northernmost end of Sandy Hook (Edinger et al. 2008b). North Atlantic coastal plain vine dune associations are found at Sandy Hook, Fort Tilden, and sections of the Jamaica Bay Wildlife Refuge and islands. Of these communities, the beachgrass/panicgrass dune grassland and North Atlantic coastal plain vine dune are globally imperiled. The remainder are not imperiled, but provide habitat for rare, unique, or listed plants or animals or species of management concern, such as horseshoe crabs.

Jamaica Bay Unit

As noted above, all alternatives include implementation of a sand erosion control project at Plumb Beach. This would provide localized benefits by creating beach habitat and preserving existing mudflats for use by horseshoe crabs. Atlantic ribbed mussels and other shellfish would also be expected to benefit, including from new habitat created by the groins themselves.

Intertidal mudflat habitat occurs on islands in Jamaica Bay, at the Jamaica Bay Wildlife Refuge, and to a much lesser degree at Floyd Bennett Field and Great Kills Park. This habitat is important as a feeding ground for shorebirds and for horseshoe crab spawning and feeding. Atlantic ribbed mussels and other shellfish also use intertidal mudflats.

Continued cooperation with federal, state, and local agencies to limit impacts on habitats in Jamaica Bay may improve conditions for estuarine mudflat habitat in this area if individual restoration projects target this kind of habitat. As noted in the "Wetlands and Floodplains" section of this GMP/EIS, substantial benefits for saltmarsh vegetation have already come from this kind of cooperative effort.

Continuing equestrian use at Bergen Beach would continue to result in the degradation of beach and dune habitat at this park site; the restoration of a portion of Bergen Beach is part of the no-action alternative, with possible localized benefits for these same habitats.

Continuing to mechanically rake and maintain Jacob Riis Park Beach for recreational swimming may to some degree prevent beaches or foredunes from revegetating and stabilizing; if so, this would be an adverse localized impact on vegetation associations and the wildlife that could use them.

Managing the beach and dune system at Fort Tilden as a natural area, including allowing natural coastal processes to dominate, would normally be a beneficial impact for beach and dune habitat. As noted in other sections of the GMP/EIS, the foredune at Fort Tilden was well developed, vegetated with beachgrass and North Atlantic coastal plain vine dune associations (an imperiled vegetative community), and extended along the entire park unit. However, dunes were substantially overwashed and eroded by several feet on the ocean-facing side of Fort Tilden by Hurricane Sandy. This illustrates the substantial localized adverse impacts that coastal processes like cyclones can have on available habitat for marine and foredune vegetation and the wildlife that use these habitats, particularly when human-built groins and jetties diminish sand supply. Although the no-action alternative includes continuing efforts to restore coastal vegetation when funds allow, this may not offset the impact of coastal storms and interrupted sand transport mechanisms.

Staten Island Unit

In the Staten Island Unit, Fort Wadsworth and Miller Field beach and dune habitat would continue to be left unmanaged and Hoffman and Swinburne Islands would continue to be off limits to visitors. Great Kills Park swimming beaches would be managed by raking; the northern shoreline of this park unit would be monitored for erosion. Crooke's Point, at the western end of this park site, would continue to be maintained as a natural area, and the park would partner with New York City to reestablish native species here. Great Kills Park also has dune grassland and mudflat habitat in addition to the beach areas common to all three park sites in this unit. As noted in the discussion of coastal processes, these sites have a history of beach nourishment and deposited fills, and are currently eroded somewhat by longshore transport moving from northeast to southwest, with the exception of Crooke's Point (where sand accumulates). Continuing existing management is likely to result in continued losses of beach and foredune habitat from erosion and in some areas from coastal storm damage. Beneficial impacts on these vegetation associations would be likely at Crooke's Point under this alternative.

Sandy Hook Unit

At Sandy Hook, much of the northern beach and dune systems (including the imperiled beachgrass/panicgrass dune grassland vegetation association, which at Gateway only occurs at this park site) are maintained as a protected area. Coastal vegetation restoration is also ongoing in this area. North Atlantic upper ocean beach interspersed with overwash dune grassland and nearby mudflats and marshes for feeding makes Sandy Hook an ideal location for nesting shorebirds, and several rare or listed species breed here successfully each year. In addition to closing areas or installing protective fences around nests during nesting periods, the park also may transfer sand from a site in the surf zone offshore of the northern accreting areas to the southern/central "critical" zone to maintain habitat for breeding birds and other beach and dune natural resources. The environmental assessment for this sand slurry project (NPS 2004g) indicated the following:

- Some temporary impacts on vegetation and wildlife from the construction of the slurry system

- No long-term impacts on soils or wildlife from the loss of sand from Gunnison Beach, the borrow site (plovers and other shorebirds do not nest in the vicinity of Gunnison Beach)

- Few impacts on benthic marine life because of its location in the surf zone and the use of a mesh screen to filter larger organisms

The areas where plovers or other listed birds nest are largely protected from impacts of human activities during the nesting season. However, other vegetation associations, including beachgrass/panicgrass dune grassland, for example, do occur at locations on Sandy Hook where no nesting takes place and so are not fenced, closed, or otherwise restricted. In addition, all beaches of Sandy Hook are open to visitor use outside the nesting season. The loss of beach habitat from Hurricane Sandy at this park unit indicates its vulnerability, although operation of the sand slurry may provide substantial localized benefits in maintaining existing beach and dune habitat in the critical zone. Maintenance facilities in the north part of Sandy Hook as well as all beach centers along the ocean coast were also damaged.

Cumulative Impacts

A description of cumulative impacts on the marine zone at Gateway is part of the "Marine Resources" section in chapter 3, summarized here for convenience.

The New York Bight is in a heavily urbanized watershed supporting the largest coastal population of people in the United States (USFWS 1997c). Major threats affecting the bight include coastal urbanization, wetland and coastal use modifications, ocean dumping and waste disposal, port development and maintenance, agricultural practices and development, transportation, energy production, marine mineral mining, and cumulative nonpoint sources of pollutants. The ocean area of the New York Bight has traditionally been used for the disposal of waste, including sewage sludge, dredged materials, chemical wastes, and

Coordinated research and management among federal, state, and local agencies at Jamaica Bay have resulted in the partial achievement of some ecosystem and resource restoration objectives, with substantial localized benefits to some saltmarsh and mudflat habitat.

radioactive materials. Organic loading is an emerging problem, as indicated by excessive algae blooms, shifts in algal species composition, high sediment biological oxygen demand at affected sites, and anoxic events in near coastal and estuarine waters (USFWS 1997c).

Urban sprawl and suburbanization have exerted tremendous pressure on the integrity and health of the coastal ecosystem, including those of Raritan Bay and its watersheds, and some of the upland and wetland buffer areas around the shoreline of Jamaica Bay. Intense demand for home sites, resorts, marinas, and commercial development has resulted in the loss of valuable wetland resources through filling, dredging, ditching, diking, and shoreline modification. Increased population intensifies recreational uses of the coastal areas, including the demands for boating facilities and access to the water (USFWS 1997b).

Mining for sand and gravel, as well as exploration and production drilling for oil or minerals of the outer continental shelf, have directly affected marine biota as well as indirectly affecting them through increases in turbidity and spills. Deep borrow pits in areas of minimal flushing can have decreased DO and may become seasonally or permanently anaerobic where mixing does not occur regularly (USFWS 1997b, 1997c).

Climate change could have a dramatic and adverse impact on marine resources at Gateway, particularly through increases in sea level rise, which increases shoreline erosion, saltwater intrusion and estuary inundation. Much of the shoreline at the park is considered highly vulnerable to the impacts of sea level rise (USGS 2005), and inundation of habitats for intertidal species during storms and loss of shore or marsh habitat from incremental sea level rise is likely (Columbia University 2009). Sea level rise can also change fresh or brackish water habitats into ones that are substantially more saline and make them unsuitable for some vegetation or wildlife.

Given the overwhelming nature of adverse cumulative impacts in the marine environment surrounding the park, localized benefits under this alternative would not likely have more than an imperceptible offsetting impact. Adverse effects from this alternative would also add to an imperceptible degree to cumulative adverse impacts.

Conclusion

Coordinated research and management among federal, state, and local agencies at Jamaica Bay have resulted in the partial achievement of some ecosystem and resource restoration objectives, with substantial localized benefits to some saltmarsh and mudflat habitat. Activities in the marine zone of Gateway include borrow sites for sand used in beach nourishment at several park sites, including at Plumb Beach and Sandy Hook (before the sand slurry project began). Although adverse impacts from these borrow activities were noted in the environmental assessments prepared as part of planning for these projects, none have shown the potential for significant adverse effects on marine resources. Similarly, although deposition of sand at the park would bury some marine plants and animals, impacts would be limited. In the longer term, localized benefits to marine wildlife, including mussels and horseshoe crabs, would result from the increased habitat from these beach nourishment or sand stabilization efforts. Other localized benefits to marine life from unspecified erosion control and dune restoration efforts at some park sites would continue;

however, actions like raking (Jacob Riis Park, Great Kills Park) or even managing park sites where sediment transport is interrupted to allow natural coastal processes such as strong storms and flooding to occur without protection (Fort Tilden, Fort Wadsworth) could have localized adverse impacts on marine or beach organisms. Continuing to close portions of the park for nesting birds would help protect these important resources, as would continuing the sand slurry project because this preserves existing plover and tern nesting habitat at Sandy Hook. Benefits would be localized and substantial.

Although components of dune and beach systems may experience substantial benefits, the system itself includes sustainable sediment supplies, intact vegetative communities, protection from human development and disturbance, and healthy, fully functional wildlife species. Many of these components are currently degraded and would not improve under the no-action alternative. Because it is the complete beach and dune "system" that is considered a fundamental resource and evaluated in the "Marine Resources" section in this chapter of the GMP/EIS, benefits are not likely to be considered significant. Both adverse and beneficial impacts resulting from alternative A (no action) would be imperceptible compared to significant adverse cumulative impacts on the marine environment at Gateway.

Common to Both Action Alternatives

Impacts of Alternatives B and C

The marine zone would be unchanged under alternatives B and C compared to alternative A, as would the continuation of sand borrowing from the Ambrose Channel and other locations in New York Bay to nourish beaches. The action alternatives may increase the amount of sand from these borrow areas to help protect coastal areas from strong storms, which as noted above and in other sections of the GMP/EIS can substantially reduce sand volume from beaches and dunes. The impacts of taking sand from offshore to supply park sites at Gateway would be adverse and similar to or slightly worse than those described under the no-action alternative. Both action alternatives include additional ferry or sightseeing by boat through Jamaica Bay. Wakes from these boats could increase shoreline erosion or cause wildlife disturbance. Impacts from wakes are adverse and localized; those to wildlife are discussed in the "Wildlife" and "Species of Special Concern" sections of this chapter of the GMP/EIS.

The action alternatives anticipate a much higher degree of coordination, which for the purposes of analysis it has been assumed would lead to joint funding and problem solving in Jamaica Bay to increase saltmarsh and other important habitats, including the marine mudflats and foredune associations described above. The commitment by the NPS to this increased level of partnering is shown by its participation in and likely hosting of the new JBSRI, a top-tier science research institute focused on urban ecosystem restoration and resiliency in Jamaica Bay. The JBSRI would be a public/private partnership with agencies, academia, foundations, and NGOs that would be encouraged to use Jamaica Bay as a laboratory to assess, research, and improve the ability of ecosystem components to function in the face of climate change and other cumulative impacts. Benefits to marine, intertidal, and coastal habitats from this research could be substantial.

Both action alternatives include several mitigation measures and a set of desired conditions for marine resources that are listed and explained in the "Alternatives" chapter. In addition to the direction of JBSRI to focus on current impacts to marine resources and means to alleviate them, these include preparing a multi-agency marine resource management plan to help evaluate user capacity that allows for healthy marine life and expanding signage, education and outreach to visitors on foot and in boats to protect sensitive marine wildlife, fragile coastlines and the unique ecology of Jamaica Bay. It is the desired condition of the NPS that fin and shellfish communities at the park have a high species richness and sustainable populations of each species as well as a sustainable fishery. Specifically, reestablishing key marine species such as eelgrass and oysters is a priority, as is providing visitors a chance to fish for finfish and shellfish species as indicated in the park's enabling legislation. The desired condition for Gateway waters and sediments is described in Chapter 2 as "free of chemical contaminants, such that less than one percent of the aquatic animal species will experience adverse biological effects…."

Marine, Beach, and Foredune Habitat at Park Sites

Although both action alternatives propose development at certain park sites, the level of development differs. Because development does potentially affect marine, beach, or foredune habitat differently, it is discussed under each alternative.

Efforts to control beach erosion at Plumb Beach would be included in both action alternatives, with similar localized benefits for marine or intertidal wildlife to those described for alternative A. Working to restore natural sand transport processes at Jacob Riis Park and at Great Kills Park could restore an essential component of beach and dune systems, a fundamental resource, at these park sites. Monitoring and protecting dunes at Fort Tilden in the aftermath of Hurricane Sandy to restore sand volume and ensure natural dune vine and beach vegetation returns would provide local benefits to this habitat. Controlling beach erosion and maintaining natural beach and dune habitats at Bergen Beach, Fort Wadsworth, Sandy Hook, and Miller Field could benefit these systems if efforts result in natural dune formations, vegetation, and wildlife using them.

Increasing the protection of habitats at Breezy Point Tip, including for horseshoe crabs, is common to both action alternatives, with potential localized benefits for species of management concern.

Alternative B: Discovering Gateway – NPS Preferred Alternative

Impacts of Alternative B

No changes to larger-scale actions identified under alternative A or actions common to alternatives B and C, such as increased collaboration on research and actions to restore Jamaica Bay habitat or to continue approved or ongoing sand replacement efforts, would occur specific to alternative B.

Marine, Beach, and Foredune Habitat at Park Sites

Actions at Floyd Bennett Field include development of visitor facilities in existing buildings and at other locations, including a wetlands center and enhanced marina area, as well as creating wetlands, saltmarsh, and areas of saline and freshwater habitats. Current estimates (WWT Consulting 2012) are 57 acres of open saline water, 12 of open freshwater, and a combined total of nearly 50 acres of wetlands. This is less than under alternative C, but could still increase habitat for mudflats, beaches, or important dune vegetation and wildlife. If so, localized benefits could be substantial. Improving the marina so that it can be used by visitors could require dredging of soils from Jamaica Bay, a localized adverse impact on marine resources.

Plumb Beach management would be the same as described under the no-action alternative, including the implementation of beach erosion and stabilization measures. Some new visitor amenities are proposed but these would not affect the marine zone. Launching from the shore could have temporary impacts on benthic species or disturb mobile wildlife, a localized adverse impact.

At Bergen Beach, equestrian use would be maintained, with the associated unwanted nutrients and disturbance of marine and beach or foredune habitat similar to under alternative A.

The development of facilities at Jacob Riis Park is unlikely to affect marine systems, because most of this area is already hardened or managed in a relatively unnatural state. Sediment transport is also interrupted at this park site, contributing to a less than natural condition for marine, beach, and foredune resources.

The development planned for Fort Tilden in this alternative would have the potential for substantially changing the natural, undisturbed nature of dunes at the site through camping, trails, and increased use. Some of this use would be more likely to affect terrestrial maritime vegetation such as that covering backdunes, shrublands, grasslands, and forests. Stabilizing Riis Landing buildings and facilities so that they can support increased ferry use could result in increases in turbidity and noise, as well as dredging of marine soils, a short-term adverse effect. However, alternative B would also include working closely with New York City and other landowners to improve conditions here and along the entire coastline of the Rockaway Peninsula to create a holistic beach management plan. To the extent that this includes restoring sand transport processes, natural stabilization of dunes and associated rare vegetation, and protection of these resources from human disturbance to allow widespread use by wildlife, the quality and resiliency of the intertidal and dune ecosystem could dramatically improve.

The presence of beach clubs at Breezy Point Tip could continue an ongoing adverse effect on marine systems by maintaining a human presence and by drawing visitors, actions that may be keeping dune vegetation from growing or wildlife, such as rare and listed shorebirds, from using or nesting in otherwise appropriate habitat.

Planning to improve water quality or habitat conditions to restore marine vegetation or wildlife, or to allow shellfishing may rely on some of this coordinated research, and could provide additional benefits for marine resources.

The reestablishment of the marina at Great Kills Park would require dredging and construction, with increases in turbidity, potential direct loss of benthic species, and noise and vibration that could adversely affect sea turtles, fish, and marine mammals. Human activity associated with the marina would also keep many sensitive wildlife species from establishing here.

As at Plumb Beach, kayak launching and water-based recreation at Miller Field would have localized adverse impacts on marine shorelines, and potentially on vegetation or wildlife habitat.

Alternative B would include increasing camping and water recreation at Horseshoe Cove, an action that could adversely affect some beach or saltmarsh habitat or wildlife using these habitats. Additional and more structured camping facilities, such as cabins or yurts, are proposed for the ocean side of Sandy Hook; cabins would also be included under alternative B in the dunes at Fort Tilden. To the extent that these new facilities would be located in or bring additional visitors to sensitive foredune habitats, such as North Atlantic coastal plain vine dune or beachgrass/panicgrass dune grassland, impacts would be adverse. Rebuilding beach centers at Sandy Hook could have temporary impacts on beach or marine wildlife from noise and disturbance.

Cumulative Impacts

Impacts of outside actions that contribute to cumulative impacts (i.e., those not related to alternative B) on marine resources are the same as described under alternative A. Given the dramatic and overwhelming nature of adverse cumulative impacts in the marine environment surrounding the park, localized adverse effects from this alternative would add to an imperceptible degree to cumulative adverse impacts. However, benefits from increased collaboration at Jamaica Bay and holistic management of the coastline along the Rockaway Peninsula could appreciably improve conditions for marine systems in these locations.

Conclusion

Most of the planned development or use of park sites or increased boating would have adverse localized impacts. Because these actions would not affect entire marine systems, they would not be significant. The potential planned actions at Fort Tilden may not only include camping or other visitor-related facilities in or near dunes, but would potentially also bring more visitors to these sites, with the potential for adverse impacts on sensitive dune vegetation or wildlife. These impacts could be substantial, but monitoring and protection by the NPS would likely keep them from being significant. Substantial localized benefits to mudflat or other intertidal marine systems would come from the increased coordination and application of research to Jamaica Bay common to both action alternatives, and to beach and foredune communities along the Rockaway Peninsula from efforts to holistically manage coastal resources to improve resiliency. Planning to improve water quality or habitat conditions to restore marine vegetation or wildlife, or to allow shellfishing may rely on some of this coordinated research, and could provide additional benefits for marine resources. Because these efforts could improve conditions for entire beach and dune systems, benefits

could be significant and could appreciably offset significant adverse cumulative impacts to marine resources at the park as well.

Alternative C: Experiencing Preserved Places

Impacts of Alternative C

No changes to larger-scale actions identified under alternative A or actions common to both action alternatives, such as increased collaboration on research and actions to restore Jamaica Bay habitat or to continue approved or ongoing sand replacement efforts, would occur specific to alternative C.

Marine, Beach, and Foredune Habitat at Park Sites

Actions at Floyd Bennett Field include a lesser degree development of visitor facilities than under alternative B, including an enhanced marina area and creating wetlands, saltmarsh, and areas of saline and freshwater habitats. Although it is not yet finalized, the number of acres of saline and saltmarsh marine habitat created at Floyd Bennett Field under alternative C would be greater than those reported above for alternative B, with potential substantial localized benefits for marine resources. Improving the marina so that it can be used by visitors could require dredging of soils from Jamaica Bay, a localized adverse impact on marine resources.

The reestablishment of the marina at Great Kills Park would require dredging and construction, with increases in turbidity, potential direct loss of benthic species, and noise and vibration that could adversely affect sea turtles, fish, and marine mammals.

Impacts on marine and intertidal habitat at Plumb Beach would be the same as those under the other alternatives, with potential localized adverse impacts from boat launching.

At Bergen Beach, equestrian use would be discontinued, with potential localized benefits from reduced disturbance and nutrients in the intertidal or dune habitats at this park site.

The development of facilities at Jacob Riis Park is unlikely to affect marine systems, because most of this area is already hardened or managed in a relatively unnatural state. Sediment transport is also interrupted at this park site, contributing to a less than natural condition for marine, beach, and foredune resources.

The development planned for Fort Tilden under this alternative would be substantially less than under alternative B, without cabins, pods, or other structures in the dunes. Impacts would still have the potential to be adverse, however. Stabilizing Riis Landing buildings and facilities could result in increases in turbidity and noise, as well as dredging of marine soils, a short-term adverse effect. However, like alternative B, alternative C would include working closely with New York City and other landowners to improve conditions here and along the entire coastline of the Rockaway Peninsula to create a holistic beach plan. This could dramatically improve the resiliency of intertidal and dune ecosystems by restoring sand transport processes, stabilizing dunes and allowing them to naturally revegetate with rare vegetation associations, and protecting them from human disturbance to encourage wildlife. The benefits of this kind of approach for marine systems at these park sites could be substantial.

The presence of beach clubs at Breezy Point Tip could continue an ongoing adverse effect on marine systems by maintaining a human presence and by drawing visitors, actions that may be keeping dune vegetation from growing or wildlife, such as rare and listed shorebirds, from using or nesting in otherwise appropriate habitat.

The reestablishment of the marina at Great Kills Park would require dredging and construction, with increases in turbidity, potential direct loss of benthic species, and noise and vibration that could adversely affect sea turtles, fish, and marine mammals. Human activity associated with the marina would also keep many sensitive wildlife species from establishing here.

As at Plumb Beach, kayak launching and water-based recreation at Miller Field would have localized adverse impacts on marine shorelines, and potentially on vegetation or wildlife habitat.

Alternative C would include increasing camping and water recreation at Horseshoe Cove, an action that could adversely affect some beach or saltmarsh habitat or wildlife using these habitats. Sandy Hook hosts widespread nesting by several rare or listed shorebirds and is the only location in the park where the rare beachgrass/panicgrass dune grassland vegetation association grows. More intensive beach and dune study and habitat protection at Sandy Hook could therefore have additional localized benefits for these marine and intertidal or dune habitats relative to the other alternatives.

Cumulative Impacts

Impacts of the other actions that contribute to cumulative impacts (i.e., those not related to alternative C) on marine resources are the same as described under alternative A. Given the dramatic and overwhelming nature of adverse cumulative impacts in the marine environment surrounding the park, localized adverse effects from this alternative would add to an imperceptible degree to cumulative adverse impacts. However, benefits from increased collaboration at Jamaica Bay and holistic management of the coastline along the Rockaway Peninsula could appreciably improve conditions for marine systems in these locations.

Conclusion

Most of the planned development or use of park sites or increased boating would have adverse but localized impacts on marine systems; the intensity of these impacts would be less than of those under alternative B and most would not be considered significant. The effect of planned uses at Fort Tilden would likely bring more visitors to these sites, with the potential for impacts on sensitive dune vegetation or wildlife. These impacts could be substantial, but monitoring and protection by the NPS would likely keep them from becoming significant. Localized benefits relative to alternative C from increasing monitoring and protection of dunes at Sandy Hook could be substantial for beach or dune resources. Substantial and potentially significant localized benefits to mudflat or other intertidal marine systems would come from the increased coordination and application of research to Jamaica Bay common to both action alternatives, and to beach and foredune communities from efforts to holistically manage park sites along the Rockaway Peninsula to improve

the resiliency of coastal resources. Planning to improve water quality or habitat conditions to restore marine vegetation or wildlife, or to allow shellfishing may rely on some of this coordinated research, and could provide additional benefits for marine resources. These benefits would could appreciably offset significant adverse cumulative impacts to marine resources at the park as well.

Vegetation

This section focuses to a greater degree on terrestrial maritime vegetation than dune, beach, marine or wetland vegetation. For more information on these other vegetative communities, consult the "Marine Resources" or "Wetlands and Floodplains" sections of this GMP/EIS. Listed plant species are evaluated in the "Species of Special Concern" section.

Laws and Policies

NPS *Management Policies* 2006 (NPS 2006a) instruct parks to maintain all native plant species as part of the natural ecosystems of park units. The natural abundance, diversity, and distribution of native plant populations are to be preserved, and parks are to restore them when they have been extirpated by past human-caused actions (NPS 2006a, section 4.4.1). If a park proposes actions that remove native plants, it must evaluate whether the removal creates a need for population management of the plant community, including factors like natural distribution or whether the habitat is critical for a listed species (NPS 2006a, section 4.4.2.1).

Methods

This analysis uses descriptions of plant communities at the park as included in Edinger et al. (2008b), maps from Edinger et al. (2008b), and natural resource and zoning information provided by Gateway geographic information system (GIS) professionals to determine where natural plant communities (as opposed to human-altered vegetation associations) were located and whether planned development would disturb them. Beneficial impacts were assessed in a similar way—by locating vegetation associations at park sites where habitat would be preserved or protected using these maps and descriptive information. This analysis focused particularly on imperiled vegetation associations.

Resource-specific contexts for assessing the impacts of the alternatives on vegetation include the following:

- The only vegetative community named as a fundamental resource at Gateway is the Sandy Hook maritime forest.

- Because maritime forest is considered fundamental at Sandy Hook, it is also considered important because of its rarity at other park sites where it occurs (Great Kills, Fort Tilden, Floyd Bennett Field, Canarsie Pier, and Jamaica Bay Wildlife Refuge).

- Rare vegetation associations are unique, a consideration when determining whether an impact is likely to be significant according to CEQ criteria summarized at the beginning of this chapter.

Alternative A: No Action

Impacts of Alternative A

Much of the vegetation at the park is human altered in some way. For example, of the 465 identified plant species, 33 to 50 percent are nonnative (Lawrence, Roman, and Frame 2010). Intertidal and subtidal mudflats throughout Jamaica Bay were once covered in eelgrass, but this important vegetative community that has since disappeared. Although the loss of saltmarsh in Jamaica Bay has slowed from its peak during the mid-1990s, it is still disappearing at a rate of 19 acres per year (NYDEC 2013b). Many of the park's upland forest and grassland sites are artificial, and are the result of filling former freshwater wetlands, saltmarsh, and intertidal mudflats. Floyd Bennett Field and Great Kills Park are examples of park sites underlain by mostly or nearly all fill materials, including garbage and urban rubble (see the "Soils and Geology" section in chapter 4 for more information).

Despite this, Gateway is home to nine vegetation associations considered rare in New York and/or New Jersey as well as four considered globally rare (American holly forest is all three) (Edinger et al. 2008b). It also contains important bird habitat for over 300 species, including more than 60 breeding birds (USFWS 1997c), and 35 different vegetation associations mapped by Edinger et al. (2008b).

Jamaica Bay Unit

Plumb Beach

Plumb Beach has beach and dune areas, as well as saltmarsh and upland shrub/forest communities. In addition to use of the beach for sunbathing, inlet fishing, and other activities, hand launching of non-motorized boats or other recreational craft occurs here. The upland vegetation is in poor condition from trampling and the creation of social trails (Rowan 2012), an adverse impact that would continue or worsen in the no-action alternative. Dunes and beach lie primarily along the western end of this park site because of beach nourishment and coastal transport processes. These areas are relatively unvegetated, but are part of important habitat for horseshoe crabs, a park species of management concern. Rowan (2012) also indicated that the dunes may be unvegetated because of heavy foot traffic. Although the potential for additional habitat for coastal vegetation in the eastern and central portions of the site exists, sediment transport has been blocked and altered by building and dredging as described in the "Soils and Geology" section of chapter 3. All alternatives, including no action, include responding to these changes by installing groins and an offshore rock reef to trap sand and slow wave energy and erosion of the central beach, a potential beneficial impact for beach or dune vegetation.

Floyd Bennett Field

Floyd Bennett Field is a mostly manmade conglomerate of dredged fills, fly ash, garbage, and other urban fill. Nonetheless, a wide diversity of vegetation grows here, including successional maritime forest, northern beach heather dune shrubland, northern bayberry dune shrubland, and a host of human-modified associations such as early successional

woodland, northeastern modified successional forest, and northeastern old field. Both successional maritime forest and northern bayberry dune shrubland are vulnerable or imperiled statewide. Although the grassland growing in the center of Floyd Bennett Field is human-modified little bluestem old field, it is important because it is the largest remaining grassland in the New York City area and provides nesting and migratory bird habitat (USFWS 1997b). Under the no-action alternative, vegetation would remain in these associations, although grasslands would continue to undergo succession and transition to shrublands and eventually to forest if they are not maintained through mowing, a practice the park currently uses to keep them as grasslands. Although this may not particularly benefit native plant species, it does continue to have a beneficial impact on wildlife dependent on grasslands. Trails are available in parts of the site, as is camping at the Goldenrod and Tamarack Campground. Ecology Village is an area of Floyd Bennett Field used for environmental education. Much of the site is paved and developed with airplane hangars and other buildings reused for a variety of purposes. Visitors walking through or camping at this park site might trample young vegetation, and existing paved and developed areas would continue to occupy space that could potentially become vegetated, although trails minimize the potential for trampling. An invasive subtype of *Phragmites* (also called common reed) is pervasive along the shore of Dead Horse Bay at this park site, as well as on the west side of the North Forty area. The park does remove *Phragmites* as time and money permit, a localized beneficial impact on native vegetation that would continue under the no-action alternative.

Bergen Beach

This park site is filled saltmarsh and vegetated with some dune and shrubland vegetation, although much of Bergen Beach is infested with *Phragmites*. This park site is primarily used for horseback riding under a concession contract and is characterized by Rowan (2012) as heavily used, as indicated by bare areas of sand and a network of unplanned pathways, several of which are below grade and flooded in wet weather.

Canarsie Pier through Hamilton Beach Park

These park sites lie along the Jamaica Bay shore and include both sides of the pier, Fountain Avenue and Pennsylvania Avenue Parks, Spring Creek, Frank Charles Memorial Park, and Hamilton Beach Park. Although much of this land is filled, it once was tidal freshwater or saltwater marsh. In less saline areas, such as Spring Creek, vegetation is dominated by *Phragmites*. These park sites show evidence of heavy use, with bare areas and a network of social trails. Some spotty but intact saltmarsh remains in the vegetation on either side of Canarsie Pier, Frank Charles Memorial Park, and Hamilton Beach Park. New York City Department of Environmental Protection (NYCDEP) is planting the landfill sites with a mix of grasses, shrubs, and maritime woodland species. Soil depth is limiting for larger trees (NYCDEP 2010).

Jamaica Bay Wildlife Refuge

This park site includes both the filled main area of the refuge, as well as remaining "fast" islands and hassocks in the bay. Vegetation over most of the refuge is saltmarsh and

intertidal mudflats (Edinger et al. 2008b), with some early successional woodland/forest on Canarsie Pol and northern bayberry dune shrubland and North Atlantic coastal plain vine dune vegetation associations at the main area and on Ruffle Bar and Little Egg, for example. Unusual vegetation associations including southern New England red maple seepage swamp, mixed forb marsh, and woolgrass marsh have grown adjacent to the filled near-freshwater (formerly 1–3 parts per thousand [ppt] but now at about 18 ppt since its destruction by Hurricane Sandy and subsequent repair) East Pond at the refuge. Successional maritime forest, a vegetation association considered rare, also grows at the main area of the refuge. Big Egg Island, the site of additional interpretive use under alternative B, is vegetated with saltmarsh and estuarine intertidal mudflat (Edinger et al. 2008b). The islands in the refuge are currently unused by visitors although boat tours are allowed to circle them. Trails currently circle West Pond and lie along both sides of East Pond; Hurricane Sandy caused substantial damage to West Pond, which resulted in breaching of the pond and substantial damage to the trail. Although East Pond was also breached during the hurricane, it has been repaired.

Under the no-action alternative, West Pond would remain breached. As noted in the "Affected Environment" chapter, the refuge was created by filling and excavating island and marsh habitat in the northern portion of Jamaica Bay, including portions of several hassocks and marshy bays. West and East Pond are artificially created habitats maintained by valves. The salinity at West Pond was 4–5 ppt before it was breached; that is, slightly brackish (NRCS et al. 2001). Although East Pond supports some unique vegetative communities, the primary vegetation in or dependent on West Pond has been *Phragmites*-dominated tidal marsh. Allowing West Pond to remain breached would increase the salinity to that of the east end of Jamaica Bay, or between 20 and 26 ppt. This would eliminate habitat for *Phragmites*, which can only withstand salinities up to 18 ppt. It would also potentially recreate shallow tidal saltwater habitat and would likely be recolonized with low and high saltmarsh species such as smooth cordgrass and saltgrass *(Distichlis spicata).* Overall, impacts from leaving West Pond breached would likely be localized and beneficial for vegetation.

In addition to these site-specific actions, alternative A would also continue agency coordination to improve conditions in Jamaica Bay and build marsh island habitat. To date (as described in the "Wetlands and Floodplains" section of the impact analysis), the NPS and New York Department of Environmental Conservation have completed restoration projects at Big Egg Marsh, Yellow Bar Hassock, Elders West Marsh Island, and Elders East Marsh Island and are currently restoring two additional marsh islands. Continuing this restoration effort under the no-action alternative could result in substantial and widespread beneficial impacts for saltmarsh in Jamaica Bay.

Jacob Riis Park

Most of this park site is developed and not vegetated. However, a small area of the northeastern side supports a small patch of dune shrubland. Beach and dunes do exist at Jacob Riis Park, but they are unvegetated. The beach is used for sunbathing and fishing, and inland areas are used for sports activities including baseball, paddle tennis, and a pitch-and-putt miniature golf course.

Fort Tilden

Vegetation at this park site is diverse and includes dune, shrub, field, and forest associations. Rare northern bayberry dune shrubland and northern beach heather dune shrubland and globally imperiled successional maritime forest grow at Fort Tilden. Other human-modified associations include early successional woodland/forest, bluestem old field, and northeastern old field. Hiking trails, generally following roads, exist in the interior of the site, and a food and drink concession (the Silver Gull Beach Club) occupies the west portion of the site. In addition to sunbathing and hiking, visitors also fish at Fort Tilden and can access Manhattan via water taxi docking at Riis Landing on the bay side of this park site. Some of the former Army buildings at Fort Tilden are occupied. Generally, vegetation at this site is characterized as undisturbed and in relatively natural condition (Rowan 2012). Park management includes removal of invasive species and planting of native plants when time and money are available, including in cooperation with New York City as part of its MillionTreesNYC program. These actions would continue under alternative A, with localized benefits to vegetation.

Breezy Point Tip

Between the NPS-managed Breezy Point Tip and Fort Tilden is Breezy Point Co-Op, a privately owned portion of the Rockaway Peninsula. Breezy Point Tip is relatively undeveloped, although two concession-operated beach clubs (Breezy Point and Silver Gull) offer beach equipment storage, food, cabanas, and pool use for members. Off-road permits are offered for beach access to fish during the shorebird nesting off season. Vegetation at Breezy Point Tip includes northern beachgrass dune, overwash dune grassland, and rare northern bayberry dune shrubland, coastal salt pond marsh, and northeastern Atlantic brackish interdunal swale. Visitors sunbathe and surf at this park site. Piping plovers and other rare shorebirds use the dunes at Breezy Point Tip for nesting; these areas are off limits to visitors during nesting season but nonetheless experience multiple violations. Fishing is available along the north shore by permit, including for over-sand vehicle access, during the nonbreeding season. Vegetation is in relatively undisturbed condition (Rowan 2012).

Staten Island Unit

Fort Wadsworth

The majority of this park site is either developed or planted lawns or other nonnative vegetation. Species include tree of heaven and black locust. A beach lies along one shore; the other is vegetated with shrub and successional forest species (Edinger et al. 2008b). Biological controls (goats) are used to keep historic batteries cleared of vegetation. Otherwise, no management of vegetation occurs and the few natural areas are relatively undisturbed.

Hoffman and Swinburne Islands

Hoffman and Swinburne Islands are wooded, but invasive species grow over much of the island; other areas remain open because of former human use. Visitor access is prohibited on both islands.

Miller Field

Although the majority of this park site is planted lawn used for sports, it also includes a rare relict swamp white oak forest and a line of dunes and beach where it faces the ocean. The forest lost its source of water when Moravian Creek was diverted in 1980 into a city storm sewer (Lawrence, Roman, and Frame 2010). Although this dramatically changed soil conditions, young trees indicate the swamp white oak population continues to regenerate. Trails are located in the swamp white oak forest, but off-trail visitor use occurs regularly. The beach is maintained by two groins, a constructed dike, and placement of artificial fill. Some dune and shrub vegetation grows here.

Great Kills Park

Great Kills Park has diverse vegetation, including rare successional maritime forest, North Atlantic Coast backdune grassland and northern tall maritime shrubland, as well as human-modified vegetation associations such as early successional woodland/forest and both little bluestem and northeastern old field areas. Much of Great Kills Park is covered in *Phragmites*-dominated reed/grass tidal marsh. The inland area, including developed spots in the reed/grass tidal marsh, was used for sport fields but is currently closed for radon remediation. Crooke's Point, on the western, accreting spit of Great Kills Park, is vegetated in successional maritime forest, northern tall maritime shrubland, overwash dune grassland, and northern beachgrass dune associations. It is currently managed as a natural area with access permitted along established trails. The NPS and New York City partner to remove invasive species and plant native ones as part of the MillionTreesNYC program. These efforts would continue to result in localized beneficial impacts on native vegetation at Crooke's Point. As described in other sections of the GMP/EIS, a long outfall pipe prevents natural sand transport from moving south along the Staten Island shoreline and nourishing Great Kills Park beach. This may be decreasing habitat for saltmarsh and/or intertidal mudflats at the north end of this park site, an adverse localized impact that would continue under no action.

Sandy Hook Unit

Vegetation at Sandy Hook varies from a wide array of beach and dune associations to grasslands at Fort Hancock to rare woodlands and shrublands in the internal part of this unit. Foredune and beach vegetation (see the "Marine Resources" section in chapter 3 for more information) includes imperiled beachgrass/panicgrass dune grassland and North Atlantic upper ocean beach interspersed with overwash dune grassland and intertidal mudflats. Backdune species include those in the rare Northeastern Atlantic brackish interdunal swale association, and farther inland, rare northern bayberry dune shrubland, successional maritime forest, and both red cedar and holly maritime forests grow. Each of these inland associations is vulnerable or imperiled at the state and/or global level. Saltmarsh, brackish interdunal swale vegetation, and reed/grass tidal marsh (e.g., *Phragmites* wetlands) dominate the bayside coastlines; some rare brackish meadow also grows north of Spermaceti Cove along the coast of Horseshoe Cove. Sandy Hook includes several beaches used for swimming and sunbathing, fishing, surfing, boating, and windsurfing. A campground inland of Horseshoe Cove is available by reservation. Existing structures at Fort Hancock are reused

and/or interpreted, and an adjacent U.S. Coast Guard area vegetated with rare northern bayberry dune shrubland, northern beach heather dune shrubland, and beachgrass/panicgrass dune grassland associations is closed to visitors. Sandy Hook includes several shorebird nesting locations where protection measures, including restricted access, are put in place during the breeding season. Access to the holly forest is also restricted. Invasive species are removed as funding and staff are available. Limiting access and treating invasive species both have localized beneficial impacts on vegetation. The no-action alternative would also include repairing one or more of the three beach centers that sustained damage during Hurricane Sandy. Some temporary impacts on vegetation from the repair would be possible.

Cumulative Impacts

In addition to the usual disturbances associated with human settlement, such as conversion of open land to agricultural, timber, or urban development, there are large tracts composed of dredged soils, garbage, and discarded building materials used to fill low-lying saltmarshes and wetlands to create new land. Floyd Bennett Field, the Jamaica Bay Wildlife Refuge, and Great Kills Park are all examples. Disruption of sand transport and hardening of shorelines has also resulted in erosion and loss of habitat for beach, dune, or bayside vegetation associations, as described in the "Marine Resources" section in this chapter. Although inland forests such as the swamp white oak forest at Miller Field and the American holly forest at Sandy Hook grow on natural soils, the forests themselves have been disturbed by cutting, burning, trampling, and, in the case of the white oak forest, alteration of the drainage pattern. Other areas of the park have been deliberately planted with lawn or nonnative species (Fort Wadsworth, parts of Jamaica Bay Wildlife Refuge). Alteration of the ecosystem, such as at Jamaica Bay, from dredging and polluting of the bay as well as from changes in the depth and hydrology of the entire system, has also affected the saltmarsh vegetation. These effects are described in the "Wetlands and Floodplains" and "Water Resources" sections in this chapter of the GMP/EIS. Development or continued use of existing facilities at several park sites continue the adverse cumulative effect of lost habitat; roads, trails, parking lots, recreational fields, campgrounds, and concessions all contribute to this loss of habitat for what could otherwise be open areas for native vegetation to grow.

In addition to the effects on vegetation at or near park sites, statewide or even global loss of habitat or ecosystem changes related to development or pollutants have resulted in the designation of vegetative communities as vulnerable to extinction or imperiled and in more immediate risk of extirpation. In some cases, such as the American holly forest, Gateway is one of the last remaining known locations for a particular vegetation association. For these communities, impacts across their range have been and continue to be substantial and adverse. Preventing or limiting access to some of the areas where this vegetation grows (Sandy Hook dunes, holly forest) likely has had noticeable localized benefits in maintaining these rare vegetative communities in a relatively undisturbed state. Removing invasive species or allowing visitor use in other locations results in imperceptible beneficial or adverse contributions to cumulative impacts. Coordinating with New York City to plant native species and to restore marsh island vegetation has had and would continue to have a noticeable beneficial effect on saltmarsh.

Finally, predicted increases in sea level rise as well as projected increases in temperature, extreme precipitation and storm intensity could each have cumulative adverse impacts on vegetation. Sea level rise is associated with increased shoreline erosion and loss of intertidal marine or estuarine habitat, as well as with salt water intrusion into ground and surface water. Each of these could change vegetative composition, as could simple increase in inundation of marsh species that are normally only covered during high tides. Ultimately, this can change the range of some species, as can changes in temperature. Invasive species are also known to fare better in changing temperature or other harsh environmental conditions and may outcompete native ones and increasingly threaten them as climate change progresses (Columbia University 2009). More intense storms can alter tidal marsh vegetation and damage freshwater wetlands or maritime forest ecosystems at the park.

Conclusion

Implementing the approved sand stabilization plan at Plumb Beach would have localized benefits for beach and dune vegetation, but upland vegetation would continue to experience adverse effects from trampling.

Jamaica Bay Unit

Implementing the approved sand stabilization plan at Plumb Beach would have localized benefits for beach and dune vegetation, but upland vegetation would continue to experience adverse effects from trampling. Off-trail visitor use at Floyd Bennett Field would continue adverse impacts from trampling, but invasive species control *(Phragmites)* would have benefits for marsh vegetation here, at Dead Horse Bay, and at Bergen Beach. Adverse impacts from disturbance by horses and contamination by manure would continue at Bergen Beach. Heavy use at park sites from Canarsie Pier through Hamilton Beach Park would continue to adversely affect native plant species. Restoration work at the Pennsylvania Avenue and Fountain Avenue Parks would have potential localized benefits for native saltmarsh, shrubland, and maritime forest vegetation. Restricting visitor use at marsh islands in the Jamaica Bay Wildlife Refuge may have widespread beneficial impacts by protecting saltmarsh vegetation from trampling. Allowing the West Pond to remain breached would have localized beneficial impacts on saltmarsh. Localized benefits to vegetation at Fort Tilden would occur from removing invasive species and planting native ones. Current management to minimize visitation and therefore trampling of vegetation at Breezy Point Tip would be beneficial for vegetation, although adverse localized impacts on dune vegetation related to surf clubs and the visitor use of Breezy Point Tip do occur. Continuing to work with the NYDEC to build marsh islands would have widespread benefits for saltmarsh vegetation, as could continued efforts to remove *Phragmites* from wetland areas. Because these wetland areas are rare and important systems, this kind of large-scale improvement could provide significant benefits. Otherwise, impacts on vegetation from ongoing management in this unit are not likely to be significant because they do not affect unique vegetation or vegetation considered a fundamental resource by the park.

Staten Island Unit

Restricting visitor access at Hoffman and Swinburne Islands may have localized beneficial impacts on vegetation by preventing trampling. Groins and a dike to keep beach sand in place at Miller Field may provide localized benefits to coastal vegetation by maintaining habitat. Removing invasives and planting native species at Great Kills Park would have localized beneficial impacts on vegetation here. Managing Crooke's Point as a natural area

would help keep habitat available for vegetation; this is a potential localized beneficial impact. An existing outfall pipe keeps natural sand transport from bring sediment to Great Kills Park beaches, and erosion is having an adverse impact on habitat for mudflat and saltmarsh. Impacts on vegetation from ongoing management in this unit are not likely to be significant because they do not affect unique vegetation or vegetation considered a fundamental resource by the park.

Sandy Hook Unit

Limiting access to the northern dunes at Sandy Hook and to nesting areas for shorebirds may have localized benefits for rare dune and shrub vegetation associations. The same is true for the very rare holly forest. Removing invasive species would have additional beneficial effects, particularly for tidal marsh vegetation. If these removals are widespread, benefits could be significant because freshwater marsh is unique and potentially part of imperiled vegetation associations. Because the holly forest is considered a fundamental resource, its ongoing protection may also provide benefits that are localized but significant. Inconsequential localized adverse effects on surrounding vegetation may occur during the repair of beach centers.

Past land use practices, urban development, dredging and filling, and current pollutants have contributed to altered ecosystems, including the vegetation component, at the park. Development and loss of habitat on a state or global scale have also threatened the viability of several vegetative communities that exist at the park. Current practices of limiting access to some of these areas at Gateway may have had noticeable or even appreciable localized benefits in maintaining these communities. Removing invasive species and overall visitor use would have imperceptible adverse or beneficial impacts compared to cumulative adverse effects on vegetation.

In sum, continuing park management under alternative A would have localized beneficial and adverse impacts on vegetation, with possible significant benefits from restoration efforts at Jamaica Bay. Some park management actions may have had noticeable or even appreciable offsetting effects on the significant adverse cumulative impacts to unique vegetation.

Development and loss of habitat on a state or global scale have also threatened the viability of several vegetative communities that exist at the park. Current practices of limiting access to some of these areas at Gateway may have had noticeable or even appreciable localized benefits in maintaining these communities.

Common to Both Action Alternatives

Impacts of Alternatives B and C

The discussion of impacts at park sites includes relevant zoning proposed in the action alternatives. The most important zones for vegetation are the Natural Zone and a Sensitive Resources Subzone. Natural Zones are open and undeveloped areas managed to preserve natural resources while allowing for the enjoyment of the outdoors and nature. Moderate use is expected at centralized activity areas or points of entry, but visitors and programs are oriented toward appreciation of the natural world. The Sensitive Resources Subzone of the Natural Zone is applied to ensure that resources receive the highest level of protection, scientific investigation, and monitoring. Public access is restricted to minimize impacts, and restoration efforts are focused in these areas.

Jamaica Bay Unit

Plumb Beach

Both action alternatives would zone the interior of this park site as a natural area, although alternative C would go further by applying the Sensitive Resources Subzone to wetlands and shrublands. Beach erosion would be controlled and natural beach and dune habitats would be maintained in both alternatives, and access to some natural areas controlled. Each of these could have localized beneficial impacts on vegetation at the site.

Floyd Bennett Field

Both action alternatives would zone a large area of Floyd Bennett Field known as the North Forty as a natural area, although the alternatives differ in the additional area each would zone as natural. In the North Forty, both alternatives would soften the shoreline and recreate a connection between the land and Jamaica Bay that would ultimately result in saltmarsh and marine associations growing on the site. Both would also construct inland freshwater wetlands and open freshwater areas in the North Forty. Although the acreage of wetlands, saltmarsh, and open water habitat differs between alternatives, both would result in at least 50 acres of wetlands. Given the dramatic loss of saltmarsh and freshwater wetlands in the Jamaica Bay region, as described in other sections of the GMP/EIS, and the designation of Floyd Bennett Field natural area (presumably including its vegetative communities and wildlife) as a fundamental resource of the park, creating 50 acres of functional wetland could result in substantial beneficial impacts on natural vegetation.

Like the no-action alternative, both action alternatives anticipate continuing to manage the grassland in the interior of the park site for wildlife habitat. This would have no impact on vegetation.

Development shared by alternatives B and C includes creating the JBSRI, a multimodal transportation hub, new maintenance areas, increased access, and increased security. Some of these could be new facilities and some would reuse existing historic structures. Those that require new building or increased footprint of existing buildings (if any) would have the potential to result in the removal of native vegetation.

Bergen Beach

Although the action alternatives zone Bergen Beach differently, both do include a large portion of natural area. Controlling erosion and protecting fringe wetlands would have localized benefits to these vegetative communities.

Canarsie Pier through Hamilton Beach Park

Both action alternatives would zone the shoreline east and west of Canarsie Pier as natural. Although recreational use would be increased at Canarsie Pier, it would not affect vegetation along the shoreline east and west of the pier. Both alternatives B and C

would enhance native vegetation, protect wetlands, and improve habitat conditions along the shoreline areas, with localized benefits for vegetative communities, particularly shoreline saltmarsh.

Both alternatives would zone the Pennsylvania Avenue and Fountain Avenue Parks for recreation and community activities and anticipate some level of use of the former landfills to generate power. To the extent that this includes the development of new facilities, trails, and gathering spots and installing solar panels, transmission lines, or other energy-related equipment, existing and potentially newly planted native species may need to be removed, with localized adverse impacts.

Spring Creek, Frank Charles Memorial Park, and Hamilton Beach Park would each be developed to accommodate more visitor use than is currently the case. If development occurs in vacant areas in an already well-used area, impacts on vegetation may be inconsequential. Both action alternatives would also continue invasive species control and improve natural resource conditions at Spring Creek, and both anticipate restoring wetlands and shorelines, including by planting native vegetation at Frank Charles Memorial and Hamilton Beach Parks. This could result in localized beneficial impacts beyond those under no action.

Jamaica Bay Wildlife Refuge

Zoning at this park site for both action alternatives would be a mix primarily of Natural Zone and Sensitive Resources Subzone, although both would leave the northern tip and developed areas as Recreation Zones. Both action alternatives anticipate leaving West Pond breached until a study is completed under a more regional effort to reestablish freshwater wetlands. As noted in the no-action alternative, the immediate impacts of leaving the pond breached would be beneficial, particularly for saltmarsh species. Reestablishing a freshwater wetland that is more typical of those present before dredge and fill operations to create the Jamaica Bay Wildlife Refuge and artificially fill East and West Ponds could have substantial localized benefits for this vegetative community that go beyond those from retaining it as saltmarsh.

In addition to these site-specific actions, both alternatives B and C anticipate a greater commitment to working with agency, academic, NGO, and private partners to improve water quality and hydrologic, vegetation, and wildlife conditions in Jamaica Bay. Although a coordinated effort between the NPS and New York City has already resulted in substantial benefits to saltmarsh vegetation, additional coordinated research, application of results, funding, and decision making could dramatically increase benefits.

Jacob Riis Park

This park site would be zoned as recreation in both action alternatives, with an additional Community Activity Subzone in alternative B and a small natural area in alternative C. Both action alternatives would continue the use of this park site for recreation, including active beach uses, sports and recreation, visitor amenities, etc. However, both alternatives would entail the NPS working with New York City to discuss removing impediments to natural sediment-transport processes along the park sites on the Rockaway barrier spit, an

action that could dramatically improve beach and dune habitat for vegetation associations requiring this habitat should discussions be successful. This is a potentially substantial, more widespread benefit for vegetation.

Fort Tilden

Both alternatives would zone a portion of the central part of this park site as natural, but differ in other ways described below under each alternative. Efforts to restore sand transport at Jacob Riis would also benefit beach and dune vegetation at Fort Tilden, which has been substantially damaged by Hurricane Sandy. Protection of dunes and beaches as they are restored over time from the impacts of visitor use would also be a beneficial and localized impact on vegetation. Both alternatives include some common development at Fort Tilden, such as an improved trail system and trails in the backcountry. Without careful planning, trails could result in the removal of relatively rare backdune or shrubland vegetation and/or increased access to these areas and with it the potential for off-trail use and trampling, a potential adverse and localized impact.

Breezy Point Tip

All alternatives include a commitment to keep Breezy Point Tip in a relatively undeveloped and natural condition. The zoning under alternatives B and C would include a large section of Sensitive Resources Subzone; the shores would be zoned as natural. Recreational activities would not change, and beach club cabanas would be stabilized and used to support recreation. Impacts on vegetation from the use of the beach would not change.

Staten Island Unit

Fort Wadsworth

Actions proposed at this park site that are common to alternatives B and C would not affect native vegetation.

Hoffman and Swinburne Islands

Both action alternatives would zone Hoffman Island as a Sensitive Resources Subzone, but differ in the zoning at Swinburne Island. No actions common to alternatives B and C would affect these park sites.

Miller Field

Both action alternatives would zone most of this park site as Community Activity Subzone, although both also leave the beach area as natural. Both alternatives would improve the trail system in this park site's swamp white oak forest with more clearly delineated trail areas, a localized beneficial impact for this vegetation association. However, they would also add trails, play features, etc. that could bring additional visitors to the site, with the potential for increased off-trail trampling. Because the forest seems to be able to regenerate under

current uses, many of which are off trail, this impact would likely be inconsequential. Both alternatives also include efforts to restore the beach and dune vegetation and minimize trampling by providing a distinct trail onto Miller Field from the beach. This would have localized beneficial impacts for dune vegetation. Both alternatives also anticipate a closer working relationship with adjacent landowners to restore natural sand transport processes. Given that sand is currently trapped by groins and a constructed dike, the degree of impact of restoring natural sand transport on beach or dune habitat for vegetation is unknown, although it would be beneficial for beach and dune species and associations.

Great Kills Park

Both alternatives zone the saltmarsh and coastal area of Great Kills Park largely as natural, although alternative C also applies the Sensitive Resources Subzone here. Both also zone Crooke's Point as natural, with the interior maritime forest at the point as a Sensitive Resources Subzone. Rebuilding the Great Kills Park marina may require the removal of some submerged vegetation, with localized adverse impacts. Both alternatives include discussions with adjacent landowners to attempt restoration of natural sand transport processes. If successful, this action could improve current shoreline conditions along the park site coastline, with localized benefits for saltmarsh and intertidal mudflat vegetation near the existing wastewater outfall, and dune and beach vegetation along the remaining area. All alternatives include continuing the remove invasive and plant native species as described under no action.

Sandy Hook Unit

Zoning over much of Sandy Hook is natural, with interior forests and important rare dune grassland and shrubland vegetation at the north end as a Sensitive Resources Subzone. A shoreline of Spermaceti Cove is also a Sensitive Resources Subzone in both alternatives. Both alternative B and C anticipate consolidating maintenance functions at Sandy Hook. If this involved a new structure, adverse localized impacts on vegetation from excavation and grading and the removal of soils and plants would occur. Both alternatives anticipate expanding camping in the existing youth campground at Sandy Hook. The campground is located in or near maritime successional forest, a rare vegetative community. Some localized adverse impacts are possible, particularly if tent pads or other facilities require the removal of this vegetation.

Alternative B: Discovering Gateway – NPS Preferred Alternative

Impacts of Alternative B

Jamaica Bay Unit

Plumb Beach

Alternative B would zone the coastline of Plumb Beach for recreation and would include orientation, neighborhood connection, and new visitor amenities. Orientation and increased

visibility of a delineated access route could have beneficial impacts on inland vegetation, which is currently trampled with multiple footpaths, although the placement of facilities would have potential localized adverse impacts.

Floyd Bennett Field

Alternative B would include additional space zoned as natural in the central portion of this park site but would include more recreation area surrounding Dead Horse Bay than alternative C. Although both alternatives anticipate additional development at Floyd Bennett Field, including a wetlands center, the center in alternative B would include an education center, trails and boardwalks, outdoor classrooms, observation facilities, interpretive media, and education exhibits. Alternative B would also include a wider range of accommodations at this park site than alternative C, including more tent and recreational vehicle (RV) camping as well as cabins and a possible hotel in an existing historic building. These actions would likely require the removal of at least some vegetation. Although soils are not natural at Floyd Bennett Field, some rare native vegetation associations, including successional maritime forest and northern bayberry dune shrubland, grow here. Careful planning could avoid impacts on these vegetative communities, but loss of natural vegetation, even of more common associations, would still be adverse. In addition, bringing more visitors to Floyd Bennett Field would increase the potential for loss of vegetation from trampling, a localized adverse impact. Alternative B would also include the removal of some paved areas and "greening" of runways, a localized benefit if planted with native species.

Bergen Beach

Alternative B would zone Bergen Beach primarily as natural, with a small Recreation Zone. Limiting horses to existing trails would help reduce impacts on vegetation related to trampling. However, impacts on soils and indirectly on vegetation from manure and increased unwanted nutrients would remain. The staging area for water-based sports could have localized adverse impacts on saltmarsh and the creation of a new trail to provide fishing access could require the removal of a small amount of vegetation.

Canarsie Pier through Hamilton Beach Park

All alternatives would zone and treat Canarsie Pier and surrounding vegetation the same. Alternative B would zone the Pennsylvania Avenue and Fountain Avenue Parks for recreation and community activities, with a variety of visitor amenities including trails, bathrooms, observation platforms and view decks, and a large gathering place. To the extent that this development would require the removal of existing and potentially newly planted native species, it would result in localized adverse impacts.

Alternatives B and C are identical at Frank Charles Memorial and Hamilton Beach Parks. At Spring Creek, no new actions beyond those described in the "Common to Both Action Alternatives" section would occur.

Jamaica Bay Wildlife Refuge

Although both action alternatives would zone this park site the same, alternative B anticipates increasing current nature-based and water-based recreation and a building connection with the JBSRI at Floyd Bennett Field. Neither of these changes in programming would affect vegetation.

Alternative B also anticipates allowing access to select islands in Jamaica Bay, including for backcountry camping at Canarsie Pol and for interpretation at Big Egg. Although vegetation at Canarsie Pol is primarily human-modified woodland, which may be less vulnerable to impacts from trampling, Big Egg is vegetated with saltmarsh and North Atlantic Coast estuarine intertidal mudflat. These latter associations may be more susceptible to degradation from human use, and possible localized adverse impacts from increasing interpretive activities here would be possible.

Jacob Riis Park

Alternative B would result in a number of programming changes that would not change impacts on vegetation. However, removing hard ball courts on one side of the park and making it a more natural area to improve resiliency to coastal storms could have a slight benefit for beach or dune vegetation.

Fort Tilden

In addition to zoning the central portion and bay coast of Fort Tilden as natural, alternative B would create a Recreation Zone area to the west. This area is vegetated in grasslands, dune, and dune shrublands that could be rare because Fort Tilden includes several state or globally vulnerable or imperiled vegetation associations. Alternative B plans new lodging, a variety of camping opportunities, and additional open space areas for visitors. Although coastal processes occur and dunes would be protected from visitor use until they are demonstrably able to tolerate impact, increasing the development and use of the area's backcountry in this Recreation Zone and Natural Zones could have substantial localized impacts on rare maritime dune or shrub vegetative communities. Additional visitation and use of the site would also increase the potential for trampling or loss of soils from erosion, with indirect loss of vegetation as a result. This is particularly true because vegetation at this park site is currently relatively undisturbed. Native vegetation here is in excellent condition, and much of it is rare at the state or global level. Impacts from the loss of native vegetation through development of visitor-related amenities or use could be substantial and adverse, although they would also be small in scale. Careful siting of tent pads, trails, cabins, and other facilities in relatively undeveloped areas and signs, fences, or other means to protect adjacent rare vegetation could mitigate these impacts.

Breezy Point Tip

Impacts on vegetation under alternative B would be the same as described for alternative A, and for actions common to alternatives B and C.

Staten Island Unit

Fort Wadsworth

Several new activities and development of facilities, including community activity areas, lodging, and camping, would be included as part of alternative B. Camping closer to the coast or even on the coast would be possible, because alternative B would zone the shoreline facing New York Bay as a recreation area. This action would have the potential to result in the removal of some natural dune or beach vegetation, a localized adverse impact. Other actions, particularly those that take place in the more developed portions of Fort Wadsworth, would not affect native vegetation.

Hoffman and Swinburne Islands

Alternative B would allow for the possibility of a dock and visitor access to Hoffman Island. Impacts on vegetation from trampling may occur, with inconsequential impacts on native vegetation because much of this island is disturbed.

Miller Field

Impacts are identical for alternatives B and C and are described in the "Common to Both Action Alternatives" section.

Great Kills Park

Alternative B would zone the interior of Great Kills Park as a recreation area, with trails, discovery zones for youth, and potential camping, biking, and hiking. Because this part of the park is already vegetated with nonnative lawns and covered in *Phragmites*, this programming change would be unlikely to have more than inconsequential localized adverse impacts on native vegetation.

Sandy Hook Unit

Alternative B would include less Natural Zone, less Sensitive Resources Subzone, and more of the beach in the central and southern portion used as recreation areas than alternative C. New and expanded trails, boating launch sites, camping facilities, and interpretive programs would be created. Direct connections between Fort Hancock and North Beach would be created and buildings at Fort Hancock would be used for lodging, food, tours, and interpretive programming. A direct connection between Fort Hancock and North Beach would need to be sited carefully to avoid removal of important saltmarsh, shrub, and dune vegetation, but would nonetheless have adverse localized impacts on vegetation from both development of the trail and potential off-trail use and trampling. On the bay side, an area considered part of the Ruins Subzone on the southern end of Horseshoe Cove in alternative C would be zoned as recreation in alternative B. The trail network at Horseshoe Cove would be expanded and new camping areas would be created. Water-based recreation would also be expanded. At the same time, access to sensitive or rare habitats, including some rare vegetation associations, would be controlled, and beach nourishment on the bayside would

take place to slow shoreline erosion. Much of this rezoned area is currently brackish meadow, and careful planning and siting of camping areas and associated facilities would be needed to avoid adverse impacts on this rare vegetation association. Impacts on vegetation from increased development and use would be adverse and localized, and in addition to affecting brackish meadow, could adversely impact other rare vegetation, such as saltmarsh or maritime forests. Beach camping including the use of yurts or cabins would become available in the Recreation Zone. These sites would be located primarily in North Atlantic upper ocean beach habitat, which is home to listed and rare plant and animal species at the park. Very careful planning and the use of exclosures, buffers, and other measures to avoid impacts on these species would be required to avoid substantial impacts on rare vegetation associations or rare plants. Impacts on beach and dune vegetation would also increase from trampling and use, with localized adverse impacts.

Cumulative Impacts

Impacts of outside actions that contribute to cumulative impacts (i.e., those not related to alternative B) on vegetation are the same as described under alternative A. However, alternative B would have the potential for more intensive contributions to adverse cumulative impacts from increased development, such as at Fort Tilden or Sandy Hook, for example. Given the rarity of the potentially affected vegetative communities, these contributions could be noticeable. The same is true of benefits, because alternative B would include the creation of the JBSRI and expanded coordination efforts (which would have the potential for baywide beneficial impacts on saltmarsh vegetation), as well as the creation of saltmarsh and freshwater marsh habitat at Floyd Bennett Field and the potential for freshwater wetlands to be created in a more natural way than West Pond at the Jamaica Bay Wildlife Refuge. In addition, alternative B calls for discussions to restore natural sand transport processes at sites along the Rockaway barrier spit and along the Staten Island shoreline, which could result in substantial and widespread restoration of beach and dune habitat and their accompanying vegetative communities. Over time, these actions would have noticeable and even appreciable beneficial offsetting effects on the cumulative adverse impacts on vegetation that have occurred and continue to occur from sources outside the park.

Conclusion

Alternative B would entail the NPS working with adjacent landowners to remove impediments to natural sediment transport processes at several park sites, an action that could dramatically improve beach and dune habitat for vegetation associations requiring this habitat. This would be a possibly significant benefit for beach and dune systems named as fundamental resources. Controlling beach erosion at Plumb Beach would have potential localized beneficial impacts, as could better delineation of a path through upland vegetation to the beach. Visitor-related amenities and/or accompanying increases in visitor use could have localized adverse impacts on vegetation at Plumb Beach, Bergen Beach, the Pennsylvania Avenue and Fountain Avenue Parks, Floyd Bennett Field, and Fort Tilden. Careful planning to avoid impacts on rare vegetation, particularly at Fort Tilden, would be needed because impacts on rare vegetation associations here could be considered significant without it. Restoring and/or building wetlands at Floyd Bennett Field could have significant

beneficial impacts on vegetation, as could potentially recreating natural freshwater wetlands in the West Pond area at Jamaica Bay Wildlife Refuge, because freshwater wetlands are so rare. Increasing partnering for research and applying findings to jointly restore marsh islands could have widespread and substantial benefits for saltmarsh. Because these resources are fundamental (natural areas of Jamaica Bay Wildlife Refuge, submerged lands of Jamaica Bay), benefits would be considered significant. Efforts to control erosion and protect wetlands at Bergen Beach or Canarsie Pier and efforts to control invasive species and plant native species at several Jamaica Bay Unit park sites would have localized beneficial impacts. Protection from trampling by keeping areas with rare vegetation associations at Breezy Point closed to visitors has had beneficial impacts.

Adverse impacts from increasing coastal camping at Fort Wadsworth, increasing use of Miller Field, or allowing visitors to use Hoffman Island would be localized and minor. Restoring natural sand transport at Great Kills Park could provide localized benefits for dune, beach, or mudflat vegetation. Beneficial impacts from directing visitors away from beach and dune vegetation at Miller Field could occur under both alternatives B and C.

Increased camping and trails at new Sandy Hook bayside sites, trails connecting Fort Hancock and North Beach, and increased water-based recreation on the bay side could result in the removal of and localized adverse effects on rare vegetation, including saltmarsh and brackish meadow. Restricting access to rare forest habitat and controlling bayside shore erosion would have beneficial impacts. Beach camping could remove habitat otherwise available to listed plant (and animal) species and is discussed in more detail in "Species of Special Concern."

Past land use practices, urban development, dredging and filling, and current pollutants have contributed cumulative impacts and altered ecosystems, including the vegetation component, at the park. Development and loss of habitat on a state or global scale have also threatened the viability of several vegetative communities that exist at the park.

In sum, Alternative B would have significant beneficial impacts on park vegetation and localized adverse impacts that would require careful planning to prevent them from becoming significant. Alternative B could contribute noticeable adverse impacts to cumulative significant impacts to vegetation from development in the area, as well as noticeable or appreciable cumulative benefits from saltmarsh restoration and the creation of freshwater wetlands.

Alternative C: Experiencing Preserved Places

Impacts of Alternative C

No changes to larger-scale actions identified under alternative A or actions common to both action alternatives, such as increased collaboration on research and actions to restore Jamaica Bay habitat or to continue approved or ongoing sand replacement efforts, would occur specific to alternative C.

Jamaica Bay Unit

Plumb Beach

Although alternative C would include different development than alternative B, the impacts on vegetation from development would be the same as described for alternative B. Alternative C would include a Sensitive Resources Subzone overlay and designated natural area of part of the eastern portion of Plumb Beach, more intensive natural area restoration, and coastal habitat enhancement. Restricting access to the upland area of this part of Plumb Beach could have substantial localized benefits for shrublands and forest vegetation.

Floyd Bennett Field

Zoning in alternative C would include a large historic area maintained in the center of this park site, as well as increased natural area zoning around Dead Horse Bay. Alternative C would include a lesser degree of development of visitor facilities than alternative B, and a larger created area of saltmarsh and freshwater wetlands. New built visitor facilities would be minimized and would be concentrated in pockets. This would help avoid any rare vegetation associations and likely would result in only inconsequential impacts on native and/or rare vegetative communities. As in alternative B, creating new wetlands, particularly freshwater wetlands and/or high quality saltmarsh, would have substantial beneficial impacts. The building of an anaerobic digester could have localized adverse impacts if it requires a new facility and removal of native vegetation.

Bergen Beach

Zoning at Bergen Beach would be primarily Natural Zone. Equestrian use would be discontinued, with potential localized benefits to vegetation from reduced disturbance and nutrients in the soils of upland vegetation and water around saltmarsh or intertidal beach habitat.

Canarsie Pier through Hamilton Beach Park

All the alternatives would zone and treat Canarsie Pier, Frank Charles Memorial, Hamilton Beach Park, and Spring Creek the same. However, alternative C would include more extensive habitat enhancements in saltmarsh and forested areas, with potential localized benefits. Alternative C would zone the Pennsylvania Avenue and Fountain Avenue Parks for recreation, and visitor amenities would be diminished. Although impacts on vegetation may be less than under alternative B, they would still be localized and adverse.

Jamaica Bay Wildlife Refuge

Minor changes in alternative C from existing conditions, such as expanding the East Pond trail system, would have potential localized adverse impacts on vegetation. Limited and guided boat access to Canarsie Pol and Ruffle Bar could result in trampling of vegetation, with localized impacts, but requiring park guides would keep impacts to a minimum. Similar to alternative B, using the JBSRI to expand partnerships to research and restore habitats in

Jamaica Bay would have the potential for significant benefits to saltmarsh, eelgrass, and other important vegetation. Alternative C also anticipates a more holistic examination of freshwater wetlands in the Jamaica Bay Unit to determine whether and where additional habitat should be created, a potential additional benefit beyond that from studying West Pond in alternative B.

Jacob Riis Park

Zoning of this park site under alternative C would be primarily for recreation, although an area on the eastern border would be zoned as natural. Facility development would be less than under alternative B, with more open space and nature-oriented play and skills areas. Additional "softening" of the area by removing paved or hardened surfaces would occur relative to alternative B. Some benefits to vegetation by making habitat available would be possible.

Fort Tilden

Additional natural area zoning relative to alternative B, including a portion of the natural area zoned to protect sensitive resources, would occur under alternative C. Less development and only low-impact, moveable camping facilities like pods or removable tent pads would be allowed in the backcountry. Some of the dune and upland vegetation associations described as rare would be protected from the impacts of human use by the Sensitive Resources Subzone overlay. Impacts would be adverse and localized, but substantially less severe than under alternative B.

Breezy Point Tip

Impacts and zoning would be nearly the same as described above for other alternatives, except that alternative C would include greater efforts to protect and enhance habitats at Breezy Point Tip. This difference would potentially provide important beneficial impacts for some of the rare vegetation associations at the site, including coastal salt pond marsh and Northeastern Atlantic brackish interdunal swale, because these communities are currently open to investigation by visitors, including those on over-sand vehicles accessing Breezy Point Tip for fishing.

Staten Island Unit

Fort Wadsworth

No coastal camping is proposed in alternative C, and other activities would not affect natural vegetation.

Hoffman and Swinburne Islands

Impacts would be as described for alternative A: vegetation would remain relatively undisturbed by visitors, but is already heavily disturbed from past land use practices.

Miller Field

Impacts would be as described in the section "Common to Both Action Alternatives."

Great Kills Park

Zoning of the interior section of Great Kills Park would be natural under alternative C, and land along the coast and the park's northeast corner would be overlaid with a Sensitive Resources Subzone. The interior, which is currently ball fields and *Phragmites*-dominated marsh, would be left natural with some trails and camping. These changes from current conditions could have a localized adverse impact on vegetation. However, alternative C would also include efforts to restore beach, dune, and upland vegetation beyond the invasive species control and native species planting currently taking place, a localized benefit to vegetation.

Sandy Hook Unit

Alternative C would include a larger area zoned as natural as well as additional Sensitive Resources Subzone overlays compared to alternative B. All of Spermaceti Cove would be zoned for the protection of sensitive resources, and much of the central/southern oceanfront (except for beach areas B, C, and D; see maps of recreational use in chapter 1 for locations) would be zoned as natural. Impacts from development would be the same as described above in the "Common to Both Action Alternatives" section. Under alternative C, efforts to protect beach, dune, saltmarsh, and the holly forest would be increased, a potentially widespread (e.g., across the unit) and important benefit for these vegetative communities.

Cumulative Impacts

Impacts of outside actions that contribute to cumulative impacts (i.e., those not related to alternative C) on vegetation are the same as described under alternative A. Alternative C would contribute localized adverse impacts from some small-scale development at park sites like Fort Tilden or Sandy Hook, but these would be localized and imperceptible relative to cumulative impacts from sources outside the park. Benefits could be more noticeable, because alternative C would include the creation of the JBSRI, which has the potential for baywide beneficial impacts on saltmarsh vegetation, as well as the creation of saltmarsh and freshwater marsh habitat at Floyd Bennett Field and the potential for freshwater wetlands to be studied for all of Jamaica Bay and created where they would be most beneficial. Alternative C calls for discussions to restore natural sand transport processes at sites along the Rockaway barrier spit and along the Staten Island shoreline, which could result in substantial and widespread restoration of beach and dune habitat and their accompanying vegetative communities. It would also include intensive habitat protection of unique vegetative communities at Sandy Hook, Breezy Point Tip, and Fort Tilden. The combination of these actions would have noticeable and even appreciable beneficial offsetting effects on the cumulative adverse impacts on vegetation that have occurred and continue to occur from sources outside the park.

Conclusion

Creating wetlands at Floyd Bennett Field could have significant beneficial impacts on vegetation, as could studying and establishing freshwater wetlands where they are most ecologically appropriate across the Jamaica Bay Unit. Increasing partnering for research and applying findings to jointly restore marsh islands could have widespread and significant benefits for saltmarsh.

Controlling beach erosion at Plumb Beach would have potential localized beneficial impacts, as could restricting access to upland vegetation. Visitor-related amenities and/or accompanying increases in visitor use could have localized adverse impacts on vegetation at Plumb Beach, Bergen Beach, the Pennsylvania Avenue and Fountain Avenue Parks, Floyd Bennett Field, and Fort Tilden, but impacts would be less than those associated with alternative B. Creating wetlands at Floyd Bennett Field could have significant beneficial impacts on vegetation, as could studying and establishing freshwater wetlands where they are most ecologically appropriate across the Jamaica Bay Unit. Increasing partnering for research and applying findings to jointly restore marsh islands could have widespread and significant benefits for saltmarsh. Intensive protection of unique vegetative communities at Sandy Hook, Breezy Point Tip, and Fort Tilden, including restricting visitor access, could maintain these communities in a relatively undisturbed condition, a localized or even widespread benefit. Efforts to control erosion and protect wetlands at Bergen Beach or Canarsie Pier and to control invasive species and plant native species at several Jamaica Bay Unit park sites would have localized beneficial impacts.

Restoring natural sand transport at Great Kills Park could provide localized benefits for dune, beach, or mudflat vegetation. Additional efforts to restore beach, dune, and upland associations under alternative C would result in additional benefits for vegetation at this park site. Beneficial impacts from directing visitors away from beach and dune vegetation at Miller Field could occur under either alternative B or C.

Minor development would have localized adverse effects at Sandy Hook on some vegetation, such as at existing campgrounds. Maintaining existing restrictions and adding protection measures including closures to protect unique vegetative communities would have additional, potentially more widespread benefits for vegetation at this park site.

Past land use practices, urban development, dredging and filling, and current pollutants have contributed cumulative impacts such as altered ecosystems, including of the vegetation component, at the park. Development and loss of habitat on a state or global scale have also threatened the viability of several vegetative communities that exist at the park.

In sum, Alternative C would have significant beneficial impacts on park vegetation and localized adverse impacts that would are less likely than in Alternative B to become significant. Alternative C could contribute imperceptible adverse impacts to cumulative significant impacts to vegetation from development in park sites with rare vegetative communities, as well as noticeable or appreciable cumulative benefits from saltmarsh restoration and the creation of freshwater wetlands.

Wildlife

Laws and Policies

Marine wildlife is regulated by laws and policies described in the “Marine Resources” section in this chapter.

The Migratory Bird Treaty Act of 1918 prohibits killing, capturing, buying or selling, or importing or exporting migratory birds, eggs, feathers, or other parts. Harassment or habitat modification resulting in the direct loss of birds, eggs, or nests is also prohibited.

The NPS *Management Policies* 2006 indicate that parks are to take actions to maintain natural population fluctuations and processes that influence the dynamics of individual animal populations, communities, and migratory animal populations in parks (NPS 2006a, section 4.4.1.1).

Methods

This is a primarily qualitative analysis of the beneficial or adverse effects on wildlife using agency reports, the scientific literature, and information about habitat in each park unit. Because wildlife species are mobile for the most part, the analysis assesses impacts by habitat and types of wildlife in park unit rather than by individual park site. It also focuses on larger issues and differences between alternatives for that reason.

Resource-specific contexts for assessing the impacts of the alternatives on wildlife include the following:

- Wildlife is not separately named as a fundamental resource of the park.

- Because the surrounding area is highly urbanized with little natural habitat remaining, the park represents a high percentage of available habitat for some species.

- Natural areas at Breezy Point Tip, Crooke's Point, Floyd Bennett Field, Great Kills Park, Hoffman and Swinburne Islands, Jamaica Bay Wildlife Refuge, and Sandy Hook are named as fundamental resources.

- The region in which the park is located is situated such that it funnels migratory species both from the east to the west and from the south to the north into the New York Bight and New York Bay, making it a unique area for some wildlife.

Alternative A: No Action

Impacts of Alternative A

Jamaica Bay Unit

Continued visitor use, occupation of reused buildings, and operation of visitor and other facilities in several park sites at the Jamaica Bay Unit disturb wildlife and may displace them from otherwise suitable habitat. This is true of Floyd Bennett Field's developed area, camping and environmental education center, and trails; of visitor use at all beach sites (Plumb, Bergen, Jacob Riis Park, Fort Tilden, and Breezy Point Tip) and local neighborhood park sites (Canarsie Pier through Spring Creek); and of the Jamaica Bay Wildlife Refuge.

Implementing the approved sand stabilization plan at Plumb Beach would increase the extent, stability, and quality of beach and dune habitat, with benefits for horseshoe crabs and other marine or intertidal wildlife. Atlantic ribbed mussels and other shellfish would experience slight benefits from the addition of habitat from new groins installed in this effort. Visitors accessing Plumb Beach and off-trail use at Floyd Bennett Field would result in trampling of shrub and forest vegetation, with impacts on upland invertebrates, small mammals, and upland birds.

Invasive species control *(Phragmites)* would benefit marsh wildlife at Floyd Bennett Field, Dead Horse Bay, and Bergen Beach. Maintenance of the grassland at Floyd Bennett Field through mechanical means (primarily mowing) would continue, with localized benefits for grassland nesting birds, including horned lark, eastern meadowlark, upland sandpiper, savannah sparrow, northern harrier, American kestrel, and common barn owl. Many of these species also depend on Floyd Bennett Field grasslands for overwintering, as do short-eared owls and rough-legged hawks. Historically, the Jamaica Bay and Long Island region was thought to contain some of the largest contiguous grassland habitats east of the Mississippi River (Drennan 1981, as cited in NYCDEP 2007). Although the 140-acre grassland at Floyd Bennett Field is artificially maintained by mowing, it is extremely rare as remaining large grassland habitat in the New York City area. Its unique character and ability to support wildlife that would otherwise not be present in the park in more than an incidental way provides substantial benefits for grassland species.

Restoration work at the Pennsylvania Avenue and Fountain Avenue Parks would have potential localized benefits for native saltmarsh, shrubland, and maritime forest vegetation and the wildlife that use these habitats, including waterbirds, upland small and medium-sized mammals, reptiles, and insects.

Continuing to restrict visitor use at marsh islands at Jamaica Bay Wildlife Refuge may have widespread beneficial impacts by protecting saltmarsh and nesting waterbirds, which are only able to successfully nest on islands and away from predators.

Allowing the West Pond to remain breached would have localized beneficial impacts for saltmarsh bird species. However, freshwater wetlands were once numerous in the watershed, including those at Fresh Creek, Paerdegat Creek, Bergen Creek, and Hassock Creek, supporting a diverse association of macroinvertebrates, fish, and amphibians that attracted larger predatory birds, reptiles, and mammals. Freshwater wetlands are critical habitat for many species of native wildlife, providing breeding grounds for amphibians like salamanders, which can spend one or two years in the water before emerging as an adult, and several species of frogs and toads, including wood frogs *(Rana sylvatica),* northern spring peepers, and Fowler's toads (NYCDPR 2013). The park has reintroduced some of these species, as well as snakes and snapping turtles, to freshwater habitat at Jamaica Bay Wildlife Refuge. Birds, such as red-winged blackbirds *(Agelaius phoeniceus)* and yellow warblers *(Dendroica petechia),* and mammals like muskrats also require freshwater wetland habitat. In addition to housing these native species, freshwater wetlands also provide resting, breeding, and feeding grounds for hundreds of thousands of migrating birds, including for many species of ducks, geese, swans, grebes, herons, ibis, egrets, and loons. Freshwater wetlands in the

Jamaica Bay watershed are now almost completely gone, covering less than 1 percent of the 224,000 acres of New York City area they did historically (USACE and PA 2009). As noted in other areas of this GMP/EIS, the sources of freshwater to Jamaica Bay are heavily polluted, and for the most part consist of wastewater treatment effluent and combined sewer outfalls. Before it was breached, West Pond provided 45 acres of freshwater habitat. Given the scarcity of this habitat in the watershed, a decision to leave it breached will likely mean a substantial adverse localized adverse impact on freshwater wetland-dependent species.

Continuing to work with New York Department of Environmental Conservation to build marsh islands would have potential substantial and widespread benefits for saltmarsh vegetation and the species that depend on it. As explained in the "Wildlife" section in chapter 3, these islands are used by at least 326 species of birds, and provide nesting habitat for colonial nesting waterbirds, including herons, ibis, and egrets, as well as shorebirds like common terns and the only nesting colony of laughing gulls in the state of New York. The islands support populations of aquatic invertebrates including shellfish as well as waterfowl and seabirds. The islands also provide important stopover habitat for migratory shorebirds, which feed in the saltmarsh and on mudflats at low tide, as well as at East and West Ponds and on beaches. Plovers, sanderlings, and sandpipers all use these habitats extensively on their migrations in the fall, as does the state-listed red knot in the spring, a species that depends on horseshoe crab eggs for nutrition during its migration. Well over 250,000 individuals of 32 species of ducks have been recorded in a single year using habitat at Jamaica Bay (USFWS 1997b). The partnership between the NPS and New York Department of Environmental Conservation has already resulted in the creation of over 130 acres of saltmarsh island habitat and would continue to restore additional habitat as funding and staff are available. This is a substantial benefit for wildlife that is also widespread, extending across the bay.

The park has also set several objectives for clean-up of Jamaica Bay that would result in improved water quality and aquatic habitat conditions for fish and other species. Many species of fish in danger of becoming overfished have essential fish habitat located in Jamaica Bay, Sandy Hook Bay or offshore of Staten Island (see the "Wildlife" section of "Affected Environment" for species specific information). In Jamaica Bay, the target of clean-up efforts in the partnership between the park and New York Department of Environmental Conservation in this alternative, whiting, red hake, winter flounder windowplane flounder, black sea bass, summer flounder and several species of sharks lay eggs or mature larvae or juveniles. Improving water quality is a key step in creating and maintaining aquatic habitat for these species. In addition, it would help in facilitating the restoration of key aquatic life including oysters, eelgrass and scallops. The park has conducted numerous surveys, experimentation and planning for restoring these species, which are considered a central part of an ecological web that includes upwards of 150 species of algae, single celled animals, invertebrates, fish and birds and provide protection to marshes and dampen wave energy (NPS 2010b).

Management by the park of Fort Tilden and Breezy Point Tip as relatively undisturbed areas has preserved dune, shrub, forest, and even offshore habitats. Less human use also means wildlife is less likely to be disturbed or displaced by noise or sensitivity to human presence.

Both of these park sites are host to large numbers of migrating raptors during the spring, and grasslands and shrublands at Fort Tilden offer habitat for a number of songbird species. In addition to its use by migrating hawks and owls, Breezy Point Tip also has excellent shorebird habitat, used by multiple sensitive or listed shorebird species as well as waterfowl and upland passerine birds. Breezy Point Tip also provides nesting habitat for terrapins. Maintaining these park sites to preserve natural characteristics is beneficial for wildlife, and it may allow particularly species that are particularly sensitive to human disturbance and therefore rare in the region to occupy habitat at both park sites.

Staten Island Unit

Restricting visitor access at Hoffman and Swinburne Islands is likely to have been highly beneficial for colonial wading birds that nest here, including herons, ibis, and egrets, as well as for harbor seals, which are winter visitors. Recreationists can disrupt foraging, social behavior, feeding animals, and communication and can cause energy losses and reduced nesting success in some species. Birds nesting in dense colonies can be particularly vulnerable to disturbance (Burger et al. 2010). Scientific literature reports that birds alter their behavior by taking flight (flushing), increasing vigilance, and changes in daily activities such as feeding or foraging (Borgmann 2011). When a nesting bird flushes or leaves the nest, it expends energy and leaves eggs or chicks unguarded and vulnerable to predation or the effects of weather. If the adult birds are unable to make up the energetic loss, they can become malnourished and unable to withstand severe weather or eventually to migrate. Nesting success and productivity also are reduced. The distance at which a bird flushes varies by species, time of year, type of approach, reproductive stage, time of day, previous encounters with people, density of human activity, and body condition (Burger et al. 2010). Those that flush when a disturbance, such as a person on foot or in a boat, is farther away are considered more sensitive. This sensitive group includes many of the species that nest or are related to nesting species at Hoffman and Swinburne Islands, as well as marsh islands in Jamaica Bay, such as great egret, snowy egret, great blue heron, and common loon (Borgmann 2011). Harbor seals are also easily disturbed by humans (NPS 2010h).

Other actions in the Staten Island Unit that may affect wildlife include efforts to keep a beach and dune system in place at Miller Field, and efforts at Great Kills Park to control invasive species and plant native species. These actions improve habitat for wildlife, a localized beneficial impact.

Sandy Hook Unit

The bay shoreline of Sandy Hook is mostly vegetated with saltmarsh associations and provides habitat for shellfish, finfish, estuarine and marine invertebrates, and migratory and wintering concentrations of birds, as well as for nesting terrapins. Uplands at Sandy Hook also are used by insects, reptiles, passerine birds, and mammals. Harbor seals also haul out in areas of Sandy Hook. Sandy Hook supports some of the highest concentrations of beach-nesting birds in the entire New York Bight coastal region, including federally listed piping plovers and several other state-listed or rare species of shorebirds, gulls, and wading birds. It is also important as a site for migrating raptors to rest and feed, including at grasslands

in the Fort Hancock area. Ospreys and other birds nest in the trees of maritime forests at Sandy Hook. Current management at this park site includes restricting access to some areas in the northern portion of this unit as well as to the very rare maritime holly forest. These restrictions help maintain the diversity and quantity of wildlife, although use of the area, such as for sunbathing, surfing, fishing, camping, reuse of Fort Hancock buildings, etc., may keep wildlife from occupying additional space or increasing in number.

Cumulative Impacts

Wildlife species in the park are parts of populations that have experienced impacts that may stretch along an entire migration route or be confined to the local area. In the vicinity of the park, impacts on wildlife have included loss of habitat from urban development, contamination of soils and surface waters, invasive species, predation, and human disturbance. Climate change has affected habitat for wildlife, from changing temperature regimes to sea-level rise and related changes in storm surge, groundwater characteristics, and salinity in large embayments such as Jamaica Bay. Impacts from many of these factors are not just historical but ongoing and likely to worsen in the future. Additional adverse cumulative impacts on wildlife habitat are characterized in other sections of this chapter of the GMP/EIS, such as "Wetlands and Floodplains," "Vegetation," and "Marine Resources."

In the vicinity of the park, impacts on wildlife have included loss of habitat from urban development, contamination of soils and surface waters, invasive species, predation, and human disturbance.

Much of the shoreline at Gateway is considered to be highly or very highly vulnerable to flooding and loss from climate change. Simple inundation as the sea level rises could affect low marshland habitat, with indirect impacts on shorebirds, fish, and some reptiles that use this habitat. Storm surge from projected increasingly frequent and/or severe storms associated with climate change could result in drowning of small mammals and other vertebrates in coastal wetlands, including from inundation of the nests of terrapins, plovers, and other beach or foredune nesting species. Inlets or overwash can increase salinity in freshwater habitats that are usually protected by dunes, resulting in the loss of ponds, palustrine wetlands, or other important freshwater habitat that is extremely rare in the park. These changes in habitat quality and changes in climate can also leave open a window for increases in invasive species at the park. For example, mild winters may favor nonnative species such as ticks, mosquitoes, and fire ants over native species adapted for cooler weather. Temperature-related range changes could also result in mistimings between food sources and migrating species and redistribution of species into and away from park habitats (Columbia University 2009).

Beneficial cumulative actions affecting wildlife by improving habitat conditions include multiphased programs to address impacts of wastewater and combined sewer/stormwater flows into Jamaica Bay, landfill closures, and other restoration projects by NYCDEP and other agencies (NYCDEP 2007; USACE and PA 2009).

Implementing alternative A would contribute imperceptible adverse cumulative impacts on wildlife from continued visitor use and other activities that disturb wildlife, such as park operations and maintenance. Restricted visitor access to relatively natural areas at Breezy Point Tip, Sandy Hook, and Fort Tilden contributes noticeable beneficial cumulative impacts for migrating birds, nesting shorebirds, terrapins, and other wildlife species. Working with

NYCDEP to restore marsh island habitats at Jamaica Bay has noticeable beneficial impacts for marsh-dependent species such as nesting colonial wading birds, shorebirds, and gulls. Research conducted under the auspices of the JBSRI would also provide potential noticeable localized benefits by increasing understanding about how to improve the resiliency of wildlife in the face of climate change impacts. Allowing West Pond to remain breached could have noticeable adverse cumulative impacts on freshwater wetland–dependent wildlife.

Conclusion

Visitor use disturbs wildlife, and facilities related to visitor use or park operations may displace wildlife from otherwise available habitat. This is true in most park sites. However, management of large natural areas at other sites, such as Breezy Point Tip, Fort Tilden, and portions of Sandy Hook, minimize disturbance to wildlife and have allowed these locations to become habitat for sensitive species. Both the adverse and beneficial effects from allowing and restricting visitor use may be significant, as wildlife is an important component to these natural areas, named as fundamental park resources.

Park management to stabilize or improve wildlife habitat by invasive species control, beach nourishment, or restricted visitor access at several park sites would result in localized benefits. Maintenance of grasslands at Floyd Bennett Field, Fort Hancock, and Fort Tilden would provide substantial benefits for grassland-nesting birds as well as for migrating raptors. Although the 140-acre grassland at Floyd Bennett Field is artificially maintained by mowing and is not a designated fundamental resource, it is extremely rare as remaining large grassland habitat in the New York City area and is valuable for its ability to support wildlife that would otherwise not be present in the park in more than an incidental way. Benefits may be significant for wildlife because of these factors.

Keeping visitors off marsh islands in Jamaica Bay and Hoffman Island could have substantial and even significant benefits for sensitive species, and in particular for colonial-nesting waterbirds. Keeping West Pond breached may have short-term beneficial impacts on saltmarsh species but substantial or even significant adverse impacts on freshwater wetland–dependent wildlife. Continuing to restore marsh habitat in Jamaica Bay would likely continue to provide substantial and possibly significant benefits for saltmarsh-dependent birds such as nesting waterbirds, ducks, and other waterfowl, as well as migratory shorebirds and fish that depend on Jamaica Bay as a nursery or shellfish that use it as habitat.

Cumulative impacts on wildlife include substantial habitat loss, contamination of soils and surface waters, invasive species, predation, human disturbance, and climate change. Climate change is expected to worsen and adversely affect wildlife by inundation from sea-level rise, destruction of habitat and drowning during coastal storms, and contamination of fresh groundwater and surface water through inlets and overwash. Warmer temperatures are expected to increase the competitive advantages of invasive species, wildlife moving north as temperatures increase, and mistimings between food sources and migrating species. Beneficial impacts from restoration efforts by New York Department of Environmental Conservation and others would offset some of these adverse effects.

Implementing alternative A would contribute imperceptible adverse cumulative impacts on wildlife from human activities and noticeable beneficial effects by continuing to keep several sites in a natural and relatively undisturbed condition. Working with NYCDEP to restore marsh island habitats at Jamaica Bay would have noticeable beneficial impacts for marsh-dependent species such as colonial-nesting wading birds, shorebirds, and gulls. Research conducted under the auspices of the JBSRI would also provide potential noticeable localized benefits by increasing understanding about how to improve the resiliency of wildlife in the face of climate change impacts. Allowing West Pond to remain breached could have imperceptible beneficial impacts on saltmarsh wildlife but noticeable adverse cumulative impacts on freshwater wetland–dependent wildlife.

In sum, Alternative A would result in significant adverse and beneficial impacts, which are likely to have both noticeable adverse and beneficial contributions to significant adverse cumulative impacts that currently affect park wildlife.

Common to Both Action Alternatives

Impacts of Alternatives B and C

Jamaica Bay Unit

Controlling beach erosion at Plumb Beach would have potential localized beneficial impacts on coastal wildlife, including horseshoe crabs, as would better delineation of a path through upland vegetation to the beach. Currently, visitors access the beach through this upland vegetation, and defining a clear path would minimize disturbance to upland birds and small mammals. Increasing visitor-related amenities and/or the accompanying rise in visitor use could have localized adverse impacts from disturbance at Plumb Beach, Bergen Beach, the landfill sites, Floyd Bennett Field, and Fort Tilden. Limiting visitor access around new moon and full moon high tides during May and June would help mitigate impacts on horseshoe crabs from additional visitation. As noted in the discussion of alternative A, the grasslands at Floyd Bennett Field and Fort Tilden are particularly beneficial for wildlife, including ground-nesting birds and migrating raptors. Both alternatives call for increases in visitor-related facilities for activities such as camping and outdoor education, and would include the reuse of existing buildings. These changes would both directly impact wildlife species by removing habitat and indirectly affect them by increasing noise and human activity.

Creating wetlands and open water habitat at Floyd Bennett Field is also an action alternatives B and C share, although the acreage may be different. As noted in the description of impacts from alternative A, freshwater wetlands are particularly scarce at the park, although they were once an integral and widespread component of the ecosystem. Saltmarsh is also critical wildlife habitat, and the park has committed to restoring saltmarsh islands in Jamaica Bay. Both alternatives call for restoring over 100 acres of wetland and fresh or marine open water habitat through reestablishing connections with Jamaica Bay or constructing inland freshwater habitats. This is likely to provide substantial benefits for wetland-dependent species.

Efforts to control erosion and protect wetlands at Bergen Beach or Canarsie Pier and to control invasive species and plant native species at several Jamaica Bay Unit park sites would have localized beneficial impacts by improving the quality of wildlife habitat.

Both action alternatives anticipate leaving West Pond breached until a study is completed as part of a more regional effort to reestablish freshwater wetlands. The immediate impacts of leaving the pond breached would be beneficial for saltmarsh species, and reestablishing a freshwater wetland that is more typical of those present before dredge and fill operations to create the Jamaica Bay Wildlife Refuge and artificially fill East and West Ponds could have substantial benefits for wildlife that go beyond those from retaining it as saltmarsh. Because less than 1 percent of freshwater wetlands at Jamaica Bay remain, the benefits of creating more natural freshwater wetlands at the Jamaica Bay Wildlife Refuge could be particularly important.

In addition to these site-specific actions, both alternatives B and C anticipate a greater commitment to working with agency, academic, NGO, and private partners to improve water quality and hydrologic, vegetation, and wildlife conditions in Jamaica Bay. Although a coordinated effort between the NPS and New York City has already resulted in substantial benefits to saltmarsh-dependent wildlife, additional coordinated research, application of results, funding, and decision making could dramatically increase benefits. Benefits to fish and other wildlife from this increased effort would be greater than those from coordinated restoration under alternative A.

Staten Island Unit

Leaving the beach area and swamp white oak forest at Miller Field as a more natural area, as well as delineating a route from the beach through the park site, could provide localized benefits for wildlife. Restoring natural sand transport at Miller Field or Great Kills Park could provide localized benefits for dune, beach, or mudflat wildlife.

Sandy Hook Unit

Very few changes to Sandy Hook are common to alternatives B and C. Restricting access to interior forests, rare dune grassland and shrubland vegetation at the north end, and a shoreline of Spermaceti Cove and continuing to fence shorebird nesting habitat during nesting season would have localized benefits for some wildlife species. Expanding camping in the existing youth campground at Sandy Hook could increase disturbance to wildlife in the vicinity, with localized adverse impacts.

Alternative B: Discovering Gateway – NPS Preferred Alternative

Impacts of Alternative B

Jamaica Bay Unit

Alternative B includes substantially more development of Floyd Bennett Field for visitor-related activities than alternative C. In some cases, such as with camping and a wetlands

center, new facilities are likely to be needed, resulting in the removal of vegetation and potential wildlife habitat with adverse localized impacts. However, the development of Floyd Bennett Field would be expected to bring in hundreds of thousands of additional visitors over those who currently visit the site. Paved areas and existing buildings would be expected to experience heavy use as well. These additional people, cars, night lighting, and noise would disturb and likely displace some wildlife, with adverse impacts over much of this park site. Increased access to fishing in many park sites of the Jamaica Bay Unit could have localized adverse impacts on fish. Avoiding important habitat like the grasslands or saltmarsh areas at Floyd Bennett Field could help minimize direct impacts from habitat loss. Removing some paved areas and "greening" them with grass, shrubs, or trees could have beneficial impacts for wildlife by increasing habitat.

Alternative B calls for restricting equestrian use at Bergen Beach to existing trails only; this could have localized benefits for dune or beach wildlife by eliminating direct trampling of individuals and trampling of habitat. At the Pennsylvania Avenue and Fountain Avenue Parks, using land for visitor amenities would mean the loss of wildlife habitat and increases in disturbance to upland wildlife here.

Allowing visitor access to Canarsie Pol or to Big Egg Island would have the potential for impacts on herons, ibis, or other wading birds, as well as on saltmarsh-dependent species. Impacts would be similar in type to those described in alternative A (for Hoffman Island). However, allowing interpretation of the Big Egg restoration project could also result in unknown long-term benefits on wildlife through visitor education. Restricting access so that it does not take place from March 15 through August 31 would mitigate visitor-related impacts on herons or other wading birds nesting on saltmarsh islands in Jamaica Bay. Alternative B plans new lodging, camping, environmental education, and development of the parade ground and reuse of buildings to bring many new daytime and overnight visitors to Fort Tilden and the adjacent Jacob Riis Park. Grassland habitat here is used by birds and small mammals and is a source of resting and food for migrating raptors. Shrublands are also used by passerines, and the splash zone at this park site has been noted for its potential diverse marine invertebrate fauna (Rowan 2012). Vegetation here is also in relatively undisturbed condition and is likely to provide higher-quality habitat for upland species. New development could both remove habitat and bring additional disturbance for wildlife at Fort Tilden, a potentially more serious localized adverse impact than at other more altered sites like Jacob Riis Park.

Staten Island Unit

The primary proposed activity at this unit under alternative B that could impact wildlife is the use of Hoffman Island for visitors. Alternative B also anticipates blueways along the coast of both Hoffman and Swinburne Islands. Before making a decision, the park would study the potential for impacts on wildlife, including on heron rookeries and harbor seals, in more detail. However, as noted in the impacts discussion for alternative A, wading birds like herons, ibis, and egrets are considered species sensitive to human disturbance, as are harbor seals. A summary of literature on flushing distances (Borgmann 2011) found the average distance at which common loons flushed when a non-motorized boat approached was 167

feet, breeding great blue herons flushed at 88 feet and nonbreeding great blue herons at 325 feet, great egrets flushed at 118–167 feet, and snowy egrets flushed at 265 feet. Flushing distances when faced with people on foot were also recorded for some of these species: 104 feet for great blue herons, 98 feet for great egrets, 88 feet for snowy egrets, and 102 feet for black-crowned night-herons. Several studies also noted that beaches where there were recreationists but that were otherwise appropriate habitat consistently had fewer individuals and fewer species of shorebirds. These studies also suggested buffer sizes, which ranged from 270 feet for great blue herons to 715 feet for common loons for boats, and were generally around 300–350 feet for most species for approaching on foot. If these or similar buffers for visitors in boats or on foot are honored, impacts on wildlife from using Hoffman Island would be minimized. In addition, the park is likely to mitigate impacts from visitation by closing the island to human access during the nesting period from March 15 to August 31 to protect nesting by herons and other wading birds on Hoffman Island. Otherwise, impacts on energetics, resilience, and nesting success of birds on the island could be substantial.

Camping and trails in the Horseshoe Cove area could require removal of saltmarsh habitat or result in indirect impacts from erosion.

Sandy Hook Unit

Development of facilities and amenities, including trails, boat launch sites, and camping, are proposed in alternative B. At the same time, access to sensitive or rare habitats, including some rare vegetation associations, would be controlled, and beach nourishment on the bayside would occur to slow shoreline erosion. Camping and trails in the Horseshoe Cove area could require removal of saltmarsh habitat or result in indirect impacts from erosion. On the ocean site, yurts or cabins adjacent to beaches where unique shorebirds nest could add to existing impacts from visitors. These species are known to be especially sensitive to humans (see "Species of Special Concern" section of this chapter) and impacts on these shorebirds could be especially adverse. Careful siting of campgrounds and trails could avoid more substantial impacts, but saltmarsh, shrub, dune, or maritime forest habitat could still be removed. In addition, an influx of visitors, including overnight visitors, would disturb wildlife and if sustained could displace them.

Cumulative Impacts

Impacts of outside actions that contribute to cumulative impacts (i.e., those not related to alternative B) on wildlife are the same as described under alternative A. However, alternative B would have the potential for more intensive contributions to adverse cumulative impacts from habitat loss associated with increased development, such as at Fort Tilden or Sandy Hook, or from allowing visitor use of marsh islands or Hoffman Island, than alternative A. The same is true of benefits, because alternative B includes the creation of saltmarsh and freshwater wetland habitat, increased efforts to restore Jamaica Bay saltmarsh and improve water quality, research into how to increase wildlife resiliency in the face of climate change and the potential for holistic freshwater wetlands created in appropriate locations in the Jamaica Bay Unit, all of which would have noticeable or appreciable beneficial offsetting impacts for cumulative impacts on wildlife habitat in the Jamaica Bay watershed. Adverse impacts from alternative B are unlikely to be more than imperceptible compared to existing cumulative adverse impacts on wildlife.

Conclusion

Increasing the visitor-related amenities and/or accompanying increases in visitor use could have localized adverse impacts from disturbance at Plumb Beach, Bergen Beach, the Pennsylvania Avenue and Fountain Avenue Parks, Floyd Bennett Field, and Fort Tilden as well as localized impacts to fish populations at several park sites . Controlling beach erosion at Plumb Beach could benefit coastal species, and delineating a path through upland vegetation would reduce disturbance of wildlife. Efforts to control erosion and protect wetlands at Bergen Beach or Canarsie Pier and to control invasive species and plant native species at several Jamaica Bay Unit park sites would have localized beneficial impacts by improving the quality of wildlife habitat. Alternative B anticipates leaving West Pond breached while the park studies how best to create freshwater wetlands in the Jamaica Bay Unit. This benefits saltmarsh-dependent wildlife in the short term, and could offer substantial and even significant benefits for freshwater species in the long term. This is because freshwater wetlands were once abundant and integral parts of many wildlife species' habitats but are now extremely rare in the watershed. Because the natural area of Floyd Bennett Field is a designated fundamental resource and wetlands are a unique and important habitat in the New York City area, substantial and even significant benefits are also possible from the creation of saltmarsh and freshwater wetland habitat at Floyd Bennett Field under either action alternative. Establishing the JBSRI and working with additional partners to research and apply the results to restore the Jamaica Bay ecology would have widespread and substantial benefits for wildlife in this park unit. Because natural areas of Jamaica Bay Wildlife Refuge are fundamental resources and freshwater wetland habitat is both natural and important to the area and is now unique because of cumulative losses, the benefits to shellfish, finfish and other wildlife from this expanded coordination would be considered significant even compared to those from coordinated restoration under alternative A.

Substantial facility development and increased visitor use in Floyd Bennett Field and Fort Tilden, as well as at Sandy Hook and at the newly planted landfill sites in the Jamaica Bay Unit, would have the potential for adverse localized impacts on wildlife. These increases would add to existing possibly significant adverse impacts to wildlife from existing visitation but because wildlife are already displaced from human activities would be unlikely to have substantial additional impacts. The exceptions to this are if visitors are allowed at Canarsie Pol, Big Egg Island, and Hoffman Island, where they are currently restricted. If so, nesting birds could be disturbed by visitors in boats or on foot, with possible substantial localized adverse impacts on energy reserves or nesting success. Because natural areas at Hoffman Island and Jamaica Bay Wildlife Refuge (including its marsh islands) are named as fundamental resources and nesting rookeries are rare, impacts from increased access and nearby visitation could be potentially significant for herons and other wading birds. Measures such as buffers and closures during nesting would substantially mitigate these impacts.

Localized benefits for wildlife from managing park sites as natural areas in both the Staten Island and Sandy Hook Units and restoring sand transport processes to the Great Kills Park coast would occur under alternative B.

The development of facilities and amenities at Sandy Hook under alternative B could adversely affect wildlife by removing habitat and bringing additional visitors and human disturbance. This is true of planned changes on both the bay and ocean side; those on the ocean side could particularly affect feeding or nesting rare shorebirds.

Cumulative impacts on wildlife include substantial habitat loss, contamination of soils and surface waters, invasive species, predation, human disturbance, and climate change. Climate change is expected to worsen and adversely affect wildlife by inundation from sea-level rise, destruction of habitat and drowning during coastal storms, and contamination of fresh groundwater and surface water through inlets and overwash. Warmer temperatures are expected to increase the competitive advantages of invasive species, wildlife moving north as temperatures increase, and mistimings between food sources and migrating species. Beneficial impacts from restoration efforts by New York Department of Environmental Conservation and others would offset some of these adverse effects. Implementing alternative B would contribute imperceptible adverse cumulative impacts on wildlife and noticeable or appreciable beneficial cumulative impacts by research into how to increase wildlife resiliency in the face of climate change and creating saltmarsh and freshwater wetland habitat and restoring critical elements of a healthy Jamaica Bay ecology.

In sum, alternative B would have significant beneficial impacts for wildlife but could also have significant adverse impacts from opening areas to visitors. In the context of the significant cumulative impacts facing wildlife, alternative B would contribute imperceptible adverse and noticeable or appreciable beneficial impacts.

Alternative C: Experiencing Preserved Places

Impacts of Alternative C

Generally, impacts on wildlife from facilities development and use and from increased visitation would be somewhat reduced under alternative C compared to alternative B, although they would still be greater than under alternative A and would result in localized adverse impacts on wildlife related to habitat loss and disturbance. This is true for Floyd Bennett Field, Bergen Beach, sites from Canarsie Pier through Hamilton Beach Park, Jacob Riis Park and Fort Tilden, and Sandy Hook.

Jamaica Bay Unit

Beneficial impacts on wildlife from creating wetlands at Floyd Bennett Field could be greater under alternative C than alternative B, because additional created acreage is proposed. As in alternative B, benefits to wildlife could be considered significant from this action. Actions such as studying the potential for creating freshwater wetlands over much of the unit and leaving West Pond breached until findings are finalized and applied would have short-term benefits for saltmarsh-dependent wildlife and possibly significant long-term and more widespread benefits for freshwater species, as in alternative B. Establishing the JBSRI and working with partners to jointly research and apply the findings to restore habitats in Jamaica Bay would likely have significant and widespread benefits for aquatic and saltmarsh species, as it would under alternative B.

Decisions to eliminate equestrian use at Bergen Beach or to restrict access to the upland area of Plumb Beach, to increase efforts to restore habitat at Plumb Beach or at park sites from Canarsie Pier through Hamilton Beach Park, or to eliminate some hardened shoreline at Jacob Riis Park would each have localized benefits by improving the quality of habitat or reducing disturbance.

Protection and enhancement of rare habitat at Breezy Point Tip could also continue to provide or improve habitat quality and reduce the potential for human disturbance or displacement of wildlife. In addition to being an important resting and feeding site for migratory birds, Breezy Point Tip provides shorebird nesting habitat for several species of special concern, as well as a number of rare vegetative communities. Increasing protection of these areas and working to improve habitat quality could provide substantial localized benefits for wildlife.

Protection and enhancement of rare habitat at Breezy Point could also continue to provide or improve habitat quality and reduce the potential for human disturbance or displacement of wildlife.

Staten Island Unit

Impacts from alternative C on wildlife would either be the same as under the no-action alternative (at Fort Wadsworth and Hoffman and Swinburne Islands) or as described for actions common to alternatives B and C (Miller Field), with the exception of Great Kills Park. Areas of this park site are currently closed for radon remediation, but have been used in the recent past for sports and recreation. Alternative C would zone these areas as natural and restrict visitor use to walking trails and some camping. It would also restore beach, dune, and upland vegetation at this park site, with potential benefits for wildlife habitat.

Sandy Hook Unit

Alternative C would add a protective subzone for many of the areas in Sandy Hook, including Spermaceti Cove and much of the central/southern oceanfront. These and other important wildlife areas at Sandy Hook (including shorebird nesting locations in the north and along the central/southern coast, as well as saltmarsh and rare vegetative communities along Horseshoe Cove and Spermaceti Cove and American holly or other maritime forest associations) would be kept as natural areas and become the sites for targeted restoration efforts. Protection and restoration would be greater than is currently the case, with potential localized beneficial impacts on wildlife.

Cumulative Impacts

Impacts of outside actions that contribute to cumulative impacts (i.e., those not related to alternative C) on wildlife are the same as described under alternative A. Alternative C may contribute imperceptible adverse impacts from small-scale habitat loss associated with increased development and visitor use. The beneficial contribution of alternative C would be the same as for alternative B, and includes research into how to increase wildlife resiliency in the face of climate change, the creation of saltmarsh and freshwater wetland habitat, increased efforts to restore Jamaica Bay saltmarsh and improve water quality, and the potential for holistic freshwater wetlands created in appropriate locations in the Jamaica Bay Unit. Each of these actions would have noticeable or appreciable beneficial offsetting impacts for cumulative impacts on wildlife habitat in the Jamaica Bay watershed.

Conclusion

In alternative C, increasing the visitor-related amenities and the accompanying rise in visitor use could have localized adverse impacts from disturbance at Plumb Beach, Bergen Beach, the Pennsylvania Avenue and Fountain Avenue Parks, Floyd Bennett Field, and Fort Tilden. Controlling beach erosion at Plumb Beach could benefit coastal species, and delineating a path through upland vegetation would reduce disturbance of wildlife. Efforts to control erosion and protect wetlands at Bergen Beach or Canarsie Pier and to control invasive species and plant native species at several Jamaica Bay Unit park sites would have localized beneficial impacts by improving the quality of wildlife habitat. Alternative C anticipates leaving West Pond breached while the park studies how best to create freshwater wetlands in the Jamaica Bay Unit. This would benefit saltmarsh-dependent wildlife in the short term, and could offer substantial and even significant benefits for freshwater species because freshwater wetlands were once abundant but are now extremely rare in the watershed. The same is true for saltmarsh and freshwater wetland habitat that would be created at Floyd Bennett Field. Establishing the JBSRI and working with additional partners to research and apply the results to restore the Jamaica Bay ecology would have widespread and significant benefits for fish and other wildlife in this park unit. Protection and restoration efforts at Breezy Point Tip could result in continuation of current beneficial impacts on wildlife or localized habitat improvement.

Small-scale facility development and increased visitor use in Floyd Bennett Field and Fort Tilden, as well as at the newly planted Pennsylvania Avenue and Fountain Avenue Parks in the Jamaica Bay Unit, would have the potential for adverse localized impacts on wildlife under alternative C.

Localized benefits for wildlife from managing park sites as natural areas in both the Staten Island and Sandy Hook Units and restoring sand transport processes to the Great Kills Park coast would occur under alternative C. Additional protection for rare habitats or habitats used by unique shorebirds at Sandy Hook would result in localized benefits for wildlife.

Cumulative impacts on wildlife include substantial habitat loss, contamination of soils and surface waters, invasive species, predation, human disturbance, and climate change. Climate change is expected to worsen and adversely affect wildlife by inundation from sea-level rise, destruction of habitat and drowning during coastal storms, and contamination of fresh groundwater and surface water through inlets and overwash. Warmer temperatures are expected to increase the competitive advantages of invasive species, wildlife moving north as temperatures increase, and mistimings between food sources and migrating species. Beneficial impacts from restoration efforts by New York Department of Environmental Conservation and others would offset some of these adverse effects. Implementing alternative C would contribute imperceptible adverse cumulative impacts on wildlife and noticeable or appreciable beneficial cumulative impacts by research into how to increase wildlife resiliency in the face of climate change and creating saltmarsh and freshwater wetland habitat and restoring critical elements of a healthy Jamaica Bay ecology.

In sum, alternative C would have significant beneficial impacts for wildlife and localized adverse impacts from facility development and increased visitor use. In the context of the significant cumulative impacts facing wildlife, alternative B would contribute imperceptible adverse and noticeable or appreciable beneficial impacts.

Species of Concern

Laws and Policies

Threatened and endangered species are protected by the federal Endangered Species Act, as well as by statutes in both New Jersey and New York. NPS *Management Policies* 2006 also contains language directing parks to protect listed or rare species (NPS 2006a).

The purpose of the federal Endangered Species Act of 1973 (7 USC 136; 16 USC 460 et seq.) is to conserve the "ecosystem upon which endangered and threatened species depend" and to conserve and recover listed species. This act requires all federal agencies to consult with the Secretary of the Interior on all projects and proposals having potential adverse impact on federally endangered and threatened plants and animals. The two bureaus of the Department of the Interior that conduct this consultation are the U.S. Fish and Wildlife Service (USFWS) and, if the species is marine or anadromous, NOAA–Fisheries. If the GMP/EIS analysis finds that the preferred alternative "may affect" a listed species or its critical habitat, a separate biological assessment is submitted for USFWS review and concurrence before a "take" (e.g., an impact that harms or kills an individual) is permitted. If none of the effects is considered "adverse" as defined by the Endangered Species Act, no further consultation is required. However, if an adverse effect exists, formalized consultation with the USFWS or NOAA–Fisheries begins and mitigation or constraints to ensure that the species is not jeopardized added to the preferred alternative. No finding regarding "take" is required for listed plant species, although an assessment of whether an action would put an entire species of listed plants in jeopardy is required.

NPS *Management Policies* 2006 states that parks are to both proactively conserve and prevent detrimental effects on native listed species or their habitat in park units (NPS 2006a, section 4.4.2.3). In addition to species listed under the federal Endangered Species Act, parks are to inventory other native species of special management concern (such as rare, declining, sensitive, or unique species) and manage them to maintain natural distribution and abundance. This includes state- or locally listed species, which are to be managed in a manner as similar as possible as that for federally listed species.

Both New Jersey and New York have passed laws regulating management and treatment of endangered species. New Jersey has a law that regulates wildlife (New Jersey Endangered and Nongame Species Act of 1973 [NJSA 23:2A-13]) and another that governs plants (New Jersey State Endangered Plant Species Act of 1989 [NJSA 13:1B-15, 151]). New York has passed the Environmental Conservation Law, which includes regulations, definitions, and lists of endangered and threatened species and species of special concern in section 11 0535.

The Jamaica Bay Unit includes known locations for several state-listed plants, including Schweinitz's flatsedge at Floyd Bennett Field in sandy, windblown dune sites, and yellow flatsedge in wetter sandy sites, including along the shores of coastal ponds. Species in sandy coastal locations, including old field or other grasslands at park sites in the Jamaica Bay Unit, include southern arrowwood and cut-leaved evening-primrose.

Methods

This is a primarily qualitative analysis of the beneficial or adverse effects on species of special concern using agency reports, lists of species of management concern, state and federal lists of threatened or endangered animals and plants, state lists of species of special concern, the scientific literature, and information about habitat and confirmed presence of species in each park unit.
Resource-specific contexts for assessing the impacts of the alternatives on species of special concern include the following:

- The criteria used by all agencies to determine whether an impact is significant (CEQ criteria) include one that addresses adverse effects on listed species or their habitat.

- The CEQ criteria include whether a resource is unique; by default, a rare, threatened, or endangered animal or plant is unique.

- No listed or rare species are also identified as fundamental resources by the park.

- Because the area is urbanized with little habitat for listed species, the open and natural areas of the park may represent a high percentage of available habitat for listed species and be particularly important for their survival in the New York City area. This is not true for all listed species at the park.

- Beach, dune, and natural areas at several park sites are listed as fundamental; a species of special concern may be key to the functioning of these systems.

- Because listed species are scarce, the Endangered Species Act finds that even harassment of a single individual is a take and requires consultation and a permit before a federal action can move forward.

Alternative A: No Action

Impacts of Alternative A

Jamaica Bay Unit

The Jamaica Bay Unit includes known locations for several state-listed plants, including Schweinitz's flatsedge at Floyd Bennett Field in sandy, windblown dune sites, and yellow flatsedge in wetter sandy sites, including along the shores of coastal ponds. Species in sandy coastal locations, including old field or other grasslands at park sites in the Jamaica Bay Unit, include southern arrowwood and cut-leaved evening-primrose. Smooth bur-marigold, smartweed dodder, gypsy wort, and narrow leaf sea-blite occupy wetland or saltmarsh habitat. Slender crabgrass, which inhabits dune, brackish meadows, and saltmarsh, has been found in the Jamaica Bay Unit at Fort Tilden and Breezy Point Tip. A few woodland species, including sweetbay magnolia and willow oak, also occupy habitat in this unit. Federally listed seabeach amaranth occupies open overwash or barrier beach habitat in the Jamaica Bay Unit, primarily at Breezy Point Tip, although Fort Tilden and Jacob Riis Park host small populations.

Listed or rare wildlife in the Jamaica Bay Unit includes checkered white butterfly, eastern hognose snake, eastern box turtle, and northern diamondback terrapin. Nesting sites for the terrapin are known on two of the islands in Jamaica Bay, at dunes south of the visitor center, and at Floyd Bennett Field. The highest number of ospreys in any unit of the park nest in the Jamaica Bay Unit. Piping plovers, a federally threatened species, as well as several state-listed shorebirds including common tern and least tern, nest in beach or overwash habitat at park sites in the Jamaica Bay Unit, primarily at Breezy Point Tip. Occasionally, federally endangered roseate terns have also nested at Breezy Point Tip. Breezy Point Tip is also an important habitat for many migrating raptors, as are grasslands at Floyd Bennett Field. These grasslands are also home to several grassland-dependent species, including listed horned lark, upland sandpiper, savannah sparrow, and northern harrier. Several species of wading birds nest on islands in Jamaica Bay, including at Canarsie Pol, Ruffle Bar and Subway Island, and other islands including Joco and Silver Hole are known nesting sites for common terns. Saltmarsh and mudflat habitat supports feeding by many species of shorebirds and wading birds. Plumb Beach and other shorelines of Jamaica Bay provide important habitat for various life stages of the horseshoe crab, a species of management concern. Eelgrass, eastern oyster, and Atlantic Bay scallops were all key species in Jamaica Bay but have since disappeared (NPS 2010b). Each remains a species of management concern.

Under alternative A, continued visitor use, occupation of reused buildings, and operation of visitor and other facilities in several park sites at the Jamaica Bay Unit would disturb wildlife of concern and may displace them from otherwise suitable habitat. This is true of visitor use at several sites (Plumb Beach, Fort Tilden, and Breezy Point Tip), boat traffic near Jamaica Bay islands, and hiking off trail or camping at Floyd Bennett Field. On the other hand, park managers take many measures to protect and enhance habitat for wildlife of special concern. These measures are described in the "Affected Environment" chapter and are focused primarily on protecting piping plovers and other shorebirds. They include fencing to keep visitors away from nesting birds, signs, predator removal, closures (to dogs, for example), buffer zones, prohibition of certain recreational activities (e.g., kite flying, kite surfing, fireworks during the breeding season), and visitor education. Although the park has not reached its recovery goal for plover nesting of an average of 1.5 chicks per nesting pair over five years, the Jamaica Bay population has fledged up to 1.89 checks per pair at Breezy Point Tip and 2 at the Breezy Point Surf Club location in past years, indicating that park management efforts are beneficial for plovers. Other listed species, including least tern, common tern, seabeach knotweed, and seabeach amaranth, occupy the same habitat as piping plovers in the park, and have similarly benefited from park protection efforts. Continuing these efforts under the no-action alternative would continue substantial localized benefits for these species of concern.

Plumb Beach

Implementing the approved sand stabilization plan at Plumb Beach would increase the extent, stability, and quality of beach and dune habitat, with benefits for horseshoe crabs. The environmental assessment for the plan noted that adverse impacts from building a terminal groin needed to capture sand would occur because it would be located in or near a spawning area. However, mitigation would help minimize impacts by constraining construction so it takes place outside the spawning months of May and June and does not occur during evening tides when the majority of spawning takes place.

Floyd Bennett Field

At least one state-listed plant species (Schweinitz's flatsedge) and likely others occur at Floyd Bennett Field. It is possible that visitors trample individual plants, or that development at this park site has covered habitat where listed plants could otherwise grow. However, Floyd Bennett Field was primarily created by filling wetlands and spaces between marsh islands with artificial soils like fly ash, rubble, and dredged material, which may make it a less likely area for native species to grow. In addition, Dead Horse Bay, which is less developed, is infested with thick stands of *Phragmites*, reducing its value as habitat for rare native plant species. Continuing visitor use as it currently takes place at this park site would likely have no more than an incidental adverse localized impact on listed plants because of these factors.

Maintenance of the grassland at Floyd Bennett Field through mechanical means (primarily mowing) would continue, with localized benefits for a few listed grassland species, including checkered white butterfly, horned lark, savannah sparrow, and northern harrier. Listed grassland birds that have been confirmed nesting at Floyd Bennett Field include horned lark, upland sandpiper, savannah sparrow, and northern harrier (USFWS 1997b). Each of these species nests over a vast portion of North America, but horned larks and upland sandpiper numbers in New York have fallen dramatically in the last few decades, primarily from habitat loss. The availability of large, contiguous tracts of grasslands is an important feature of breeding habitat for upland sandpipers and northern harriers, and the grasslands at Floyd Bennett Field are adequate for nesting. Continuing to maintain the grasslands at this park site may provide localized substantial beneficial impacts for these listed wildlife species.

Bergen Beach

As at Floyd Bennett Field, the mostly unnatural filled saltmarsh and infestation by *Phragmites* of possible habitat at Bergen Beach likely minimize the potential for rare plant species to grow. However, allowing equestrian use over the entire site may be adversely affecting habitat that could be vegetated with rare or listed plant species, because some dune and shrubland vegetation occurs here. The impacts of continuing equestrian use would be adverse, but likely to be localized and incidental.

Canarsie Pier through Hamilton Beach Park

Heavy use and hardened or planted grounds at park sites from Canarsie Pier through Hamilton Beach Park may also be preventing the colonization of these areas by listed plant species, a possible localized adverse impact.

Jamaica Bay Wildlife Refuge

At least two species of listed wading birds (yellow-crowned and black-crowned night-herons) and many listed shorebirds (least tern, roseate tern, common tern, and black skimmer) use island or shoreline habitat in Jamaica Bay that is considered part of the Jamaica Bay Wildlife Refuge park site for nesting and feeding. The great majority of the 25 osprey nests in this park unit are located on marsh and wooded islands in the bay, and northern diamondback

terrapins also nest on islands in the bay. These species benefit by park policies of keeping islands visitor free and working with New York Department of Environmental Conservation to complete restoration projects, including building marsh habitat. The benefits of these activities could be substantial and relatively widespread. The same may be true for listed plants, many of which could grow in marsh, mudflat, or wet sandy environments on islands or at undeveloped shorelines of the bay. In addition to the benefits from restoring habitat, maintaining the islands relatively free from human use may also have had benefits for rare plants by keeping their habitat free from foot traffic. Continuing these efforts under the no-action alternative would continue beneficial impacts for rare and listed plants and animals.

The park has reintroduced several reptile species of management concern at habitats in this park site, including the eastern hognose snake and eastern box turtle. Continuing this practice would likely result in localized benefits for these species.

Fort Tilden and Breezy Point Tip are managed by the park to protect shorebirds and other important natural resources and keep habitat relatively undisturbed.

Park Sites on the Rockaway Peninsula

Fort Tilden and Breezy Point Tip are managed by the park to protect shorebirds and other important natural resources and keep habitat relatively undisturbed. As noted in other sections of this GMP/EIS, this means that rare vegetation associations grow in these areas and that they are used by tens of thousands of migrating birds each spring and fall. It is likely that listed plant species such as slender crabgrass and many others grow in these undisturbed habitats. Seabeach amaranth grows in open overwash and barrier island beach habitat at Breezy Point Tip, along both the ocean side and inlet coast. Although habitat at Fort Tilden and Jacob Riis Park is available, no recorded seabeach amaranth individuals were noted in a 2012 survey (NPS 2012g). This could be a result of heavy visitor use, as recent surveys of dune habitat at these park sites showed signs of trampling (NPS 2012g).

Piping plover nesting at these park sites is primarily limited to Breezy Point Tip, where plovers nest at several locations. They are generally absent from Fort Tilden and Jacob Riis Park; again, a possible result of more intense visitor use as well as more narrow beaches. Visitation to Breezy Point Tip from mid-March to September is restricted to protect piping plover nesting as well as seabeach amaranth. Although common terns and least terns have historically nested at Breezy Point Tip, numbers have decreased in recent years (see the "Species of Special Concern" section of this chapter) and breeding has taken place at the Breezy Point Cooperative outside the park. This is likely to be due at least in part to the increasingly dense dune and shrub vegetation that has grown up in the absence of coastal storms, a condition that has been changed by Hurricane Sandy. The scouring associated with Hurricane Sandy could have a beneficial effect on these species, as well as on piping plovers, which require open habitat to minimize impacts from predation. Generally, maintaining Breezy Point Tip in relatively undisturbed condition, as well as protecting piping plovers and incidentally protecting other state-listed shorebirds and seabeach amaranth, has resulted and would continue to result in beneficial impacts on these species of special concern. Allowing heavy visitor use at dunes and beach at Jacob Riis Park and Fort Tilden would continue adverse effects.

Staten Island Unit

To the extent that state-listed herons nest at Hoffman or Swinburne Island, restricting visitor access has potential substantial localized benefits, because nesting birds can leave chicks or eggs vulnerable to predation or effects from weather, or can expend energetic reserves and stop feeding, when approached by humans in boats or on foot. This impact is described in more detail in the "Wildlife" section of this chapter.

Great Kills Park, and in particular Crooke's Point, is the site of a few state-listed plant species, including sanddune sandbur, hop sedge, retrorse flatsedge, and fringed boneset on dunes and beaches, as well as white-bracted boneset, which grows on the shores of shallow ponds. At least one osprey pair nests in the Staten Island Unit as well. Keeping Crooke's Point as a natural area may have localized benefits for these species by reducing the potential for the trampling of plants or disturbance of osprey.

Currently, horseshoe crab habitat at Crooke's Point exists but is adversely affected by dredging of the entry to Great Kills Harbor by the USACE, a practice that occurs periodically to keep littoral drift from closing the entrance to the harbor.

Sandy Hook Unit

A large population of seabeach amaranth grows at Sandy Hook and piping plover nesting takes places at several locations along the ocean and bay sides. Many other listed species or species of management concern occupy habitat at Sandy Hook, including red knot, American oystercatcher, black skimmer, least tern, roseate tern (on occasion), common tern, osprey, black rail, American bittern, seabeach evening primrose, seabeach knotweed, Northeastern beach tiger beetles, northern diamondback terrapins, and horseshoe crabs. The updated management plan for piping plovers at Sandy Hook (NPS 2007a) describes expanded conservation measures the park implements to protect this species. Although these measures are particularly targeted at protecting the federally listed piping plover and its habitat (including seabeach amaranth), they would also offer similar protection for all species noted above because they are part of the same beachfront ecological community (NPS 2007a). Many of these measures are aimed at reducing human disturbance, considered a major source of impacts on listed or other sensitive species. For example, ORV use is prohibited in northeastern beach tiger beetle areas, and limiting human use to no more than 50 people per week along the water's edge in summer and fall is proposed to protect the beetles. However, recent inventories suggest that the tiger beetle population may have died out despite these protective measures.

Use of bayside habitats at Sandy Hook for recreational kite surfing and allowing visitors to bring pets has had substantial impacts on shorebirds (NPS 2007a). Pets can also disturb nesting terrapins and spawning horseshoe crabs. In response, the park has closed Spermaceti Cove and the saltmarsh and tidal creeks at Horseshoe Cove to recreational use, with beneficial impacts on shorebirds, horseshoe crabs, and nesting terrapins. Seabeach amaranth protection involves limiting human use and locating dune crossovers and patrol routes away from known locations. The updated management plan (NPS 2007a) proposes

expanding these measures to include seabeach knotweed and seabeach evening-primrose and eliminating beach raking, sand scraping, and any ORV use within 33 feet of seabeach amaranth. Predation management, including trapping of foxes or feral cats, managing trash to reduce crows and other avian predators, and predator deterrents like electrified fences, were each proposed and evaluated in the updated management plan, and many have been implemented. Beach nourishment to help provide habitat for tiger beetles, terrapins, horseshoe crabs, and shorebirds has also been evaluated, approved, and implemented at Sandy Hook. These measures would all continue to have substantial areawide beneficial impacts under the no-action alternative for all listed species or species of management concern in Sandy Hook's beach and bay coastal habitats.

Cumulative Impacts

Although cumulative impacts on listed plants or animals vary, most have suffered as a result of habitat losses, whether through direct development or through alteration by pollutants, invasive species, dredging or filling, recreation or other human uses, increases in feral predators like dogs or cats, or changes in agricultural practices (and their effect on available grassland habitat, for example). Climate change has affected habitat for wildlife, from changing temperature regimes to sea-level rise and related changes in storm surge, groundwater characteristics, and salinity in large embayments such as Jamaica Bay. For listed species that have become rare over time because they are specialized, climate change can mean substantial loss of individuals as conditions are too quickly altered for these species to relocate. Impacts from many of these factors are not just historical but ongoing and likely to worsen in the future. Dune, beach, and other coastal species have lost habitat because of groins, jetties, and other structures that affect transport systems, as well as limited supplies of sediment (see the "Soils and Geology" section for more information).

Much of the shoreline at Gateway is considered to be highly or very highly vulnerable to flooding and loss from climate change. Simple inundation as the sea level rises could affect low marshland habitat, with indirect impacts on listed shorebirds and nesting terrapins. Storm surge from potentially increasingly frequent and/or severe storms associated with climate change could result in inundation and drowning of eggs in terrapin, plover, or other shorebird nests, or in destruction of the nests by wind and waves. Inlets or overwash can increase salinity in freshwater habitats that are usually protected by dunes, resulting in the loss of ponds, palustrine wetlands, or other important freshwater habitat that is extremely rare in the park and that may support unique aquatic invertebrates or state-listed plants, although some species including seabeach amaranth and piping plover may experience benefits from newly created overwash habitat. These changes in habitat quality and changes in climate can also leave open a window for increases in invasive species at the park, which can outcompete native plants or animals, particularly those that are specialized, immobile, or rare. For example, the northern diamondback terrapin is extremely vulnerable to warmer temperatures because drier summers reduce nesting success (NPS 2009h). Data collected over a two-year period show a dramatic decline in the hatching success of the terrapin during a hot and dry year. As sea-level rise accelerates, areas of shallow water covering deeper sandy beaches needed for horseshoe crab spawning are quickly disappearing under deeper water, with potential adverse cumulative effects across this species' coastal habitat (NPS 200h9).

Beneficial cumulative actions affecting wildlife by improving habitat conditions include multiphased programs to address the impacts of wastewater and combined sewer/stormwater flows into Jamaica Bay, landfill closures, and other restoration projects by NYCDEP and other agencies (NYCDEP 2007; USACE and PA 2009).

Implementing alternative A would contribute noticeable adverse cumulative impacts on some listed animal species from continued visitor use and other activities that disturb wildlife, including recreational uses like kite surfing, walking, or sunbathing in the vicinity of nesting birds; violations of closures by visitors, including those with dogs; and over-sand vehicle use by park rangers in areas like Sandy Hook or Breezy Point Tip. Some of these could also result in crushing of individual plants or small populations, with imperceptible to noticeable impacts. Impacts are likely to be noticeable rather than imperceptible because population numbers in the region and at the park are low, so the loss of even a few individuals would be measurable. Restricted visitor access to relatively natural areas at Breezy Point Tip, Sandy Hook, and Fort Tilden contributes noticeable beneficial cumulative impacts for these same species. Maintaining grasslands at Floyd Bennett Field may also contribute noticeable beneficial impacts for some listed grassland species. The park working with NYCDEP to restore marsh island habitats at Jamaica Bay may have noticeable beneficial impacts for marsh-dependent listed species such as night-herons, shorebirds, and terrapins.

Conclusion

Continued visitor use and operation of visitor and other facilities in several park sites could result in trampling and loss of listed plants or disturbance of listed wildlife, with localized adverse impacts. Park management to protect listed species, such as with signs, closures, predator management, buffer zones, and prohibitions of certain recreational uses, has had and would continue to have beneficial localized impacts on listed species. Plumb Beach sand nourishment would have short-term adverse and long-term beneficial impacts on horseshoe crabs. Maintenance of grasslands at Floyd Bennett Field could provide substantial localized benefits for at least four listed grassland birds. Because listed wildlife species are unique and considered important in their own right under the CEQ criteria for significance, these benefits could be considered significant. Maintaining Jamaica Bay islands as natural areas without visitors and restoring saltmarsh island habitat would provide substantial, widespread, and potentially significant benefits for listed wildlife, and localized benefits for state-listed plants. This may be true for night-herons nesting on Hoffman Island as well. Heavy visitor use at Fort Tilden and Jacob Riis Park may be preventing seabeach amaranth growth and limiting piping plovers and other listed shorebirds from using otherwise suitable habitat, a localized adverse impact that would continue under the no-action alternative. Maintaining Breezy Point Tip as a relatively undisturbed area would be beneficial for these same species. The presence of several state-listed plants at Crooke's Point may mean that keeping this area in a relatively natural state would continue localized benefits. Closures, fencing, buffers, and other measures to reduce disturbance of nesting shorebirds and minimize impacts on listed plants and horseshoe crabs, for example, may have had substantial, widespread, and potentially significant beneficial impacts for several species, including piping plover, least terns, common terns, seabeach amaranth, seabeach knotweed, seabeach evening-primrose, osprey, terrapins, and horseshoe crabs.

Cumulative adverse impacts on listed species include habitat loss, pollution, recreation or other visitor uses, increases in feral predator populations, and climate change. Increases in sea level can swamp and kill species of special concern or damage or destroy shorebird and terrapin nests, and rapid increases in temperature can particularly adversely affect specialists or vulnerable rare species like terrapins or key species like horseshoe crabs.

In sum, continuing current management would have significant benefits for and localized adverse impacts on species of special concern. Implementing alternative A would contribute noticeable adverse and beneficial cumulative impacts from continuing human disturbance and from protection measures.

Common to Both Action Alternatives

Impacts of Alternatives B and C

Jamaica Bay Unit

Plumb Beach

Controlling beach erosion at Plumb Beach would have potential localized beneficial impacts on horseshoe crabs. Increasing visitor-related amenities and/or the accompanying rise in visitor use could have localized adverse impacts on crabs from crushing or disturbance.

Floyd Bennett Field

As noted in the discussion of alternative A, the grasslands at Floyd Bennett Field and Fort Tilden are particularly beneficial for at least four listed species of birds as well as for the rare checkered white butterfly. Both alternatives call for increases in visitor-related facilities for activities such as camping and outdoor education, and would include the reuse of existing buildings. If visitors are encouraged to hike through or investigate the grasslands as part of their environmental education programming, nesting grassland birds would be disturbed and could temporarily or even permanently abandon nests. Seasonal restrictions would mitigate the impact.

Creating wetlands and open water habitat at Floyd Bennett Field is also an action that alternatives B and C share, although the acreage may be different. Both alternatives call for restoring over 100 acres of wetland and fresh or marine open water habitat through reestablishing connections with Jamaica Bay or constructing inland freshwater habitats. This is likely to provide beneficial localized impacts for listed species such as wading birds, waterfowl, or shorebirds that use saltmarsh or freshwater marshes for feeding and resting. Although waterfowl may experience particularly beneficial impacts, no waterfowl using this habitat would be likely to be state- or federally listed species.

Both action alternatives anticipate leaving West Pond breached until a study of a more regional effort to reestablish freshwater wetlands is completed. The immediate impacts of leaving the pond breached would be beneficial for listed saltmarsh species. Although

reestablishing a freshwater wetland that is more typical of those present before dredge and fill operations could have substantial benefits for wildlife, few of these species are listed. Benefits to species of concern from creating freshwater wetlands at West Pond would therefore be less consequential.

Although a coordinated effort between the NPS and New York City has already resulted in substantial benefits to some listed species or species of management concern, such as terrapins, least terns, common terns, night-herons, or ospreys that nest on islands in the bay, additional coordinated research, application of results, funding, and decision making could dramatically increase benefits to these and other listed species.

Jamaica Bay Wildlife Refuge

Both alternatives B and C anticipate a greater commitment to working with agency, academic, NGO, and private partners to improve water quality and hydrologic, vegetation, and wildlife conditions in Jamaica Bay. Although a coordinated effort between the NPS and New York City has already resulted in substantial benefits to some listed species or species of management concern, such as terrapins, least terns, common terns, night-herons, or ospreys that nest on islands in the bay, additional coordinated research, application of results, funding, and decision making could dramatically increase benefits to these and other listed species. Imposing a buffer zone around the park's osprey nests on the saltmarsh islands of Jamaica Bay, as well as at other locations in Sandy Hook and Crooke's Point where nests are located, would help in keeping nesting success for this species high.

Park Sites on the Rockaway Peninsula

Both action alternatives would include discussions with neighboring landowners to holistically manage sand transport processes and return them to a more natural condition. The addition of sand to beaches along the Rockaway barrier spit could provide important beach habitat that would support listed plants like seabeach amaranth and seabeach knotweed, as well as nesting piping plovers and other shorebirds. This could be a substantial localized benefit for these listed coastal species.

Both action alternatives include some development of Fort Tilden, as well as possible programming changes at Jacob Riis Park or Fort Tilden. New or expanded trails could remove habitat for listed plants and disturb or displace any listed animal species using vegetation in Fort Tilden's backcountry, an adverse impact. Both alternatives also include protection of dunes and beaches as they are restored over time at Fort Tilden. Although this could help some listed dune or beach plants grow, heavy dune vegetation would keep several shorebirds, including least terns, black skimmers, and possibly piping plovers, from successfully nesting here, a possible adverse effect.

Breezy Point Tip

All visitors are restricted from entering nesting areas for piping plovers or fenced amaranth areas from mid-March through September at Breezy Point Tip. These restrictions and current, relatively undisturbed conditions would continue at this park site under either alternative, as would park management to both protect listed species and allow visitor uses. Impacts would be both adverse and beneficial for listed species, as described above for no action.

Staten Island Unit

Leaving the beach area and swamp white oak forest at Miller Field as a more natural area, as well as delineating a route from the beach through the park site, could provide localized benefits for wildlife. Restoring natural sand transport at Miller Field or Great Kills Park could provide localized benefits for listed plant species, including hop sedge or sanddune sandbur, for example. Some feeding grounds for listed shorebirds could also be created by controlling erosion through restoring sediment transport, including for mudflat and beach habitat, a localized benefit.

Currently, horseshoe crab habitat at Crooke's Point exists but is adversely affected by dredging of the entry to Great Kills Harbor by the USACE, a practice that occurs periodically to keep littoral drift from closing the entrance to the harbor. Working with the USACE to change the direction of dredging to preserve crab habitat at Crooke's Point would improve the quality and extent of horseshoe crab habitat and is included as a mitigation measure the park would consider.

Restoring natural sand transport at Miller Field or Great Kills Park could provide localized benefits for listed plant species, including hop sedge or sanddune sandbur, for example.

Sandy Hook Unit

Very few changes to Sandy Hook are common to alternatives B and C. Restricting access to interior forests, rare dune grassland, and shrubland vegetation at the north end, as well as the shoreline of Spermaceti Cove, and continuing to fence shorebird nesting habitat during nesting season would have localized benefits for listed wildlife. Listed species that would benefit from these restrictions include nesting ospreys, Henry's elfin butterflies (which live in the maritime holly forest), seabeach knotweed, piping plovers, least terns, common terns, black skimmers, and seabeach amaranth. Expanding camping in the existing youth campground at Sandy Hook could increase disturbance to wildlife in the vicinity, with localized adverse impacts.

Alternative B: Discovering Gateway – NPS Preferred Alternative

Impacts of Alternative B

Jamaica Bay Unit

Plumb Beach

No impacts on listed species would occur beyond those discussed for actions common to both alternatives B and C.

Floyd Bennett Field

Alternative B would include substantially more development of Floyd Bennett Field for visitor-related activities and predicts a higher degree of increase in visitor use than does alternative C. These additional people, cars, night lighting, and noise would disturb and likely displace some listed wildlife, including those using newly created marsh or open water areas or nearby grasslands, an adverse impact on listed species.

Jamaica Bay Wildlife Refuge

Allowing visitor access to Canarsie Pol or to Big Egg Island would have the potential for adverse impacts on feeding or nesting night-herons or shorebirds from disturbance.

Park Sites on the Rockaway Peninsula

Alternative B plans new lodging, camping, environmental education, and development of the parade ground and reuse of buildings to bring many new daytime and overnight visitors to Fort Tilden and the adjacent Jacob Riis Park. Grassland habitat here is used by birds and small mammals and is a source of rest and food for migrating raptors. Several raptors are state listed and may experience disturbance or even displacement from traditional feeding and resting grounds along their migration because of visitors using the new facilities at Fort Tilden. The same is possibly true for feeding shorebirds, which because of the presence of and sensitivity to humans, would avoid using a known source of invertebrates in the splash zone of Fort Tilden.

Staten Island Unit

The primary proposed activity at this unit under alternative B that could impact wildlife is the use of Hoffman Island for visitors. Alternative B also anticipates blueways along the coast of both Hoffman and Swinburne Islands. Before making a decision, the park would study the potential for impacts on wildlife, including on heron rookeries where it is possible that listed night-herons nest. However, wading birds like herons, ibis, and egrets are sensitive to human disturbance, as described in the “Wildlife” section of this chapter. If listed herons or other species of management concern are present at Hoffman Island, adequate buffers for both boats and visitors on foot would be needed to prevent disturbance. It is likely that the park would also impose a restriction on visitors so they cannot visit the island between March 15 and August 31. Otherwise, localized impacts on energetics, resilience, and nesting success could be substantial, and the rookeries may be in danger of abandonment.

Sandy Hook Unit

Development of facilities and amenities, including trails, boat launch sites, and camping, are proposed in alternative B. At the same time, access to sensitive or rare habitats, including some rare vegetation associations, would be controlled, and beach nourishment on the bayside would occur to slow shoreline erosion. Camping and trails in the Horseshoe Cove area could require removal of saltmarsh habitat or result in indirect adverse impacts from erosion.

On the ocean side, the addition of yurts or cabins on or adjacent to beaches could affect shorebirds like the piping plover or least tern. Currently, protected areas at Sandy Hook alternate with open recreational public beaches, particularly in the southern half of the site. Although adding cabins or yurts to these recreational beaches would not necessarily directly impact listed species, the addition of overnight visitors who may walk the beach in the evening or early morning when visitation is currently very low could have adverse impacts on shorebirds. Piping plovers are highly sensitive to the presence of humans, and the park currently employs a variety of intensive management efforts to keep people and predators away from nesting birds. Even so, beachgoers, dogs, large moveable objects such as kites or sails, fireworks, or other human disturbances cause piping plovers to flush from their nests, increase alert behavior, decrease foraging, and even abandon otherwise suitable nesting sites (NPS 2004f). A 2004 biological assessment of impacts on piping plovers at Sandy Hook concluded that the presence of people at the beaches of Sandy Hook may be deterring piping plovers from using a larger percentage of the site. The addition of structures and overnight visitors would worsen impacts from visitor use by increasing disturbance and potentially causing birds to abandon an even larger portion of the beach.

Additional adverse impacts on shorebird feeding would result from the development and use of boat launches, trails, and additional campsites on the bay side, because this is where adults often feed. Terrapins and horseshoe crabs could also experience adverse effects from this development and the additional visitors it would bring. Any impact on horseshoe crabs would also have an indirect impact on the state-listed red knot, because this species depends solely on the eggs of horseshoe crabs to sustain its long migration.

Cumulative Impacts

Impacts of outside actions that contribute to cumulative impacts (i.e., those not related to alternative B) on species of special concern are the same as described under alternative A. However, alternative B would have the potential for more intensive contributions to adverse cumulative impacts from habitat loss associated with increased development, such as at Fort Tilden or Sandy Hook, or from allowing visitor use of marsh islands or Hoffman Island. The same is true of benefits, because alternative B would include the creation of saltmarsh and freshwater wetland habitat and increased efforts to restore Jamaica Bay saltmarsh and improve water quality, both of which could have noticeable beneficial offsetting impacts for adverse cumulative impacts on habitat for listed plants or animals in the Jamaica Bay watershed. Adverse cumulative impacts from alternative B would also be noticeable, and greater than those described for alternative A.

Conclusion

Beneficial impacts on listed species would come from restoring natural sand transport processes, creating wetland or open water habitat, working with partners to research and apply results to create saltmarsh habitat and restore water quality, maintaining West Pond as a saltmarsh environment, mowing to maintain an existing large grassland, and continuing restrictions and protection of listed species through fencing, buffers, and closures. Listed species are both unique and listed by CEQ as important to consider in their own right

when determining whether impacts are considered significant. The New York City area is urbanized and the park may provide the only habitat, or a large portion of the habitat, for a listed species in the area. For these reasons, creating additional habitat and protecting listed species from disturbance or direct losses could each have significant beneficial impacts.

Adverse effects would come from continued visitor use, which is unrestricted in some areas where listed species habitat exists, and from increases in trails or other small-scale visitor amenities. Visitor use could result in trampling of plants or harassment, energy losses, and reduced nesting success in shorebirds where visitors do not follow restrictions or are allowed in park sites where nesting could take place. This could be a take under the Endangered Species Act and a significant adverse impact on some species such as seabeach amaranth or piping plovers, requiring consultation and approval by the USFWS.

Substantial facility development and increased visitor use in Floyd Bennett Field and Fort Tilden under alternative B would have the potential for adverse localized impacts on listed species, as could allowing visitors to some Jamaica Bay islands. Increasing recreational amenities at Sandy Hook could have adverse effects on shorebirds by increasing visitor use at both the bay and ocean sides of the site.

Cumulative adverse impacts on listed species include habitat loss, pollution, recreation or other visitor uses, increases in feral predator populations and climate change. Increases in sea level can swamp and kill species of special concern or damage or destroy shorebird and terrapin nests, and rapid increases in temperature can particularly adversely affect specialists or vulnerable rare species like terrapins or key species like horseshoe crabs.

In sum, alternative B could have both significant beneficial and adverse impacts compared to no action. It would contribute noticeable adverse cumulative impacts from visitor use and development and noticeable beneficial cumulative impacts from continuing protection measures and adding saltmarsh, grassland, and wetland habitat restoration.

Alternative C: Experiencing Preserved Places

Impacts of Alternative C

Generally, impacts on wildlife from facilities development and use and from increased visitation would be somewhat reduced under alternative C compared to alternative B, although they would still be greater than under alternative A and could result in localized adverse impacts on listed species related to habitat loss and/or disturbance. This is true for Floyd Bennett Field, Bergen Beach, Jacob Riis Park and Fort Tilden, and Sandy Hook.

Jamaica Bay Unit

Plumb Beach

No impacts beyond those discussed for actions common to both alternatives B and C would occur to listed species.

Floyd Bennett Field

Alternative C would include some development of Floyd Bennett Field for visitor-related activities and an increase in visitor use. These additional people, cars, night lighting, and noise would disturb and likely displace some listed wildlife, including those using newly created marsh or open water areas or nearby grasslands, an adverse impact on listed species that would be less than under alternative B.

Beneficial impacts on wildlife from creating wetlands at Floyd Bennett Field could be greater than under alternative B, because additional created acreage is proposed under alternative C.

Jamaica Bay Wildlife Refuge

No impacts from actions specific to alternative C would occur.

Park Sites on the Rockaway Peninsula

Small-scale development at Fort Tilden could disturb and/or displace listed species, including piping plovers or seabeach amaranth, which are currently not occupying otherwise suitable habitat at this park site at beach and dune sites showing evidence of heavy trampling and use. Protection and enhancement of rare habitat at Breezy Point Tip could also continue to provide or improve habitat quality and reduce the potential for human disturbance or displacement of wildlife. In addition to being an important resting and feeding site for migratory birds, Breezy Point Tip provides shorebird nesting habitat for several species of special concern, as well as a number of rare vegetative communities. Increasing protection of these areas and working to improve habitat quality could provide substantial localized benefits for listed wildlife.

Staten Island Unit

Impacts from alternative C on listed species would either be the same as under the no-action alternative (at Fort Wadsworth and Hoffman and Swinburne Islands) or as described for actions common to alternatives B and C (Miller Field), with the exception of Great Kills Park. Areas of this park site are currently closed for radon remediation, but have been used in the recent past for sports and recreation. Alternative C would zone these areas as natural and restrict visitor use to walking trails and some camping. It would also restore beach, dune, and upland vegetation at this park site, with potential benefits for listed plants or wildlife.

Sandy Hook Unit

Alternative C would add a protective subzone for many of the areas in Sandy Hook, including Spermaceti Cove and much of the central/southern oceanfront. These and other important wildlife areas at Sandy Hook (including shorebird nesting locations in the north and along the central/southern coast, as well as saltmarsh and rare vegetative communities along Horseshoe Cove and Spermaceti Cove and American holly or other maritime forest

associations) would be kept as natural areas and become the sites for targeted restoration efforts. Protection and restoration would be greater than is currently the case, with potential localized beneficial impacts on listed beach and dune plants and animals.

Cumulative Impacts

Impacts of outside actions that contribute to cumulative impacts (i.e., those not related to alternative C) on species of special concern are the same as described under alternative A. Alternative C may contribute noticeable adverse impacts from continuing and adding to visitor use and from small-scale habitat loss associated with increased development. The beneficial contribution of alternative C would be the same as for alternative B, and includes the creation of saltmarsh and freshwater wetland habitat, increased efforts to restore Jamaica Bay saltmarsh and improve water quality, and the potential for holistic freshwater wetlands created in appropriate locations in the Jamaica Bay Unit. Each of these actions would have noticeable beneficial offsetting impacts for cumulative impacts on wildlife habitat in the Jamaica Bay watershed.

Conclusion

Beneficial impacts on listed species would come from restoring natural sand transport processes, creating wetland or open water habitat, working with partners to research and apply results to create saltmarsh habitat and restore water quality, maintaining West Pond as a saltmarsh environment, mowing to maintain an existing large grassland, and continuing restrictions and protection of listed species through fencing, buffers, and closures. Listed species are both unique and listed by CEQ as important to consider in their own right when determining whether impacts are considered significant. The New York City area is urbanized and the park may provide the only habitat, or a large portion of the habitat, for a listed species in the area. For these reasons, creating additional habitat and protecting listed species from disturbance or direct losses could each have significant beneficial impacts.

Adverse effects would come from continued visitor use, which is unrestricted in some areas where listed species habitat exists, and from increases in trails or other small-scale visitor amenities. Visitor use could result in trampling of plants or harassment, energy losses, and reduced nesting success in shorebirds where visitors do not follow restrictions or are allowed in park sites where nesting could take place. This could be a take under the Endangered Species Act and a significant adverse impact on some species such as seabeach amaranth or piping plovers, requiring consultation and approval by the USFWS.

The small-scale facility development and increased visitor use in Floyd Bennett Field and Fort Tilden, as well as at the newly planted Pennsylvania Avenue and Fountain Avenue Parks in the Jamaica Bay Unit, would have the potential for adverse localized impacts on listed species under alternative C.

Cumulative adverse impacts on listed species include habitat loss, pollution, recreation or other visitor uses, increases in feral predator populations, and climate change. Increases in sea level can swamp and kill species of special concern or damage or destroy shorebird and terrapin nests, and rapid increases in temperature can particularly adversely affect specialists or vulnerable rare species like terrapins or key species like horseshoe crabs.

In sum, alternative C could have both significant beneficial and adverse impacts compared to no action, although adverse impacts from development and increased visitor use would be less than alternative B. It would also contribute noticeable adverse and beneficial cumulative impacts.

Cultural Resources

Laws and Policies

The NPS is charged with management and protection of cultural resources through a variety of guidance documents, policy, and legislation followed by NPS managers to avoid or minimize, to the greatest degree practicable, adverse impacts on park resources and values. Cultural resources are nonrenewable and adverse impacts can consume, diminish, or destroy these resources in such a way that they cannot be recovered. In addition to the National Environmental Policy Act (NEPA), for which this document has been prepared, the primary regulatory and policy framework for cultural resources managed by the NPS includes the following:

Director's Order 28: ***Cultural Resources Management Guidelines*** (NPS 1998a) is the fundamental guidance document for the management of cultural resources in the national park system and contains park management standards and other requirements for cultural resources.

Director's Order 28A: ***Archeology*** (NPS 1998b) provides a common management framework for planning, reviewing, and undertaking archeological activities and other activities that may affect archeological resources in the national park system.

NPS ***Management Policies 2006*** (NPS 2006a) outlines NPS management policies for cultural resources including the identification and evaluation of cultural resources, the integration of this information in planning and decision making, and the stewardship to ensure that cultural resources are preserved and protected.

The **National Historic Preservation Act, as amended,** provides a legislative framework for the preservation and management of cultural resources. Section 110 of the National Historic Preservation Act directs federal agencies to establish preservation programs for the identification, evaluation, and nomination of historic properties to the National Register of Historic Places (National Register). Section 106 of the act requires all federal agencies to consider the effects of their actions on historic properties. Compliance with section 106 of the National Historic Preservation Act is being conducted as a separate effort and is not included in this analysis.

Executive Order 11593, "Protection and Enhancement of the Cultural Environment," requires federal agencies to support the preservation of cultural properties they manage and to direct their policies, plans, and programs in such a way that federally owned sites, structures, and objects of historical, architectural, or archeological significance are preserved, restored, and maintained. Agencies are required to locate, inventory, and

nominate all properties under their jurisdiction or control that appear to qualify for listing in the National Register. It also directs agencies to reconsider any plans to transfer, sell, demolish, or substantially alter any property determined to be eligible for the National Register and to afford the Advisory Council on Historic Preservation an opportunity to comment on any such proposal.

Gateway's enabling legislation includes the provision of appropriate programs for the preservation, restoration, interpretation, and use of historic properties (16 USC 1).

The ***Programmatic Agreement Among the NPS, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers*** (Service-wide Programmatic Agreement) (NPS et al. 2008) provides coordination between the NPS, the Advisory Council on Historic Preservation, and the National Conferences of State Historic Preservation Officers for the section 106 process, providing a roadmap to minimize adverse effects to cultural resources resulting from day-to-day operations, management and administrative undertakings.

The ***Archaeological Resources Protection Act*** of 1979 complements requirements of the Antiquities Act through the strengthening of the permitting process for conducting archeological fieldwork on federal and Indian lands, establishing more rigorous fines/ penalties for unauthorized excavation on and removal of resources from federal and Indian lands, and prohibiting public disclosure of the nature and location of archeological resources on federal and Indian lands.

Mitigation Measures

The laws and policies detailed above have given rise to a standardized set of mitigation measures that would apply regardless of the alternative. These apply to historic district, historic structures, archeological resources, and cultural landscapes and include the following:

- In the event of new cultural resource discoveries made during the implementation of the GMP, the park will initiate consultation with the appropriate SHPO in compliance with section 106 of the National Historic Preservation Act.

- Should human remains or funerary or sacred objects be encountered, work will immediately cease and the park staff will notify and consult with appropriate American Indian Tribes as required under the Native American Graves Protection and Repatriation Act of 1990 (NPS 2003c, 51–52).

- Unless otherwise stated, the Secretary of the Interior's Standards will guide work affecting any historic properties. The standards include, among others:
  - Secretary of the Interior's Standards for the Treatment of Historic Properties (NPS 1992)
  - Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes (NPS 1996)
  - Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation

- Secretary of the Interior's Standards and Guidelines for Architectural and Engineering Documentation
- Professional Qualifications Standards

- Where they exist (also see the "Affected Environment" chapter), cultural landscape reports will be used to provide guidance for work in historic districts / cultural landscapes. These reports contain treatment guidelines for all aspects of the cultural landscape, including spatial organization, natural systems and features, land use, circulation, topography, buildings and structures, vegetation, and small-scale features.

- When historic properties, identified in the Ruins Subzone, are left unmanaged and are expected to deteriorate and decay, additional section 106 consultation will take place to identify mitigation measures as outlined in the section 106 Programmatic Agreement developed for this GMP.

Impact Analysis for Cultural Resources

This document includes analysis of impacts on historic districts and historic structures, archeological resources, and museum collections. The topic of ethnographic resources was dismissed because it was determined that there would be no impact or a negligible impact on these resources as a result of the implementation of the GMP/EIS.

Fundamental resources are presented at the beginning of the analysis sections for each cultural resource type. Please refer to the "Affected Environment" chapter for information on resources that have been identified as fundamental for Gateway.

The following assumptions have been made for the evaluation of impacts on cultural resources:

- Compliance with section 106 of the National Historic Preservation Act for actions proposed in this GMP/EIS is being completed through a separate process and will be guided by a Programmatic Agreement currently being developed between the NPS and the New Jersey and New York SHPOs.

- Most of the park's historic structures fall within the boundaries of and are integral to the park's nine historic districts. For this reason, analysis of historic structures is included in that of historic districts.

- Archeological resources are finite, non-renewable resources. Impacts on these resources have the potential to cause irretrievable loss. Ground-disturbing activities have the potential to disturb archeological resources. This can be caused by any action that breaks the soil surface—vegetation management (planting, etc.), grading, excavation, structure removal, or trenching—or as a result of natural factors such as storms. The potential to affect buried, intact archeological resources is dependent on the natural processes that have shaped the area as well as the history of land use of the area (for instance, whether it has it been filled/graded).

- Many of Gateway's cultural resources sustained damage from Hurricane Sandy in the fall of 2012. Damage assessments and management recommendations are ongoing. Detailed resource-specific condition information is not yet complete. Preliminary information to date suggests that almost all of the park's historic properties that are listed in, have been determined eligible for, or are considered eligible for listing in the National Register are assumed to retain their NRHP status.

Historic Districts and Historic Structures

Historic districts and their contributing historic structures are presented together in this analysis under the category of Historic Districts (see the "Methods" section below). Historic districts are resources that possess a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development (NPS 1998a). Nine historic districts have been recorded inside the park boundaries. Historic structures include buildings, bridges, roads, forts and associated earthworks, monuments, ruins, and other manufactured objects that extend the limits of human capability.

All of the fundamental cultural resources identified for Gateway—those that are critical to maintaining the park's purpose and significance—fall within three historic districts. All historic districts are listed below.

Historic districts containing fundamental resources:

- Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District (also referred to as Fort Hancock and Sandy Hook Proving Ground)—Fundamental resources include Endicott/Taft-era batteries, the parade ground, the Nike Missile Launch Site / Radar Site, the Sandy Hook Lighthouse, and the Spermaceti Cove Life Saving Station.

- Fort Tilden Historic District—Fundamental resources include Battery Harris and the Nike Missile Launch Site.

- Fort Wadsworth Historic District—Fundamental resources include Battery Weed, Endicott/ Taft-era batteries, Fort Tompkins, and the torpedo-storage building.

Other historic districts:

- Floyd Bennett Field Historic District
- Miller Army Air Field Historic District (also referred to as Miller Field)
- Jacob Riis Park Historic District
- Silver Gull Beach Club Historic District
- Breezy Point Surf Club Historic District
- Far Rockaway Coast Guard Station Historic District

Laws and Policies

The primary regulatory and policy framework for historic districts managed by the NPS

includes the following:

- Director's Order 28: *Cultural Resources Management Guidelines*
- NPS *Management Policies 2006*
- The National Historic Preservation Act
- Executive Order 11593, "Protection and Enhancement of the Cultural Environment"
- Enabling Legislation, Gateway National Recreation Area
- Service-wide Programmatic Agreement

Methods

Information on Gateway's historic districts and their contributing historic structures and associated landscapes was obtained through the review of historic district nomination forms, determination of eligibility documentation, cultural landscape reports, cultural landscape inventories, landmark designation documentation, the park's List of Classified Structures (LCS), historic structure reports, general Gateway history overview documents, and project-specific reports addressing historic districts.

Cultural landscapes are often associated with historic districts and are defined as geographic areas associated with a historic event, activity, or person (refer to the "Affected Environment" chapter). In the case of Gateway, cultural landscape reports documenting landscape features and providing management guidance exist for five of the park's nine historic districts. Anticipated use of this important information to guide work within cultural landscapes is described under "Mitigation Measures."

Historic districts are placed in the National Register when it has been determined that they possess significance in their ability to convey historical, architectural, archeological, engineering, or cultural values. Districts can contain buildings, structures, sites, objects, or open space that demonstrate a continuity of elements that are united historically or aesthetically by plan or physical development. Not all elements within the defined geographic boundary of a historic district must be determined to contribute to the district's significance, but the majority of components that add to the district's character must possess integrity, as must the historic district as a whole (NPS 1990a).

Gateway manages over 550 historic structures, which make up the primary components of the historic districts of the park. Impacts on these resources are integrally connected with and critical to the significance of historic districts. Contributing resources can become non-contributing resources through inappropriate modification/alteration, if they are moved from their original locations, if they have deteriorated to the point where their integrity is lost, etc. For this reason, they have been integrated into the analysis of impacts on historic districts.

Impacts on historic districts and historic structures anticipated by the implementation of the Gateway GMP are related to removal or alteration of contributing elements (e.g., structures), as well as to the implementation of the park's management strategies for each historic district and the contributing resources included in each district.

The resource-specific context for assessing significance of impacts on historic districts (including historic structures) includes the following:

- The ability of a historic district to continue to represent and convey historical events and themes determined to be fundamental to Gateway—these themes are related primarily to military, aviation, and maritime history

- The degree to which the National Register significance and integrity of historic districts containing fundamental resources—those vital to the park's purpose and significance—is retained as the plan is implemented

- The degree to which the proposed management of historic districts, national historic landmarks, and historic structures complies with the park's enabling legislation by providing for appropriate programs for preservation, restoration, interpretation, and use of important cultural resources

- The degree to which proposed management of historic districts, national historic landmarks, and historic structures complies with section 110 of the National Historic Preservation Act regarding the preservation and use of historic properties to the maximum extent feasible

Alternative A: No Action

Impacts of Alternative A

Under the no-action alternative, historic districts/landmarks, cultural landscapes, historic structures, archeological resources, and museum collections would continue to be managed through maintenance and repair where feasible and when funding becomes available. Many vacant buildings would continue to deteriorate. Basic protections related to existing legislation and NPS policies would continue. Museum collections and archives would be maintained in their current locations. Assessing and/or repairing damage to cultural resources related to Hurricane Sandy is being prioritized; although measures taken as a result of the storm may be mentioned in this GMP/EIS, they are not analyzed because much of this work continues outside the GMP.

The following presents an analysis of historic districts containing fundamental resources (historic structures) first, followed by other historic district resources in the park.

Historic Districts Containing Fundamental Resources

The Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District is composed of over 200 contributing structures, including Endicott- and Taft-era batteries related to the coastal defense of New York Harbor. Under the no-action alternative, Endicott-era batteries Potter, Gunnison, and Mortar would continue to be maintained, stabilized, and interpreted as funding is available. A recent assessment of Batteries Potter and Gunnison describes their general pre–Hurricane Sandy condition as fair to poor, with storm damage ranging from none to moderate (appendix B). The continuing maintenance and stabilization that are currently taking place at the batteries would result in direct long-term beneficial impacts on the individual historic structures, as well as on the historic district. However, should funding be unpredictable or insufficient, this strategy would result in long-term direct adverse impacts on these structures and the larger historic district. Mitigation measures would lessen the impacts but they would remain adverse.

Some Endicott- and Taft-era batteries (Morris, Urmston, Peck, Arrowsmith [already defined as a ruin], Kingman, and Mills) at Fort Hancock and Sandy Hook Proving Ground would remain in their current state, without additional maintenance/stabilization. A recent assessment of these batteries describes their general pre–Hurricane Sandy condition as ranging from poor to serious, with storm damage ranging from none to minimal (appendix B). Left unmanaged, these structures can be expected to deteriorate further over time, resulting in possible loss of integrity and their contributing status to the historic district, a long-term direct adverse impact on both the historic district and the individual historic structures. Mitigation measures would have the potential to lessen the impact but it would remain adverse.

The Nike Missile Launch Site at Fort Sandy Hook Proving Ground continues to be threatened by erosion; maintenance of both the radar and launch sites occurs as funding is available. A recent assessment of the launch and radar site facilities describes their general pre–Hurricane Sandy condition as ranging from poor to good, with storm damage ranging from minimal to moderate (appendix B). The uncertainty of the timing and degree of maintenance that would occur in the future would have the potential to result in further deterioration of the resources, possibly jeopardizing their contributing status to the historic district. This situation would result in direct long-term adverse impacts on both the historic district and the individual historic structures. Mitigation measures would have the potential to lessen the impacts.

Under the no-action alternative, the park would continue to explore the best methods for the maintenance, stabilization, and rehabilitation of Fort Hancock buildings. The Fort Hancock 21st Century Advisory Committee would continue to advise the park on future preservation and potential uses for Officers' Row, the parade ground, and select other buildings. Most of the buildings are described as being in poor condition, although the condition of two of the buildings is listed as fair (History House, Lieutenants' Quarters 1) and the condition of one is listed as good (Lieutenants' Quarters 18). Damage sustained from Hurricane Sandy ranged from minimal to moderate (appendix B). The continued efforts to

The Sandy Hook Lighthouse and the Spermaceti Cove Life Saving Station, individually designated as national historic landmarks, would continue to be maintained in good condition under the no-action alternative.

identify and use the best methods for maintenance, stabilization, and restoration of these buildings would be considered a long-term benefit both to the historic district and to the individual historic structures.

The Sandy Hook Lighthouse and the Spermaceti Cove Life Saving Station, individually designated as national historic landmarks, would continue to be maintained in good condition under the no-action alternative. Prior to Hurricane Sandy, the Sandy Hook Lighthouse was considered to be in fair condition and the Spermaceti Cove Life Saving Station was listed as being in good condition. The Sandy Hook Lighthouse sustained no apparent damage from the storm, whereas the lifesaving station sustained moderate damage (appendix B) and will require repairs. The continued maintenance of these two important historic structures would be a direct long-term benefit to the historic district, as well as to the individual structures.

From the early 20th century, Fort Tilden functioned as an integral part of the New York Harbor coastal defense system, complementing the defensive capabilities present at Fort Wadsworth and Fort Hancock and Sandy Hook Proving Ground. Under the no-action alternative, Taft-era Batteries Kessler, Harris, and Construction 220 at Fort Tilden would remain unmanaged and continue to deteriorate and become overgrown with vegetation. Both Battery Kessler and Battery Construction 220 were assessed as in poor condition prior to Hurricane Sandy and sustained minimal to moderate storm damage. Battery Harris was listed as in fair condition prior to Hurricane Sandy and was not impacted by the storm (appendix B). All these batteries contribute to the significance of the historic district and under this alternative, the lack of systematic maintenance and stabilization actions would result in the further deterioration of the structures. Batteries Kessler and Construction 220 would be at risk of more rapid decline as a result of their oceanside location. Absent ongoing and systematic maintenance and stabilization, impacts on these resources would be expected to be direct, long term, and adverse for both the historic district and the individual historic structures. Mitigation measures would have the potential to lessen the impacts but they would remain adverse.

The Fort Tilden Nike Missile launch site, once an integral part of an important surface-to-air defense program located in the New York Harbor area, would continue to be used as a maintenance yard under the no-action alternative. The launch site is considered to be in poor condition but does not appear to have been affected by Hurricane Sandy (appendix B). Its current use would continue to detract from the historic significance of the structure and the larger historic district and hamper its interpretation. This ongoing situation would be considered a direct adverse impact on both the historic district and the launch site itself.

Along with Fort Hancock and Sandy Hook Proving Ground and Fort Tilden, Fort Wadsworth has been associated with the coastal defense system of New York Harbor for some 200 years. Under the no-action alternative, 11 batteries would continue to be unmanaged by the park, including Catlin, Bacon, Turnbull, Barbour, Hudson, Mills, Dix, Upton, Barry, Richmond, and Ayers. They are collectively included in a separate National Register listing (NPS 1985), as well

as contributing to the significance of the larger historic district (NPS n.d.b). The batteries continue to be overgrown with vegetation and some are fenced off due to safety concerns. They would not undergo specific stabilization treatment under this alternative. All but one of these was considered to be in either serious or poor condition prior to Hurricane Sandy; storm damage to the structures ranged from no apparent impact to moderate impacts. Battery Duane is considered to be in fair condition and sustained no apparent impact from the hurricane (appendix B). Left unmanaged, these already compromised resources would be expected to deteriorate further, a notably long-term adverse impact on both the historic district and the individual historic structures. Mitigation measures would have the potential to lessen the impact but it would remain adverse.

At the same time, the removal of vegetation from selected batteries at Fort Wadsworth would occur. Because vegetation growing unchecked on batteries can destabilize the structures, its removal is considered a direct benefit to both the historic district and the individual historic structures. This benefit would likely delay the ultimate deterioration of the batteries expected from the lack of maintenance and stabilization efforts.

Under this alternative, stabilization and preservation efforts for Battery Weed and Fort Tompkins (Fort Wadsworth) would continue when funding is available. Battery Weed is one of the earliest structures remaining in its entirety in the historic district; Fort Tompkins remains an outstanding example of third system military architecture. Both are listed separately in the National Register and also contribute to the significance of the larger historic district. Prior to Hurricane Sandy, they were both listed as being in fair condition. Although storm impacts were described as minimal, a recent assessment (appendix B) included specific damage related to Battery Weed and its associated seawall. The continuing stabilization and preservation efforts under the no-action alternative would equate to direct and long-term benefits to Battery Weed and Fort Tompkins and the larger historic district. However, if funding is not sufficient and unpredictable, direct long-term adverse impacts could also be expected.

Other Historic Districts

The Floyd Bennett Field Administration Building, currently used as the Ryan Visitor Center, would continue to be rehabilitated for visitor and park operation purposes. Hangars 1 and 2 would continue to be stabilized under a lease with a private energy company. These efforts would result in long-term benefits both to the historic district and to the individual historic structures.

The park continues to work with New York City to reestablish native tree species in the Floyd Bennett Historic District. Some aspects of vegetation are believed to contribute to the Floyd Bennett Field cultural landscape. Using vegetation-related guidance provided in the cultural landscape report (Cody and Auwaerter 2009) would result in long-term benefits to the historic district.

The continuing stabilization and preservation efforts under the no-action alternative would equate to direct and long-term benefits to Battery Weed and Fort Tompkins and the larger historic district.

Cumulative Impacts

Cumulative impacts on cultural resources occur incrementally as impacts unrelated to those proposed under this GMP/EIS take place, regardless of what agency (federal or non-federal) or person undertakes those actions. A description of projects and actions within and around the park that have had or have the potential to result in cumulative impacts on historic districts and historic structures follows.

Dating primarily to the 19th century and later, historic land uses of the area within and surrounding the currently designated park boundaries have undoubtedly resulted in a wide variety of impacts on historic districts and their historic structures. The alteration/destruction of historic structures through time has likely altered the presence, composition, and integrity of historic districts in the park. Numerous historical development activities—primarily grading and landfilling—over the decades in areas that are now designated as Gateway have almost certainly destroyed or buried an unknown number of historic structures or their remnants (for instance, foundations). A variety of infrastructure projects—roads, sewer/water facilities, utility transmission lines, etc.—have also likely resulted in the loss of an unknown number of historic structures in the New York Harbor area. It is possible that some of these lost resources would have been located in areas now designated historic districts/landmarks in the park, or that they could have been components of other historic districts. Such losses of unknown magnitude are considered direct adverse cumulative impacts on the historic districts and historic structures of Gateway.

The NPS has been managing much of the park for over 40 years with a focus on the preservation of its historic properties in compliance with their enabling legislation. A variety of park projects have contributed to the maintenance, stabilization, preservation, and adaptive reuse of historic structures and cultural landscapes within and outside the park's historic districts. Collectively, these preservation efforts have resulted in cumulative benefits to historic districts in the park.

Natural processes (erosion, wave action, wind, storm surges) over the past several hundred years have undoubtedly resulted in the loss of an unknown number of potentially historic properties in and around the park that may have contributed to existing or additional historic districts. These losses would be particularly pronounced along the New York Harbor coastline environments, which are subject to more damaging impacts of wind and water than are areas farther inland. It is unknown how many historic resources that may have contributed to the park's historic districts have been lost due to natural processes, but these processes are considered to have had an adverse cumulative impact on the park's historic districts and historic structures.

The effects of climate change on the New York Harbor area are a result of the combination of sea-level rise, and projected possible extreme precipitation events, heat waves, and increases in severe winds and other weather phenomena. A number of cultural resources have sustained damage over the past few decades because of extreme weather events (such as winds and storm surges). These include historic districts containing the park's fundamental resources—Fort Hancock and Sandy Hook Proving Ground, Fort Wadsworth, and Fort

Tilden—as well as most other historic districts. In the fall of 2012, Hurricane Sandy's winds and storm surge resulted in considerable damage to cultural and natural resources of the park, as well as to major infrastructure facilities. The storm, in addition to many others in the past, is a reminder of the importance of considering such future events in the responsible planning for the management of the park's cultural resources.

Other agency projects located in areas surrounding the park have been or will be completed in the future, potentially adding incremental impacts to the park's historic districts and historic structures. This could occur if historic structures or historic districts associated with and/or complementary to the history and themes reflected by park resources have been or will be impacted by these projects. For instance, a variety of recreation, environmental restoration/enhancement, and development projects proposed by New York City (Vision 2020 plan, New York City Waterfront Action Agenda) (NYCEDC n.d.; NYCDCP 2011) could potentially impact historic properties in areas surrounding park lands. Undoubtedly, past projects have affected an unknown number of cultural resources in these areas. Many of these development actions are assumed to have resulted in or would result in some degree of ground disturbance, potential impacts on archeological resources, and possible impacts on historic structures through removal and alteration. If potentially historic properties have been or will be damaged, demolished, or modified in inappropriate ways, indirect adverse cumulative impacts are assumed. Conversely, if cultural resources encountered during project implementation have been or are preserved and/or rehabilitated for use, long-term indirect benefits to the cultural resources of the park are expected.

It is believed that the continuing management actions under the no-action alternative would contribute noticeable adverse increments to the cumulative impacts on historic districts and historic structures. Beneficial cumulative impacts on historic districts and historic structures under this alternative are believed to be imperceptible in scope.

Conclusion

Under the no-action alternative, beneficial impacts on historic districts would be realized through the continuing maintenance and stabilization of historic structures (batteries, the Sandy Hook Lighthouse, and the Spermaceti Cove Life Saving Station), primarily within historic districts containing fundamental resources. Benefits to other historic districts derive from rehabilitation of historic structures and vegetation management (Floyd Bennett Field).

At the same time, a variety of adverse impacts on historic districts would be expected, resulting primarily from the lack of management of historic structures in historic districts. It is likely that under this management strategy, fundamental resources of the park and other contributing resources of historic districts would be degraded or lost. The fundamental resources of the park expected to be adversely impacted under this alternative are associated primarily with military history and the coastal defense of New York Harbor over the past 150 years. These include over 20 Endicott- and Taft-era batteries and Nike Missile sites at Fort Hancock and Sandy Hook Proving Ground and Fort Tilden. These adversely affected resources are considered non-renewable and their loss would be permanent.

The National Historic Preservation Act (section 110) and the NPS *Cultural Resource Management Guidelines* (NPS 1998a) strongly discourage the neglect or demolition of National Register properties. Appropriate documentation and consultation, as required under the National Historic Preservation Act, would partially mitigate the loss of unmanaged historic properties. Still, many of the fundamental resources located in some of the park's historic districts would be directly and adversely impacted, hampering the park's ability to maintain the integrity of historic districts in ways that convey the important events and themes of the park. The loss of these resources would also have the potential to affect the National Register listing (loss of contributing properties, integrity, etc.) of historic districts at Fort Hancock and Sandy Hook Proving Ground, Fort Tilden, and Fort Wadsworth. In addition, the intent of the park's enabling legislation regarding the preservation, restoration, interpretation, and use of significant historic properties would not be fulfilled as a result of the loss of fundamental resources. Historic districts not containing resources considered fundamental to the park would not be expected to experience the same level of impacts, although direct impacts on these resources would still be considered adverse. The majority of beneficial impacts expected for all historic districts would be expected to be limited in scope, with the exception of the maintenance of the Sandy Hook Lighthouse and the Spermaceti Cove Life Saving Station. Although beneficial impacts are expected to occur for the Fort Wadsworth Historic District (stabilization/preservation of Battery Weed and Fort Tompkins), this alternative also proposes that 11 Endicott-era batteries go unmanaged within the historic district. Beneficial impacts are not believed to be sufficient to mitigate the substantial adverse impacts expected on fundamental resources in historic districts related to the potential loss of fundamental resources under this alternative.

Implementation of the no-action alternative would result in a higher level of continuing adverse impacts on the park's historic districts, particularly those containing fundamental resources, when compared to the action alternatives. The impacts on historic districts anticipated under the no-action alternative would be considered a significant and permanent adverse impact on cultural resources. The impacts of activities under this alternative, coupled with the past, present, and future projects noted, would likely result in noticeable adverse cumulative impacts on historic districts.

Impacts on historic structures anticipated under the no-action alternative would be considered a significant adverse impact on cultural resources. The impacts of activities under this alternative, coupled with the past, present, and future projects noted, would likely result in noticeable adverse cumulative impacts on the park's historic structures.

Common to Both Action Alternatives

Impacts of Alternatives B and C

Impacts related to actions common to both action alternatives on historic districts containing historic structures considered fundamental to the park's purpose and significance are discussed first, followed by a discussion of other historic districts.

Historic Districts Containing Fundamental Resources

Cultural resource management under the action alternatives would be more focused on long-term preservation, research, and interpretation of fundamental coastal defense and maritime resources compared to the no-action alternative. The Fort Hancock 21st Century Advisory Committee would continue to advise the park on future preservation and potential uses for Officers' Row, the parade ground, and select other buildings. A small number of associated batteries in the Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District would be stabilized and interpreted for visitors. The Sandy Hook Lighthouse and the Spermaceti Cove Life Saving Station, also considered fundamental resources, would also be maintained. The involvement and guidance provided by the Fort Hancock 21st Century Advisory Committee, the stabilization of batteries, and the maintenance of the Sandy Hook Lighthouse and the lifesaving station would result in considerable long-term direct benefits to the historic district, as well as to the individual historic structures that contribute to its significance.

Under both action alternatives, the removal of invasive vegetation threatening coastal batteries and other fundamental cultural resources would be increased, resulting in benefits to these important resources, many of which are considered fundamental to the park. Because vegetation growing unchecked on batteries can destabilize the structures, its removal would be considered a direct benefit both to the historic districts and to the individual historic structures that contribute to their significance.

Certain historic structures would be stabilized under both action alternatives, including many of those considered fundamental to the park and located in historic districts (for instance, Battery Harris at Fort Tilden). This action would be considered a long-term direct benefit for the individual historic structures as well as for the historic districts in which they are located.

Both action alternatives propose new lodging/camping development within the Fort Tilden Historic District through the rehabilitation/reuse of historic buildings surrounding the parade ground. The parade ground is a feature of the landscape within the historic district. The rehabilitation and reuse of these historic structures would be a long-term benefit to the historic district and the contributing historic structures. The *Fort Tilden Cultural Landscape Report* (Selvek 2005) will be used to guide planning for the adaptive reuse proposals, resulting in a positive impact.

Portions of the Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District, Fort Tilden Historic District, and Fort Wadsworth Historic District are zoned as "historic" under both action alternatives (see chapter 2). The zone includes fundamental and historic sites, structures, and landscapes important to the park's purpose and significance and varies slightly in size between the two alternatives (see chapter 2). Resources located in this zone would be the focus of preservation projects and would be managed to ensure the long-term protection of their historic integrity. This zoning designation lends an additional layer of protection for resources within it and would be considered a substantial long-term direct benefit to the three historic districts and the individual historic structures affected.

Some of the historic structures in the park's historic districts are considered fundamental to the park but are in very poor condition. Some of these have been identified by the park as ruins (appendix B) and fall under the subzone "ruins" in the Historic Zone (see chapter 2). These structures would remain as ruins under action alternatives, continuing to decay naturally. Despite their current condition, these structures have been determined to contribute to the significance of the historic districts in which they are located. Examples of fundamental historic structures that would be managed in this way, by historic district, include the following:

Some of the historic structures in the park's historic districts are considered fundamental to the park but are in very poor condition.

- Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District—Batteries Granger, Morris, Peck, and Urmston

- Fort Tilden Historic District—Batteries Kessler and Construction 220 and Nike Missile structures associated with the launch site

- Fort Wadsworth Historic District—Batteries Ayres, Barry, Mills, Richmond, and Upton (for a complete list of those structures to be managed as ruins, please refer to appendix B and "Chapter 3: Affected Environment," for information related to these specific resources)

For these resources, the park would prioritize their documentation and, in some cases, create interpretive media to convey information about their history and significance. Left unmanaged, the historic structures can be expected to deteriorate over time, likely resulting in loss of integrity and their contributing status to the historic districts in which they are located, a substantial permanent direct adverse impact on both the historic districts and individual historic structures. Mitigation measures (documentation, etc.) would have the potential to lessen the impact but it would remain notably adverse.

Other Historic Districts

Although some of the park's historic districts include historic structures that are in very poor condition, many have been determined to contribute to the significance of the historic districts in which they are located. As is the case for fundamental resources, the park has identified some of these resources as ruins (appendix B). These structures would remain unmanaged under the action alternatives, being allowed to decay naturally. Examples of historic district structures that would be managed in this way include the following:

- Floyd Bennett Field Historic District—Married Officers' Quarters, torpedo-storage building, and magazines

- Jacob Riis Park Historic District—Boiler room, garages, and playing courts

- Far Rockaway U.S. Coast Guard Station Historic District—Garages (for a complete list of the structures that would be managed as ruins, please refer to appendix B; refer to "Chapter 3: Affected Environment," for information related to these specific resources)

As is the case for fundamental park resources, the park would prioritize the documentation of these resources and, in some cases, create interpretive media to convey information about their history and significance. Left unmanaged, these structures would deteriorate over time, resulting in loss of integrity and possibly their contributing status to the historic districts in which they are located, a permanent direct adverse impact on both the historic district and the individual historic structures. Mitigation measures (documentation, etc.) would have the potential to lessen the impact but it would remain adverse.

Under both action alternatives, a wetlands center facility (visitor facilities, education center, trails, etc.) is proposed for the Jamaica Bay Unit of the park, possibly in Floyd Bennett Historic District. It is possible that the center may be housed in rehabilitated historic structures in the historic district. This adaptive reuse of important historic structures in the park would result in a long-term direct benefit to the historic district and the individual structures.

Under both alternatives, a new cooperative stewardship program among the park, New York City, and others, tentatively named the JBSRI, would require a facility. The JBSRI may be housed in rehabilitated historic structures in Floyd Bennett Field Historic District in the Jamaica Bay Unit of the park. This adaptive use of important historic structures in the park would result in a long-term direct benefit to the historic district and the individual historic structures.

In an effort to build the park's resiliency to the effects of climate change, measures would be implemented to protect select historic structures from the threats of storm surges and flooding. This could include modifications to landscapes and topography. Most of Gateway's historic structures are encompassed in larger historic districts and are considered contributing to the historic district's significance. This effort would result in a substantial long-term direct benefit to the historic district in which these structures are located, as well as to the individual historic structures. At the same time, potentially adverse effects (possible disturbance of a district's archeological resources) are possible; implementation of mitigation measures would lessen adverse impacts (see Archeological Resources below).

Public/private partnerships that assist with the reuse and preservation of fundamental and other historic structures for a wide variety of uses would be pursued, a long-term direct benefit to historic districts, as well as to the individual historic structures that contribute to their significance.

Alternative B: Discovering Gateway – NPS Preferred Alternative

Impacts of Alternative B

The impacts of the implementation of alternative B on historic districts containing historic structures considered fundamental to the park's purpose and significance are discussed first, followed by a discussion of other historic districts and structures.

Historic Districts Containing Fundamental Resources

The Nike Missile launch site at the Fort Tilden Historic District would be stabilized, which would be considered a long-term direct benefit to the historic district as well as to the individual historic structures.

The historic structures at Riis Landing (Fort Tilden Historic District and Far Rockaway Historic District) would be stabilized, which would be considered a long-term direct benefit to the historic district as well as to the individual historic structures.

Within the Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District, the parade ground would be preserved, the Nike Missile radar and launch sites would be stabilized, and Batteries Kingman and Mills would be rehabilitated to allow for visitor access. All of these actions would result in long-term benefits to the historic district, as well as to the individual historic structures.

The use of historic structures at the Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District would be expanded to include lodging, food service, and other visitor services. This alternative would include the widest variety of potential adaptive reuses for the Fort Hancock buildings. Adaptive reuse would be considered a long-term direct benefit to the historic district, as well as to the individual historic structures that contribute to its significance.

Under alternative B, Battery Weed and Fort Tompkins (Fort Wadsworth Historic District) would be preserved. These two historic structures are an integral part of Fort Wadsworth Historic District and the military history of the New York Harbor. In addition to the batteries stabilized through actions specified in the "Common to Both Action Alternatives" section, several additional batteries will be stabilized for greater visitor interpretation and access. This will occur through vegetation removal and landscape enhancements. These actions would result in long-term direct benefits to the historic district and the individual structures.

Under this alternative, Mont Sec and New York Avenues in the Fort Wadsworth Historic District would be preserved and some interpretation provided. These two streets and their historic structures (Officers' Row, the entry gate and gatehouse, etc.) represent some of the core elements of past life at Fort Wadsworth. Their preservation would represent a long-term direct benefit both to the historic district and to the historic structures involved.

Other Historic Districts

Under alternative B, the cultural landscape at Floyd Bennett Historic District would be preserved to reflect its significance as a municipal airport. However, fewer landscape features would be included in these preservation efforts when compared to alternative C. Important historic structures—Ryan Visitor Center, hangars, runways—would be preserved and interpreted for visitors in the Aviation District. Other historic structures would be

rehabilitated and adaptively reused for interpretive visitor exhibits. The preservation and adaptive reuse of historic structures at Floyd Bennett Field Historic District would be a direct benefit for both the individual historic structures and the historic district in which they are located.

At Floyd Bennett Field Historic District, Hangar B and its surroundings would be converted to an entertainment venue. Hangar B represents the largest structure at the field and is a contributing structure to the historic district. It currently houses the Historic Aircraft Restoration Project groups and numerous historic aircraft, which would be moved to other hangars at Floyd Bennett Field. If the management guidance included in the *Floyd Bennett Field Cultural Landscape Report* (Cody and Auwaerter 2009) is used for concert venue conversion of Hangar B, long-term direct benefits would be expected for both the historic district and the structure. If Hangar B is renovated in a way that would jeopardize its contributing status to the historic district, a direct adverse impact would occur. The impact would affect both the historic district and the hangar.

A variety of improved recreational elements would be developed at Jacob Riis Park Historic District under this alternative. These include parking lot redesign for new facilities/visitor services, development of sports fields, expansion of shade structures and picnic areas, and the use of portable and mobile facilities. The introduction of permanent new elements to the landscape would have the potential to impact the historic district adversely. At the same time, this alternative proposes the maintenance of the bathhouse, boardwalk, parking lot, and associated historic features. If management recommendations set forth in the *Jacob Riis Park Cultural Landscape Report* (Lane, Frenchman, and Associates 1992) are used to guide the provision of facilities and services, related impacts on the historic district would be expected to be long term, direct, and beneficial. Maintenance of the bathhouse, boardwalk, parking lot, and associated historic features would be expected to yield long-term direct benefits to the historic district.

Under alternative B, Hangar 38 and the Elm Street Light at the Miller Army Airfield Historic District would be stabilized. Along with the hangar apron, these constitute the three contributing resources to this historic district. All these actions would result in long-term direct benefits to Miller Army Airfield Historic District as well as to the individual historic structures.

The historic cabanas at the Breezy Point Surf Club Historic District and the Silver Gull Beach Club would be stabilized, a long-term direct benefit to the historic districts and to the individual structures.

Cumulative Impacts

Past, present, and reasonably foreseeable projects and activities have resulted or could result in both adverse and beneficial cumulative impacts on Gateway's historic districts and historic structures, as described under alternative A (no action). It is believed that the proposed management actions under alternative B primarily related to unmanaged fundamental park

resources located in the Ruins Subzone would contribute noticeable adverse increments to the cumulative impacts on these resources. Beneficial cumulative impacts on historic districts and historic structures under this alternative are believed to be imperceptible in scope.

Conclusion

Common to both action alternatives are proposals that could result in both beneficial and adverse consequences to historic districts and historic structures. Long-term, direct benefits are related to preservation, research, and interpretation of fundamental coastal defense and maritime resources proposed by the Fort Hancock 21st Century Advisory Committee, the removal of invasive vegetation threatening coastal batteries and other fundamental cultural resources, the stabilization of certain fundamental resources, the rehabilitation and reuse of historic structures (e.g., Fort Tilden, Floyd Bennett Field), the protection afforded by the designation of fundamental and other cultural resources as part of a Historic Zone, and the protection of select historic structures from threats of future storm surges and flooding. Permanent adverse impacts resulting from the designation of fundamental and other cultural resources as part of a Ruins Subzone (unmanaged, expected to deteriorate) are also expected for historic districts and structures under both action alternatives.

In addition to the impacts of actions common to both action alternatives, alternative B would offer a variety of beneficial impacts on historic districts and historic structures resulting primarily from the maintenance, stabilization, and preservation of historic districts' resources, the adaptive reuse of historic structures, and the preservation of cultural landscapes. Of the two action alternatives, alternative B would offer the widest variety of potential adaptive reuses of historic park structures in the Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District. Actions under this alternative are particularly beneficial to fundamental resources located in Fort Wadsworth Historic District, Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District, and Fort Tilden Historic District. Benefits in these historic districts would positively affect fundamental resources such as Battery Weed and Fort Tompkins, a number of coastal batteries, the Sandy Hook Lighthouse, the Spermaceti Cove Life Saving Station, the Fort Hancock parade ground, and the Fort Tilden parade ground. In addition, important resources at Miller Army Airfield Historic District, Breezy Point Surf Club Historic District, and Silver Gull Beach Club Historic District would be stabilized, a benefit to both the districts and the individual historic structures.

At the same time, historic districts would potentially experience adverse impacts primarily related to the uncertainty of how conversions of historic structures to other uses will affect the historic district and landscape (Hangar B, Floyd Bennett Field Historic District), the potential to affect archeological resources through landscape modification to protect important historic structures, and the impact of portions of historic districts being included in the Ruins Subzone. In the latter situation, portions of historic districts would be unmanaged and resources (historic structures) allowed to decay naturally. The Ruins Subzone is defined similarly under alternative C. Some fundamental resources in the Fort Wadsworth Historic District, Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District, and Fort Tilden Historic District are included in the Ruins Subzone.

Fundamental resources of the park expected to be adversely impacted under this alternative are associated primarily with military history and the coastal defense of New York Harbor over the past 150 years. These include approximately 10 Endicott- and Taft-era batteries in the Ruins Subzone, affecting three historic districts (Fort Tilden, Fort Wadsworth, and the Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District). These adversely affected resources are considered non-renewable and their loss will be permanent.

When the resource-specific criteria for assessing impacts on historic districts are applied to the actions proposed under alternative B, results similar to those under the no-action alternative are reached related to concurrence with section 110 of the National Historic Preservation Act, resulting in adverse, likely permanent, impacts on the park's historic districts. However, adverse impacts would be considerably fewer under both action alternatives than under alternative A (no action). Concurrence with the park's enabling legislation also falls short where preservation, restoration, and interpretation of historic properties is concerned, but to a smaller degree than under alternative A. When compared to the no-action alternative, fewer fundamental resources would be adversely impacted under alternative B, making the park's goal of conveying important events and themes of the park to its visitors more attainable. The loss of fundamental resources under alternative B would have the potential to affect the National Register listing (contributing properties, integrity, etc.) of historic districts of the park, but to a lesser degree than under alternative A. This situation would hamper the park's ability to maintain the integrity of historic districts in such a way as to convey the important events and themes of the park (military, maritime, aviation). The proposed lack of management of historic resources in the Ruins Subzone has the potential to set a precedent for the future management of NPS cultural resources. At the same time, climate change and its associated projected possible increases in destructive winds and storm surges have made it imperative for the park to reevaluate what resources can be reasonably protected and preserved over time.

Historic districts not containing resources considered fundamental are not expected to experience the same level of impacts, although some direct impacts could still be considered adverse. A number of widespread beneficial impacts would be expected for all historic districts (historic zoning, adaptive reuse of historic structures, maintenance/preservation), although they are not believed sufficient to outweigh the substantial adverse impacts expected on fundamental resources in historic districts under this alternative.

Adverse impacts related to the management of portions of historic districts under the Ruins Subzone are similar under alternatives B and C. Both action alternatives would result in fewer adverse impacts on fundamental resources than would the no-action alternative. The provision of the widest variety of potential adaptive reuses for historic structures (a beneficial impact) under alternative B is not realized as fully under alternative C. When compared to alternative C, alternative B provides for less preservation treatment for historic districts, structures, and landscapes (e.g., Fort Hancock and Sandy Hook Proving Ground, Fort Wadsworth, Floyd Bennett Field, and Jacob Riis Park). However, Alternative B provides for more opportunities for rehabilitation and adaptive reuse of historic structures and landscapes.

A number of widespread beneficial impacts would be expected for all historic districts (historic zoning, adaptive reuse of historic structures, maintenance/ preservation), although they are not believed sufficient to outweigh the substantial adverse impacts expected on fundamental resources in historic districts under this alternative.

The impact on historic districts anticipated under alternative B would be considered significant and adverse. The impacts of activities under this alternative, coupled with the past, present, and future projects noted, would likely result in noticeable adverse cumulative impacts on historic districts.

The loss of fundamental historic structures under this alternative would be less than that expected under the no-action alternative and similar to that expected under alternative C. Impacts on historic structures anticipated under alternative B would not be considered a significant impact on historic structures. The impact of activities under this alternative, coupled with the past, present, and future projects noted, would likely result in noticeable cumulative impacts on historic structures.

Alternative C: Experiencing Preserved Places

Impacts of Alternative C

The impacts of the implementation of alternative C on historic districts containing historic structures considered fundamental to the park's purpose and significance are discussed first, followed by a discussion of other historic districts and structures.

Historic Districts Containing Fundamental Resources

Under this alternative, the Nike Missile radar site at the Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District would receive enhanced preservation efforts, a long-term direct benefit to the historic district and to the structures that contribute to its significance. When compared to alternative B, this alternative would provide for a greater degree of interior restoration.

Under this alternative, coastal defense structures at Fort Wadsworth Historic District would become a focal point for participatory stewardship, including hands-on historic preservation. Portions of Fort Tompkins would be rehabilitated as a visitor facility. Vegetation would be removed from some batteries and overlooks would be established. These efforts would result in long-term benefits both to the historic district and to the individual historic structures involved.

Under this alternative, Mont Sec and New York Avenues in the Fort Wadsworth Historic District would be preserved and restored. These two streets and their historic structures (Officers' Row, the entry gate and gatehouse, etc.) represent some of the core elements of past life at Fort Wadsworth. Although similar actions are proposed under alternative B, this alternative would provide more extensive preservation and restoration of the historic character along the streets, resulting in a higher degree of landscape preservation. Both action alternatives would result in long-term benefits to the historic district and the historic structures, but benefits would be increased under alternative C.

Cultural resource preservation and stewardship projects are proposed for the Fort Tilden Historic District under this alternative. This includes the stabilization of Riis Landing buildings—some of which are located within the Far Rockaway Coast Guard Historic District—for leasing, adaptive reuse of the parade ground buildings, and the preservation of the cultural landscape of the Fort Tilden Historic District. Use of management recommendations put forth in the *Cultural Landscape Report for Fort Tilden* (Selvek 2005) would aid in the appropriate treatment of important landscape elements. These actions are expected to result in long-term direct benefits to the historic district, as well as to the historic structures involved.

Other Historic Districts

Under alternative C, the cultural landscape at Floyd Bennett Historic District would be preserved to a greater degree than under alternative B to reflect its significance as a municipal airport. Hangars, runways, the Ryan Visitor Center, observation tower, aircraft, and other character-defining features would be preserved/restored in the Aviation District. Under this alternative, more preservation, restoration, and interpretation of the cultural landscape is proposed. Adaptive reuses would be pursued for Hangar B. These actions would amount to a direct long-term benefit for the historic district, the historic structures involved, and the associated cultural landscape.

Under this alternative, additional facilities and recreational opportunities would be added at the Jacob Riis Park Historic District but to a lesser degree than that proposed under alternative B. Proposed improvements include trails, observation platforms, a picnic grove expansion, and additional shade and open space provided through the removal of impervious surfaces. The introduction of permanent new elements to the landscape has the potential to impact the historic district adversely. At the same time, this alternative proposes the preservation of the bathhouse for recreation, provision of services, and park operations, a long-term direct benefit to the historic district as well as to the historic structure. If management recommendations set forth in the *Jacob Riis Park Cultural Landscape Report* (Lane, Frenchman, and Associates 1992) guide the proposed improvements at the historic district, overall impacts to the resource would be expected to be long term, direct, and beneficial.

Cumulative Impacts

Past, present, and reasonably foreseeable projects and activities have resulted or could result in both adverse and beneficial cumulative impacts on historic districts and historic structures, as described under alternative A (no action). It is believed that the proposed management actions under alternative C would contribute noticeable adverse increments to the cumulative impacts on these resources, primarily related to the resources that fall into the unmanaged Ruins Subzone. Beneficial cumulative impacts on historic districts and historic structures under this alternative are believed to be imperceptible in scope.

Conclusion

Impacts on historic districts and historic structures related to actions common to both action alternatives (B and C) include beneficial and adverse consequences. Long-term, direct beneficial impacts are related to preservation, research and interpretation of fundamental coastal defense and maritime resources proposed by the Fort Hancock 21st Century Advisory Committee, the removal of invasive vegetation threatening coastal batteries and other fundamental cultural resources, the stabilization of certain fundamental resources, the rehabilitation and reuse of historic structures (e.g., Fort Tilden, Floyd Bennett Field), the protection afforded by the designation of fundamental and other cultural resources as part of a Historic Zone, and the protection of select historic structures from the threat of future storm surges and flooding. Permanent adverse impacts resulting from the designation of fundamental and other cultural resources as part of a Ruins Subzone (unmanaged, expected to deteriorate) are also expected for historic districts and structures under both action alternatives.

In addition to the impacts of actions common to both action alternatives, alternative C would offer a variety of beneficial impacts for historic districts and historic structures resulting primarily from the stabilization, preservation, and restoration of elements of the historic districts, the adaptive reuse of rehabilitated historic structures, and preservation of cultural landscapes. These actions would be particularly beneficial to fundamental resources located in Fort Wadsworth Historic District, Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District, and Fort Tilden Historic District. Benefits in these historic districts would positively affect fundamental resources such as Fort Tompkins, the Nike Missile Radar Site at Fort Hancock and Sandy Hook Proving Ground, a number of coastal batteries, the Sandy Hook Lighthouse, and the Spermaceti Cove Life Saving Station. Beneficial impacts on other historic districts would include the preservation of the cultural landscape at Floyd Bennett Field to reflect its significance as a municipal airport, the stabilization of Hangar 38 and the Elm Tree Light (Miller Field), and the stabilization of cabanas at Breezy Point Surf Club Historic District.

At the same time, adverse impacts would be expected for both historic districts and historic structures, primarily related to the impact of portions of historic districts being included in the Ruins Subzone. In this situation, portions of historic districts would be unmanaged and resources (historic structures) allowed to decay naturally. Some fundamental resources in the Fort Wadsworth Historic District, Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District, and Fort Tilden Historic District would be included in the Ruins Subzone. The Ruins Subzone is defined similarly in both action alternatives. Fundamental resources of the park expected to be adversely impacted as a result of management zoning under this alternative are associated primarily with historic structures that reflect the military history and the coastal defense of New York Harbor over the past 150 years. As is true under alternative B, these would include approximately 10 Endicott- and Taft-era batteries in the Ruins Subzone, affecting three historic districts (Fort Tilden, Fort Wadsworth, and Fort Hancock and Sandy Hook Proving Ground National Historic Landmark District). These adversely affected resources are considered non-renewable and their loss would be permanent.

When the resource-specific criteria for assessing impacts on historic districts are applied to the actions proposed under alternative C, results similar to those under the no-action alternative are reached related to concurrence with section 110 of the National Historic Preservation Act, resulting in adverse, likely permanent, impacts on the park's historic districts. However, adverse impacts would be considerably fewer under both action alternatives than under alternative A (no action). Concurrence with the park's enabling legislation also falls short where preservation, restoration, and interpretation of historic properties is concerned, but to a smaller degree than under alternative A. When compared to the no-action alternative, fewer fundamental resources would be adversely impacted under alternative C, making the park's goal of conveying important events and themes of the park to its visitors more attainable. This is similar to the impacts expected under alternative B. As is true under alternative B, the loss of fundamental resources under alternative C would have the potential to affect the National Register listing (contributing properties, integrity, etc.) of historic districts of the park, but to a lesser degree than under alternative A. This situation would hamper the park's ability to maintain the integrity of historic districts in such a way as to convey the important events and themes of the park (military, maritime, aviation). The proposed lack of management of historic resources in the Ruins Subzone would have the potential to set a precedent for the future management of NPS cultural resources. At the same time, climate change and its associated possible increases in destructive winds and storm surges have made it imperative for the park to reevaluate what resources can be reasonably protected and preserved over time.

Historic districts that do not include fundamental resources would not be expected to experience the same level of impacts, although some direct impacts could be considered adverse. A number of widespread beneficial impacts would be expected for all historic districts and structures (historic zoning, adaptive reuse of historic structures, maintenance/ preservation), but they are not believed sufficient to outweigh the substantial adverse impacts expected on fundamental resources in historic districts under this alternative (this is also true for alternative B).

Adverse impacts related to management of portions of historic districts under the Ruins Subzone would be similar under alternatives B and C. Both action alternatives would result in fewer adverse impacts on fundamental resources than would the no-action alternative. When compared to alternative B, alternative C would provide for additional and enhanced cultural resource preservation treatment for historic districts, structures, and landscapes (e.g., Fort Hancock and Sandy Hook Proving Ground, Fort Wadsworth, Floyd Bennett Field, and Jacob Riis Park).

Impacts on historic districts anticipated under alternative C would be considered a significant adverse impact on cultural resources. The impact of activities under this alternative, coupled with the past, present, and future projects noted, would likely result in noticeable adverse cumulative impacts on historic districts.

The loss of fundamental historic structures under this alternative would be less than that expected under the no-action alternative and similar to that expected under alternative B. Impacts on historic structures anticipated under alternative C would not be considered

a significant impact on historic structures. The impact of activities under this alternative, coupled with the past, present, and future projects noted, would likely result in noticeable cumulative impacts on historic structures.

Archeological Resources

Archeological resources are the remains of past human activity; they are typically buried, but may extend aboveground. These resources are commonly associated with pre-contact peoples but also may be products of more contemporary societies. At Gateway, many of the archeological resources fall into this latter category.

Laws and Policies

The primary NPS regulatory and policy framework for the management of archeological resources includes the following:

- Director's Order 28: *Cultural Resources Management Guidelines*
- Director's Order 28A: *Archeology*
- NPS *Management Policies* 2006
- The National Historic Preservation Act
- Executive Order 11593, "Protection and Enhancement of the Cultural Environment"
- Enabling Legislation, Gateway National Recreation Area
- Service-wide Programmatic Agreement

Methods

Information on archeological resources was obtained through background research which included review of existing reports provided by Gateway—archeological overviews and assessments, cultural landscape reports, management plans, various archeological reports related to development projects, National Register nomination forms, historic structures reports, and general historical background documents for the park.

Potential impacts on in situ archeological resources are assessed based on the amount of disturbance a resource has experienced and the level of remaining integrity of the resource. If identified or potential archeological resources fall within an existing historic district in the park, they are discussed in the "Historic Districts" section as part of the larger historic district context. Archeological resources analyzed in this section are those that exist, or for which there is the potential to exist, outside defined historic districts in the park.

The resource-specific context for assessing the significance of impacts under NEPA includes the following:

- The ability to provide meaningful information to the park's archeological record and provide opportunities for archeological research; the archeological record for Gateway is relatively incomplete—numerous archeological resources have been destroyed or covered over by historical landfilling, grading, and other land modifications

- The degree to which the management of archeological resources complies with the National Historic Preservation Act

- The degree to which the management of archeological resources complies with the park's enabling legislation by providing for appropriate programs for preservation, restoration, interpretation, and use of significant historical, cultural, or architectural resources

Alternative A: No Action

Impacts of Alternative A

Under this alternative, certain areas of the park would continue to be managed as natural areas, with visitor access permitted only along established trails. In general, off-trail use of park lands by visitors creates ground disturbance, which can potentially expose archeological resources. The restriction to trail-only use is a direct benefit to archeological resources.

Vegetation management—invasive species removal and native species reestablishment—would continue in the park when funding is available (e.g., in the coastal area of Fort Tilden). Removal and reestablishment activities would be expected to result in ground disturbance of less than 6 inches deep in targeted areas and could potentially disturb buried archeological resources. Although natural processes continue to modify park lands, and historical uses over the past several centuries have resulted in considerable ground disturbance, the potential still exists to discover archeological (both pre-contact and historic) resources in certain undisturbed areas (NPS 2009a, 2011a, 2011b, 2011c). The implementation of mitigation measures designed to address the direct adverse impacts on such yet-undiscovered archeological resources related to vegetation management activities would likely help in limiting the degree of impact.

The park would continue to work with New York City to reestablish native tree species at Floyd Bennett Field Historic District, a resource that has been well documented (Cody and Auwaerter 2009; NPS 1978, 2010c). The ground disturbance expected would be on average 1 to 2 feet deep and 2 to 3 feet in diameter. This activity would have the potential to disturb buried archeological resources. Long-term natural and human modifications to the Jamaica Bay area, including the Floyd Bennett Field area, have occurred over time. The Floyd Bennett Field area has been extensively altered by 20th century grading, filling, and bulkheading. It is estimated that the original land surface lies buried under an average depth of 9 feet of fill. It is not likely that intact pre-contact resources would be encountered. It is considered more likely that evidence of historic uses of the area could be encountered as a result of tree-planting activities. In those cases where archeological material is encountered, the implementation of mitigation measures designed to address such discoveries would result in direct but limited adverse impacts on the resource.

Under this alternative, Hoffman and Swinburne Islands would be managed as habitat and would remain off limits to visitors. These restrictions would be expected to result in long-term direct benefits to any potential archeological deposits from the islands' uses related to immigration (quarantine stations) (NPS n.d.j).

Saltmarsh restoration activities would continue in Jamaica Bay and the Jamaica Bay Wildlife Refuge. Ground-disturbing activities (grading, excavating, etc.) related to these efforts have the potential to affect archeological resources. The amount and depth of ground disturbance would be expected to vary by project. The potential for encountering archeological deposits would be dependent on the location of the activities (NPS 2011c). If archeological deposits are encountered, direct adverse impacts on the resources would be expected, which could be lessened with the implementation of mitigation measures.

The dune areas around Miller Army Airfield would continue to be accessed without designated trails, creating ground disturbance and the potential to disturb archeological deposits (NPS 2011b). If this occurs, direct adverse impacts on the resource would be expected.

Under this alternative, some historic structures would remain as they exist today with no additional maintenance/stabilization and are expected to deteriorate over time (see discussion in Historic Districts above). The gradual loss of these structures has the potential to directly and adversely affect associated archeological resources. If mitigation measures are not undertaken to recover at-risk archeological data, this loss would be permanent.

Cumulative Impacts

Past projects and actions have occurred, primarily since the 19th century, within the currently designated park boundaries and have resulted in a wide variety of impacts on the park's archeological resources. Historical grading and landfilling over the decades has almost certainly destroyed or buried resources. Infrastructure projects—roads, sewer/water facilities, utility transmission lines, general construction, etc.—have involved ground disturbance, which can permanently alter or destroy archeological resources. Park maintenance projects (e.g., vegetation management) have created (and will continue to create) impacts on archeological resources primarily through ground-disturbing activities, but cumulative adverse impacts are believed to be relatively small in scope.

Natural processes (erosion, wave action, wind, storm surges) have undoubtedly resulted in the loss of archeological resources in the park. These losses would have involved both surface and subsurface pre-contact and historic archeological resources, particularly along coastlines, which are subject to more destructive water and wind actions than are areas farther inland.

The effects of climate change on park lands are described in other sections of the EIS, and are a result of several factors including sea level rise and potential extreme precipitation events, heat waves, and increases in severe winds and other weather phenomena. A number of cultural resources have sustained damage over the past few decades because of extreme weather events (winds, storm surges, etc.). In the fall of 2012, Hurricane Sandy's winds and storm surge resulted in considerable damage to park resources, including archeological resources. Rising sea level can have considerable effects on archeological resources along coastlines. The effects of wind and ocean currents have resulted in the exposure of previously buried archeological resources along the coastline (battery structures, bulkhead) (Uschold, pers. comm. 2013). At the same time, sites can be protected when covered by sands

transported by wind and sea action during storm surges (NPS 2009a). Hurricane Sandy, along with many other storms in the past, is a reminder of the importance of considering such future events in the responsible planning for the management of cultural resources.

Other agency projects located in areas surrounding the park have been or will be completed in the future, potentially adding incremental impacts to archeological resources. This could occur if archeological resources associated with and/or complementary to the history and themes reflected by park resources are affected. For instance, a variety of recreation, environmental restoration/enhancement, and development projects proposed by New York City (Vision 2020 plan; New York City Waterfront Action Agenda) (NYCEDC n.d.; NYCDCP 2011) could potentially impact historic properties in areas surrounding park lands. Many of these development actions would result in some degree of ground disturbance, a potential impact on archeological resources. If potentially historic properties have been or will be damaged or lost through project construction, indirect adverse cumulative impacts on archeological resources are assumed. Conversely, if archeological resources have been or are preserved, long-term indirect benefits to the cultural resources of the park are expected. It is believed that the continuing management actions under alternative A (no action) would contribute imperceptible increments to cumulative impacts on archeological resources.

Conclusion

Under the no-action alternative, small direct adverse impacts (ground disturbance, deterioration of historic structures) and beneficial impacts (visitor restrictions) on archeological resources would be expected. Beneficial impacts, coupled with mitigation measures to lessen adverse impacts, would promote the park's ability to expand its knowledge of the archeological record for the area. Mitigation actions related to adverse impacts would ensure compliance with the National Historic Preservation Act, as well as helping to fulfill the park's enabling legislation calling for the preservation, restoration, and interpretation of cultural resources. Adverse impacts on archeological resources under the no-action alternative would be expected to be less than under either of the action alternatives. The impacts of the no-action alternative on archeological resources would not be considered significant. The effects of activities under this alternative, coupled with the past, present, and future projects noted, would likely result in imperceptible cumulative impacts on archeological resources.

Common to Both Action Alternatives

Impacts of Alternatives B and C

Under both action alternatives, wetlands center facilities (visitor facilities/education center/trails) are proposed for the Floyd Bennett Field area of the Jamaica Bay Unit of the park. This could be new construction or the facility could be housed in existing historic structures in the park (see the "Historic Structures" section). While facilities are proposed for both alternatives, alternative C would involve less facility development than alternative B. Regardless, new construction and its associated ground disturbance typically pose risks to intact buried archeological deposits. Past archeological investigations in the Jamaica Bay

Unit of the park have resulted in the conclusion that much of the area holds a low potential for the presence of pre-contact and, in many case, historic resources. In addition to impacts from natural processes, much of the area has been dredged, recontoured, filled, graded, and stabilized during historical development activities (Floyd Bennett Field, highway construction, construction of recreational homes/facilities). Although the potential for buried historic archeological resources may be slightly higher under alternative B than alternative C, the probability of encountering undisturbed sites is low (NPS 2011c). If archeological resources were encountered, small-scale direct adverse impacts would be expected, which could be lessened further by the implementation of mitigation measures.

Both action alternatives propose an extensive and comprehensive network of trails in the Floyd Bennett Field Historic District, actions that could result in the disturbance of archeological resources. Floyd Bennett Field has experienced a high degree of historic impact (see discussion immediately above), and the probability of encountering intact archeological resources is low. Any adverse impacts on these resources would be small in scale and would be lessened by the implementation of mitigation measures.

The action alternatives propose the potential development of operations and maintenance facilities consolidated in more optimal park locations to ensure resiliency, but specific locations are undetermined.

Shore Road (Fort Tilden) would be removed under both action alternatives. Under alternative B, it would be converted to a trail corridor; under alternative C, the area would be restored to its natural condition. Regardless of the alternative, ground disturbance would occur with road removal that could impact buried archeological resources. There is a reasonable expectation that archeological resources related to Fort Tilden (established in 1917) could be encountered (NPS 2011c). If so, direct adverse impacts would occur but would likely be limited in scope; mitigation measures would lessen the impact further.

Some landscape and topographic features may be modified to protect historic structures from future storm surges and flooding. This type of ground disturbance (grading, filling) has the potential to adversely affect archeological depending on locations. Direct adverse impacts are possible but would likely be limited in scope as implementation of mitigation measures would minimize negative effects.

The action alternatives propose the potential development of operations and maintenance facilities consolidated in more optimal park locations to ensure resiliency, but specific locations are undetermined. The development of an operations and maintenance facility within the Sandy Hook Unit would be likely because the damage to existing facilities and equipment from Hurricane Sandy was substantial. What is known of Sandy Hook's landform over the past few centuries is that it has undergone considerable modification related to natural and impeded sediment-transport processes. It has grown incrementally northward and has undergone periodic erosion "along most of its shoreline, including major losses during storm events" (NPS 2009a, 154). Erosion, wind, storm surge, and sand-trapping groins and jetties continue to reshape Sandy Hook. The park also transports sand from the north end of Sandy Hook back to the south and central narrower portion of the site via a sandy slurry pipeline as needed. Evidence of pre-contact archeological resources is present but scarce on Sandy Hook and is believed inadequate in providing a predictive model about potential site locations. Based on information related to sea-level change over the past 8,000 years, it has been suggested that there is the potential for the presence

of archeological evidence dating back to the Archaic period. The evidence of historic land use is better documented and includes the existence of or potential for archeological sites related to maritime, burial, transportation, communications, and military/defensive resources (NPS 2009a). It is possible that archeological resources could be encountered during the construction of new operations and maintenance facilities on the Sandy Hook Unit of the park. Although this would result in a direct adverse impact on archeological resources, the impact would be lessened by the implementation of mitigation measures.

The rebuilding of beach centers lost in Hurricane Sandy in the Sandy Hook Unit of the park could involve minor ground disturbance, a possible adverse impact on archeological resources, depending on the locations selected. With the implementation of mitigation measures, adverse direct impacts would be expected to be limited in scope.

The park's terrestrial and submerged archeological resources would remain intact and undisturbed, unless the removal of artifacts is justified for preservation treatment, protection, research, interpretation, or development requirements. This action would preserve most archeological resources in place in a stable, protected condition, considered a long-term direct benefit to the park's archeological resources.

Both action alternatives propose the designation of some historic structures in the Ruins Subzone where these resources would be essentially unmanaged and allowed to decay/ deteriorate over time. The gradual loss of these structures has the potential to directly and adversely affect associated archeological resources. If mitigative measures are not undertaken to recover at-risk archeological, this loss would be permanent.

A number of actions related to the maintenance and enhancement of the natural environment are proposed under both action alternatives. These include the removal of invasive species and reestablishment of native plants, tree planting, wetland creation/ enhancement, restoration of coastal habitats, maintenance of natural beach/dune habitats, and beach nourishment. These efforts would involve a variety of impacts that can affect archeological resources and are primarily related to ground disturbance (grading, excavating, hand digging) and filling (beach nourishment). Ground disturbance could vary from no greater than 6 inches below the surface in targeted areas (invasive species removal/ planting of native species; enhancement/restoration of coastal habitats) to several feet in depth (wetland creation). The potential for encountering archeological deposits would be dependent on the location of the activities (NPS 2009a, 2011a, 2011b, 2011c). If archeological deposits were encountered, direct adverse impacts on the resource would be expected, which could be lessened with the implementation of mitigation measures.

Beach nourishment would have the potential to affect offshore, submerged archeological sites. Changes in sea level through the millennia are believed to have made larger terrestrial areas available for pre-contact human occupation in the area, much of which is now submerged. During a past project, researchers reported finding over 200 pre-contact artifacts along a stretch of beach in Monmouth County, New Jersey, which had just been renourished by sand dredged offshore in an area east of Sandy Hook (Panamerican Consultants 2001). Depending on where sand is procured for beach nourishment (in park

jurisdictional waters or not), there is the potential that the park's submerged archeological deposits may be directly and adversely impacted.

The development of new restroom facilities (Plumb Beach) and new picnic/open space and trail connections to New York City park lands (Bergen Beach) is unlikely to impact intact archeological resources due to the disturbed nature of the area (which has been dredged and filled) (NPS 2011b). If archeological resources were encountered, impacts would be expected to be limited in scope.

Alternative B: Discovering Gateway – NPS Preferred Alternative

Impacts of Alternative B

Under alternative B, Hoffman and Swinburne Islands would be managed for their cultural and natural resources, continuing an existing long-term direct benefit to potential archeological resources on the islands. Tours and limited visitor access to the islands would most likely be allowed along established trails only, a long-term benefit to archeological resources. Trail construction and visitor use on these islands would result in a minor amount of ground disturbance, which has the potential to impact archeological resources. The potential to adversely and directly impact these resources is believed to be small; with the implementation of mitigation measures, adverse impacts would be limited in scope.

A variety of recreational facilities would be developed at Fort Wadsworth, including multi-use trails with connections from the New York City Greenway and adjacent areas, lodging, and additional camping, all of which would result in a certain amount of ground disturbance. Some areas of Fort Wadsworth are believed to have the potential to include intact pre-contact and historic deposits (NPS 2011b). Although it is possible that buried archeological resources could be encountered during the development of these recreational facilities, with the implementation of mitigation measures, direct adverse impacts would be limited in scope.

Under this alternative, it is possible that a facility for a new cooperative stewardship program among the park, New York City and others, tentatively named the JBSRI, would be constructed in the Jamaica Bay Unit of the park. Although the potential for buried historic archeological resources may be slightly higher under this alternative, the probability of encountering undisturbed sites is low (NPS 2011c; see the "Historic Structures" section under "Common to Both Action Alternatives"), and likely to be no more than a small-scale adverse impact on archeological resources, lessened further by the implementation of mitigation measures.

A variety of recreational facilities would be removed (ball field complex), improved (bicycle infrastructure), or built (possible camping, trailhead at park entrance) in the Great Kills Park area. In addition, the removal of invasive species and tree planting is planned in this area. All these actions would involve some degree of ground disturbance, which has the potential to disturb buried archeological resources. Much of the Great Kills Park area was created in the early to mid-20th century by extensive dredging and landfilling operations

that expanded the available land to accommodate its use as a public park. Land surfaces and shorelines predating the landfill are no longer apparent. Prior to landfilling, the area was a marshy area subject to considerable erosion and reshaping of the shoreline. The potential for encountering intact archeological deposits during recreational facility development is very limited. Impacts on archeological resources related to this action are believed to be unlikely, but if they were encountered, direct adverse impacts would be very limited in scope.

New recreational facilities (picnic pavilion, trailhead/trails, community event space) would be developed at Miller Field. One area proposed for development is the site of a former hangar at Miller Field that is not considered part of the Miller Army Airfield Historic District. These facilities are to be developed in areas considered already developed/impacted and the likelihood of encountering intact archeological deposits is considered unlikely. Any adverse impact on discovered resources would be expected to be direct, adverse, and limited in scope.

New maintenance areas would be developed at Floyd Bennett Field to accommodate additional uses and sustainable operations. Development of a new maintenance area would likely involve ground disturbance that could impact archeological resources. However, this area of the park is believed to have sustained considerable historic impact (grading, landfilling) and the likelihood of encountering intact archeological resources would be low. If they were encountered, adverse impacts would be expected to be small in scope.

The creation of a network of trails and boardwalks and nature study facilities at the Jamaica Bay Wildlife Refuge would have the potential to impact intact archeological resources through ground disturbance. The likelihood of this would depend on the specific locations of the facilities. There are many areas of the refuge that have sustained considerable modifications related to past landfilling and dredging activities (NPS 2011c). If archeological resources are encountered, adverse impacts are likely to be limited in scope and lessened further through the implementation of mitigation measures.

At Jacob Riis Park, hard courts and other impervious surfaces on the west side of the park would be removed to soften the site and build resiliency to storm surges. The removal of these surfaces would cause ground disturbance, which can impact intact archeological resources. The park's west side has the potential of yielding evidence of an earlier children's hospital and the Rockaway Naval Air Station, both dating to the early 20th century (NPS 2011c). Should archeological resources be encountered, impacts would be direct and adverse; however, the implementation of mitigation measures would lessen the impact.

Cumulative Impacts

Past, present, and reasonably foreseeable projects and activities have had or could have adverse cumulative impacts on archeological resources, as described under alternative A (no action). It is believed that the management actions proposed under alternative B would contribute imperceptible adverse cumulative increments to impacts on archeological resources.

Conclusion

Actions proposed under both action alternatives have the potential to result in adverse and beneficial impacts for archeological resources. Long-term beneficial impacts are expected from the proposal to allow terrestrial and submerged archeological resources to remain undisturbed and intact unless their removal is justified for preservation, protection, research, interpretation, or development requirements. Direct and permanent adverse impacts are possible under both action alternatives related to potential ground disturbance for new facility construction/development (e.g., Floyd Bennett Field, Plumb Beach, Bergen Beach), road removal (Fort Tilden), development of operations and maintenance facilities within the park, rebuilding of beach centers lost in Hurricane Sandy (Sandy Hook Unit), a variety of environmental restoration projects (e.g., wetland creation, beach nourishment, dune restoration) and landscape modifications to protect historic structures from future storm damage. Loss of archeological resources associated with deteriorating structures located within the Ruins Subzone could result in permanent, adverse loss of cultural resources. Beach nourishment activities also have the potential to adversely impact submerged archeological resources. Implementation of mitigation measures for actions that have the potential to cause adverse impacts would likely result in a lessening of the degree of impact on archeological resources.

In addition to the impacts of actions common to both action alternatives, alternative B would be expected to result in small and direct adverse impacts (ground disturbance) and beneficial impacts (visitor restrictions) on archeological resources. Adverse impacts would be related to facility development and removal of impervious surfaces. Beneficial impacts from the alternative, coupled with mitigation measures currently in place for adverse activities, would help promote the park's ability to expand its knowledge of the archeological record for the area. Mitigation actions related to adverse impacts would ensure compliance with the National Historic Preservation Act, as well as helping to fulfill the park's enabling legislation calling for the preservation, restoration, and interpretation of cultural resources. Potential impacts on archeological resources would be expected to be greater under this alternative than under the no-action alternative. The impacts of alternative B on archeological resources would not be considered significant. The impacts of activities under this alternative, coupled with the past, present, and future projects noted, would likely result in imperceptible cumulative impacts on archeological resources.

Alternative C: Experiencing Preserved Places

Impacts of Alternative C

Under this alternative, Hoffman and Swinburne Islands would be managed for their cultural and natural resources with no visitor access. This is currently the case, so alternative C would continue the existing benefits of no action. Specifically, these restrictions would be expected to continue long-term direct benefits to any potential archeological deposits from the islands' uses related to immigration (quarantine stations) (NPS n.d.j).

A new "coastal defense trail" and other designated trails would be developed at Fort Wadsworth to provide interpretive experiences for visitors and access to the shoreline. Trail construction would involve ground disturbance, which has the potential to negatively impact archeological resources. Some areas of Fort Wadsworth are believed to have the potential to include intact pre-contact and historic deposits (NPS 2011b). Although it is possible that buried archeological resources could be encountered during trail construction, with the implementation of mitigation measures, direct adverse impacts would be limited in scope.

Small-scale camping areas would be developed at Floyd Bennett Field, an action that could result in ground disturbance and impacts on buried archeological resources. The Floyd Bennett Field area has experienced considerable historic impacts (see above discussion), and it is not likely that intact archeological resources remain in this area. Impacts on these resources would be direct and adverse and would be lessened by the implementation of mitigation measures.

Habitat enhancements would include the establishment of a habitat corridor in the Spring Creek area of the Jamaica Bay Unit. This would be designed to connect the park and New York City park lands and would include the removal of invasive species, an action that has the potential to disturb archeological resources. Ground disturbance would not be expected to be deeper than 6 inches in targeted areas if the plants are removed by hand. If archeological resources were encountered, the direct adverse impact would be small in scale and would be lessened by the implementation of mitigation measures.

This alternative proposes trails and an expanded picnic grove at Jacob Riis Park (Jacob Riis Historic District). It also proposes the removal of impervious surfaces where possible, to a greater degree than that proposed under alternative B. These actions would result in a certain amount of ground disturbance, which has the potential to impact archeological resources. In particular, the park's west side has the potential of yielding evidence of an earlier children's hospital and the Rockaway Naval Air Station, both dating to the early 20th century (NPS 2011c). Should archeological resources be encountered, impacts would be direct and adverse; however, the implementation of mitigation measures would lessen the impact.

Alternative C calls for the provision of limited camping opportunities and an improved trails system in the backcountry of Fort Tilden, both of which would have the potential to impact archeological resources through ground disturbance. As mentioned above, there is a reasonable expectation that archeological resources related to Fort Tilden (established in 1917) could be encountered (NPS 2011c). If so, direct adverse impacts would occur but would likely be limited in scope, and mitigation measures would lessen the impact further.

A new "coastal defense trail" and other designated trails would be developed at Fort Wadsworth to provide interpretive experiences for visitors and access to the shoreline. Trail construction would involve ground disturbance, which has the potential to negatively impact archeological resources.

Cumulative Impacts

Past, present, and reasonably foreseeable projects and activities have had or could have adverse cumulative adverse impacts on archeological resources, as described under alternative A (no action). It is believed that the proposed management actions under alternative C would contribute imperceptible adverse increments to the cumulative impacts on archeological resources.

Conclusion

Actions proposed under both action alternatives have the potential to result in adverse and beneficial impacts for archeological resources. Long-term benefits are expected from the proposal to allow terrestrial and submerged archeological resources to remain undisturbed and intact unless their removal is justified for preservation, protection, research, interpretation, or development requirements. Direct and permanent adverse impacts are possible under both action alternatives related to potential ground disturbance for new facility construction/development (e.g., Floyd Bennett Field, Plumb Beach, Bergen Beach), road removal (Fort Tilden), development of operations and maintenance facilities within the park, rebuilding of beach centers lost in Hurricane Sandy (Sandy Hook Unit), a variety of environmental restoration projects (e.g., wetland creation, beach nourishment, dune restoration) and landscape modifications to protect historic structures from future storm damage. Loss of archeological resources associated with deteriorating structures located within the Ruins Subzone could result in permanent, adverse loss of cultural resources. Beach nourishment activities also have the potential to adversely impact submerged archeological resources. Implementation of mitigation measures for actions that have the potential to cause adverse impacts would likely result in a lessening of the degree of impact on archeological resources.

In addition to the impacts of actions common to both action alternatives, alternative C would be expected to result in small and direct adverse impacts (from ground disturbance) and beneficial impacts (from visitor restrictions and buried resources remaining protected) on archeological resources. Adverse impacts would be related to facility development and removal of impervious surfaces. Beneficial impacts from the alternative, coupled with mitigation measures for adverse impacts, would help promote the park's ability to expand its knowledge of the archeological record for the area. Mitigation actions related to adverse impacts would ensure compliance with the National Historic Preservation Act, as well as helping to fulfill the park's enabling legislation calling for the preservation, restoration, and interpretation of cultural resources. The potential impacts on archeological resources would be expected to be greater under this alternative than under the no-action alternative, but similar to those expected under alternative B. The impacts of alternative C on archeological resources would not be considered significant. The impact of activities under this alternative, coupled with the past, present, and future projects noted, would likely result in imperceptible cumulative impacts on archeological resources.

Museum Collections

Gateway's museum collections contain a significant number of objects, works of art, historical documents, and/or natural history specimens that have been collected/maintained for preservation, research, and public interpretation.

Laws and Policies

The primary NPS regulatory and policy framework for the management of museum collections includes the following (please refer to the "Guiding Regulations and Policies" section for more detail):

- Director's Order 28: *Management of Museum Objects*
- Director's Order 24: NPS Museum Collections Management
- NPS *Management Policies* 2006
- Enabling Legislation, Gateway National Recreation Area
- Final Collection Management Plan (CMP), Gateway National Recreation Area
- Scope of Collection Statement, Gateway National Recreation Area
- NPS Service-wide Storage Plan
- Department of Interior Museum Property Handbook
- NPS Museum Handbook

Methods

Information on Gateway's museum collections was obtained by a review of the CMP (NPS 2009b), the Scope of Collection Statement (NPS 2011d), and the Park Museum Collection Storage Plan (NPS 2006d).

Museum collections (objects, specimens, and archival and manuscript collections) are important park resources and are valuable for the information they provide about processes, events, and interactions among people and the environment (NPS 1998a). Gateway manages a variety of museum objects and archival materials. Museum holdings include significant cultural collections associated with local military, aviation, and maritime history; pre-contact artifacts dating back to the Woodland period; archive and manuscript collections (NPS management records, rare books); and natural history and geology collections (NPS 2011d). Potential impacts on museum collections are evaluated based on the effects on the overarching goal of appropriate planning, preservation, and protection of the park's museum holdings.

The resource-specific context for assessing the significance of impacts on museum collections includes the following:

- The degree to which the management of museum collections complies with the park's enabling legislation by providing for appropriate programs for preservation, restoration, interpretation, and use of significant historical, cultural, or architectural resources

- The degree to which the park's goal of providing adequate and appropriate collection storage areas in accordance with regulatory and policy guidance is promoted and achieved

Alternative A: No Action

Impacts of Alternative A

Under the no-action alternative, Fort Wadsworth would continue to be considered as a regional storage center for the park's museum collections (NPS 2009b). Park collections are currently housed in the administration building at Fort Wadsworth and, to a smaller degree, at Fort Hancock and Sandy Hook Proving Ground. Damage to structures at Fort Hancock caused by Hurricane Sandy required that some sensitive collections be moved to Fort Wadsworth, where they would remain for the foreseeable future (Mahan, pers. comm. 2013b). The Fort Wadsworth location is considered substandard because of its size and the absence of climate-controlled storage areas. "Substandard storage conditions—evaluated based upon Department of the Interior and National Park Service policy—represent some of the most significant threats to a museum collection" (NPS 2009b, 83). The provision of appropriate storage space as defined in the Department of the Interior Museum Property Handbook (USDOI 2004) and the NPS Museum Handbook (NPS 1990b) would substantially minimize existing risks to the park's museum collections. The continuing use of substandard storage facilities would be considered a substantial direct adverse impact on the park's museum collections.

Under the no-action alternative, Fort Wadsworth would continue to be considered as a regional storage center for the park's museum collections

Cumulative Impacts

Direct cumulative impacts would primarily be related to the lack of adequate and appropriate storage space for the park's museum collections. Indirect cumulative impacts would be related to natural forces, such as storms (e.g., Hurricane Sandy), which put the park's collections at greater risk. It is believed that the proposed management actions under the no-action alternative would contribute noticeable adverse increments to cumulative impacts on the museum collections.

Conclusion

Under the no-action alternative, ongoing deficiencies related to the physical condition of existing collection storage areas at both Fort Wadsworth and Fort Hancock (Fort Hancock and Sandy Hook Proving Ground) have resulted in adverse impacts on museum collections. Much of the collection at Fort Hancock was judged at risk during Hurricane Sandy and has been moved to Fort Wadsworth. The current situation does not further the goals of preservation, restoration, and interpretation of important park resources as defined under Gateway's enabling legislation, nor does it promote the goal set forth in the CMP (NPS 2009b) of identifying and providing adequate and appropriate collection storage areas for the park's collections. The NPS Museum Handbook explains that storage space should be both suitable (adequate for storing museum objects) and sufficient (expandable space for safe, uncrowded storage with room for future growth) (NPS 1990b). Neither the Fort Hancock nor Fort Wadsworth storage areas currently meet the definition of suitable and sufficient. Adverse impacts on museum collections under this alternative would not be considered significant at this time. However, if substandard conditions continue and deteriorate to the point where important cultural or historic collections associated with

the park's National Register properties are lost, impacts considered to be significant on the park's museum collections are possible. The impact of activities under this alternative, coupled with the past, present, and future projects noted, would likely result in noticeable adverse cumulative impacts on museum collections.

Common to Both Action Alternatives

Impacts of Alternatives B and C

Under the action alternatives, the park's museum collections would be improved with upgraded and/or new archival facilities. The park's collections would be consolidated into suitable archival facilities that meet NPS standards and guidelines and would be available for research, exhibits, and interpretive programs to better inform the public. The provision of these facilities would be a substantial long-term direct benefit to the park's museum collections.

Alternative B: Discovering Gateway – NPS Preferred Alternative

Impacts of Alternative B

No impacts would occur under alternative B that would not also occur under alternative C (see the "Common to Both Action Alternatives" section).

Cumulative Impacts

Past, present, and reasonably foreseeable projects and activities have had or could have adverse cumulative adverse impacts on museum collections as described under alternative A (no action). It is believed that the proposed management actions under alternative B would contribute noticeable beneficial cumulative increments to museum collections.

Conclusion

Under alternative B, existing deficiencies related to the physical location and condition of existing collection storage areas at the park would be rectified through the provision of a suitable and sufficient archival facility that meets applicable guidelines and standards. This would further the goal of preservation, restoration, and interpretation of important park resources, as defined under Gateway's enabling legislation. At the same time, it would achieve the goal set forth in the CMP (NPS 2009b) of identifying and providing adequate and appropriate collection storage areas for the park's collections. The implementation of alternative B would result in potentially significant beneficial impacts for the park's museum collections similar to the impacts realized under alternative C, and would provide substantially more benefits to museum collections than the no-action alternative. The impact of activities under this alternative, coupled with the past, present, and future projects noted, would likely result in noticeable beneficial cumulative impacts on museum collections.

Alternative C: Experiencing Preserved Places

Impacts of Alternative C

No impacts would occur under alternative C that would not also occur under alternative B (see the "Common to Both Action Alternatives" section).

Cumulative Impacts

Past, present, and reasonably foreseeable projects and activities have had or could have adverse cumulative impacts on museum collections, as described under alternative A (no action). It is believed that the proposed management actions under alternative C would contribute noticeable beneficial increments to the cumulative impacts on museum collections.

Conclusion

Like alternative B, alternative C would correct existing deficiencies related to the physical location and condition of existing collection storage areas at the park through the provision of a suitable and sufficient archival facility that meets applicable guidelines and standards. Actions under both action alternatives would result in identical impacts on museum collections: potentially significant and beneficial. Both action alternatives would provide substantially more benefits than those realized under the no-action alternative. The impact of activities under this alternative, coupled with the past, present, and future projects noted, would likely result in noticeable beneficial cumulative impacts on museum collections.

Visitor Use and Experience

The visitor uses analyzed in this section encompasses the totality of visitor experiences and visitor uses at Gateway and range widely from water-based recreation, such as swimming and fishing, to community-based recreation, including sports leagues and picnicking, to resource-based visitor experience tied to the exploration and enjoyment of the park's natural environments and historic settings.

Laws and Policies

NPS *Management Policies* 2006 (NPS 2006a) states that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and that the NPS is committed to providing appropriate, high-quality opportunities for visitors to enjoy the national parks. Because many forms of recreation may not be suitable for a national park setting, the NPS would therefore seek to do the following:

- Provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in a particular unit

- Defer to local, state, and other federal agencies; private industry; and NGOs to meet the broader spectrum of recreational needs and demands that are not dependent on a national park setting

Unless mandated by statute, the NPS would not allow visitors to conduct activities that would have the following effects:

- Impairing park resources or values
- Creating an unsafe or unhealthful environment for other visitors or employees
- Being contrary to the purposes for which the park was established
- Unreasonably interfering with the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations in the park

Methods

Potential impacts on visitor use and experience are assessed based on the current description of visitor use and experience presented in chapter 3 of this document. Enjoyment of park resources and values by visitors is part of the fundamental purpose of all national parks.

Impacts on visitor use and experience were determined considering the best available information, and the following analysis is qualitative rather than quantitative due to the conceptual nature of the alternatives. Information on visitor use and opinions was taken from the public scoping information for this plan and surveys of visitors and nonvisitors conducted by various researchers and synthesized in *A Synthesis of Existing Visitor Data and Demographic Trends for the Gateway National Recreation Area* for the general management planning project by Pennsylvania State University (Mowen, Graefe, and Graefe 2009).

This impact analysis encompasses various aspects of visitor use and experience, including the effects on visitation levels; diversity of recreation opportunities and national park experiences; night skies and soundscapes; visual quality; visitor education, interpretation, and understanding; and visitor health and safety. For this visitor use and experience impact analysis, a short-term impact would be defined as lasting less than 1 year. A long-term impact would last 15 years or more and would be more permanent in nature. Adverse impacts are those that most visitors would perceive as undesirable. Beneficial impacts are those that most visitors would perceive as desirable.

The resource-specific context for determining the significance of the impacts of the alternatives on visitor use and experience includes the following, all of which are fundamental values for Gateway:

- The ability for visitors to enjoy the following recreation experiences, considered fundamental values by the park: nature observation; water-based activities, such as fishing

and swimming; walking, biking, and horseback riding on trails; picnicking; and visiting historic sites

- Visitor understanding of the park's coastal defense and maritime history and its connection to national history

- The ability for visitors to experience feelings associated with open space in a high-density area; views of New York Harbor; direct sensory experiences with natural elements; and darkness and night skies.

- The provision of public access to the bay and ocean shorelines

Alternative A: No Action

Impacts of Alternative A

Under alternative A, existing visitor uses and experiences would be maintained and other than repairs and/or facilities required due to damage from Hurricane Sandy, no new visitor facilities would be constructed.

Visitor Use and Characteristics

Visitor use numbers and visitor characteristics would remain consistent with those of the past several years, with no increase in visitation expected. Visitation would continue to remain consistent with the 38-year average of 9 million annual visitors. Visitors would continue to have access to most of the sites in Gateway; only a few areas may restrict access to protect sensitive resources or visitor safety. Parkwide, people would continue to find many opportunities to "get away from it all" and experience the qualities of open spaces and natural areas. These sustained levels of visitation and access would have a long-term beneficial impact.

Due to a lack of signs, poor visibility of existing signs, and inadequate parkwide orientation and promotional information, visitors and potential visitors would remain under-informed about Gateway's extensive park lands. This lack of orientation, wayfinding, and publicity would restrict visitors' and potential visitors' ability to fully explore the park. This would result in a long-term adverse impact.

Visitor Experience: Recreation

Under alternative A, visitors would continue to access a diversity of recreational opportunities in a wide range of settings throughout Gateway. The park's trails, natural areas, ball fields, and picnic areas would be available for visitors and neighboring residents. Alternative A would maintain the existing 87 permanent campsites, in addition to programmatic camping. Additionally, wildlife viewing and nature study would remain important components of the visitor experience. Athletic fields at Fort Tilden and Miller Field would continue to be popular venues for community recreation and league play.

Opportunities for both guided and self-guided exploration of the park's historic settings would continue.

Sustaining these recreational opportunities would result in a long-term beneficial impact.

Existing access to the bay, ocean, and beach, as well as water-based recreation opportunities, including fishing, surfing, swimming, kayaking, and enjoyment of Gateway's beaches and waters, would be maintained and continue to contribute beneficially to visitor experience at Gateway. Although some beaches were impacted severely by Hurricane Sandy, water-based and beach recreation facilities and opportunities would be restored throughout the park, including at Jacob Riis Park and Sandy Hook. On Sandy Hook, water-based recreation would be maintained on both the Atlantic and Bayside of the peninsula. Hoffman and Swinburne Islands off Staten Island would remain closed to visitor access, adversely impacting visitors and boaters' interest in accessing those sites.

At Fort Tilden, Fort Wadsworth, and Sandy Hook, visitors would continue to have only limited access to the park's collection of military structures, because many of the fortifications remain closed to public access or are open only on a limited basis for guided tours or programs, resulting in a long-term adverse impact on visitor experience.

Under alternative A, the Pennsylvania Avenue and Fountain Avenue Parks would not serve as a recreational resource for park visitors because they would be managed as natural areas with only limited and controlled public access. Access to Spring Creek would not be improved. The limited access and recreation opportunities in these areas under alternative A would result in an adverse impact on visitor experience.

Visitor Experience: Night Sky

With only 87 campsites and periodic programmatic camping programs at Floyd Bennett Field's Ecology Village, opportunities to experience the night sky would remain limited, which would result in a long-term adverse effect because "direct sensory experiences with natural elements and darkness and night skies" is a fundamental park value. However, this impact would be balanced by the fact that no new development and associated sources of night lighting would adversely impact the current experience of night skies.

Visitor Experience: Soundscapes

Experience of the natural soundscapes would remain unchanged and adverse impacts on the soundscape would only be short term, resulting from maintenance operations and/or heavy equipment needed for Hurricane Sandy repairs, facility improvements, and/or rehabilitation or restoration projects.

Visitor Experience: Visual Quality

The existing overlook at Fort Wadsworth and other popular areas for taking in scenic vistas would be maintained throughout the park. However, the visual quality and experience of

historic settings and vistas would continue to be adversely impacted by deteriorating historic structures, resulting in an adverse impact. Views of uncared-for, dilapidated buildings and structures would detract from the visual quality of historic settings and temper the experience of historic coastal defense structures and cultural landscapes at Fort Tilden, Fort Wadsworth, Fort Hancock, and Floyd Bennett Field.

Visitor Experience: Education, Interpretation, and Understanding

A variety of educational and interpretive programs would continue to be offered by the NPS and its partners throughout the park. At Fort Wadsworth and Sandy Hook, scheduled guided interpretive programs and ad hoc living history programs would continue. Interpretation of Sandy Hook's significant maritime resources, including the Sandy Hook Lighthouse and the Spermaceti Cove Life Saving Station, would continue to benefit visitors' understanding of the park's maritime history.

Visitor understanding of the extent of coastal defense structures and coastal defense history at Gateway would continue to be limited by lack of access to and interpretation of the system of fortifications at Fort Wadsworth, Fort Tilden, and Sandy Hook. At Fort Tilden, for example, Batteries Kessler and Harris would continue to deteriorate, the Nike Missile launch site would continue to be used as a maintenance yard, and interpretation of the site's collection of coastal defense resources would be very limited. Also, under current management, access to park collections would not be expanded nor would more of the collection be integrated into interpretive and educational programming. Despite these limitations, continuing the current educational and interpretive programming and maintaining existing interpretive communication strategies (e.g., podcasts, websites, guided tours, print media, and signs) would have a long-term beneficial impact on the Gateway visitor experience and, specifically, visitor education, interpretation, and understanding.

Visitor understanding of the extent of coastal defense structures and coastal defense history at Gateway would continue to be limited by lack of access to and interpretation of the system of fortifications at Fort Wadsworth, Fort Tilden, and Sandy Hook.

Health and Safety

The park staff would continue to work to improve upon potentially dangerous situations and conditions associated with Gateway's waters, remote natural areas, trip-and-fall hazards, unauthorized building access, and user conflicts. The maintenance of existing visitor safety protocols and communication strategy would result in a beneficial impact on visitor safety in the park. Likewise, maintaining existing access to Gateway's park lands for fitness and wellness activities, such as walking, running, dog walking, and exercise routines (e.g., Tai-chi chuan, yoga), and encouraging recreational use of Gateway's park lands would result in a beneficial impact on community health and visitor physical fitness.

Cumulative Impacts

Cumulative impacts on visitor use and experience from past, present, and reasonably foreseeable projects would result from the park's urban context, regional population growth and residential development, recreation park improvements and natural habitat restoration projects, and climate change.

Urban Context

Located in the New York City metropolitan region, the Staten Island and Jamaica Bay Units are subject to impacts in their surrounding urban context. Noise from city streets, construction projects, and airplane and helicopter flyovers results in short-term adverse impacts on visitor experience. Viewing of the night sky is an important aspect of visitor experience in Gateway; however, the park's night sky visibility is affected by light pollution from the urban environment throughout the park, resulting in a long-term adverse impact on visitor experience. This light pollution, however, is dissipated in the more remote reaches, where the overnight or evening visitor can experience relatively dark night skies in a natural setting with only dim and distant artificial lights. The environmental qualities of the urban context, including air pollution, crowding and congestion, stress, and water quality, would continue to have adverse cumulative impacts on public health and safety.

Park Recreational Improvements and Natural Habitat Restoration Projects

In 2011, New York City set the stage for expanded use of the city's waterfront for parks, housing, and economic development and its waterways for transportation, recreation, and natural habitats when it released the Vision 2020: New York City Waterfront Plan.

In 2011, New York City set the stage for expanded use of the city's waterfront for parks, housing, and economic development and its waterways for transportation, recreation, and natural habitats when it released the Vision 2020: New York City Waterfront Plan (NYCEDC 2011). The 10-year plan is accompanied by the New York City Waterfront Action Agenda (Waterfront Action Agenda) (NYCEDC n.d.), an outline of 130 high-priority projects that will catalyze waterfront investment, improve water quality, and expand public access. These projects, which include habitat restoration and shoreline stabilization, new and expanded parks, water quality improvements, and the transformation of vacant properties into waterfront destinations, as well as residential developments, will have both beneficial and adverse impacts on the Gateway visitor use and experience.

By drawing more attention to the waterfront and inviting more public use and enjoyment of the New York City shoreline, these projects will likely raise awareness of Gateway and build greater interest in opportunities for water-based and beach recreation and exploring coastal natural areas and open spaces, resulting in a cumulative beneficial impact on visitor use and visitor experience. Improving the condition of degraded habitat and investing in water quality will only make nature-based and water-based recreation in the region more appealing to visitors and groups and would result in long-term beneficial impacts on visitor experience, including health and safety. Cleaning the Jamaica Bay waters would result in a substantial benefit to visitor health and safety. A greater focus on the New York City waterfront and more appealing development along the coastline would make it likely that water-based tours in Jamaica Bay and New York Harbor led by tourism outfitters, nonprofits, and park partners would increase and create additional opportunities to learn about and see Gateway's historic and natural resources, resulting in a long-term beneficial impact on visitor and potential visitor understanding of the park's resources.

However, some of the new park development projects proposed in the Waterfront Action Agenda, like the Seaside Nature Park Playground and Fresh Kills Park on Staten Island, Ecology Park at Paerdegat Basin in Brooklyn, and the Rockaway Beach Park could draw potential visitors away from Gateway, resulting in a short-term adverse impact on visitor use.

Regional Population Growth and Residential Development

As articulated in the "Transportation" section of chapter 3, population growth in the New York City area has been substantial and rapid. If population growth combined with new and expanding residential developments near Gateway park lands, such as Edgemere in Queens, Avenue by the Sea on the Rockaways, and the Stapleton Homeport Development project on Staten Island, result in substantial increases in visitation numbers, crowding, and congestion in Gateway's park lands, these actions outside the park would result in long-term adverse impacts on visitor experience (NYCDCP 2011). Although regional population growth has not yet resulted in increased park visitation, the trend in regional growth could still result in an adverse affect because many park facilities have not been sufficiently maintained and/or have not been updated sufficiently to accommodate existing levels of visitation.

Additionally, new and expanding residential development along the waterfront and in areas surrounding Gateway park lands would also result in adverse impacts due to increased night lighting, more noise, and obstructed views. Night lighting from adjacent residential and commercial development would have a cumulative adverse impact on the night sky inside the park boundaries. Similarly, road noise due to traffic and congestion and construction noise resulting from projects on near or adjacent lands would likely increase, resulting in adverse impacts on the park soundscape. With more development on the New York City waterfront, the visual quality of views of New York Harbor and vistas from Gateway's historic coastal defense settings would also be adversely impacted.

Climate Change

Sea-level rise, and possible projected extreme precipitation events, heat waves, and increases in severe winds or other phenomena related to climate change are likely to have substantial long-term adverse impacts on visitor experience at Gateway. As a result of damage sustained during Hurricane Sandy, the park was closed to visitation for three months. Plans are in place in Gateway and surrounding parks and communities to rebuild damaged visitor and recreation facilities and to make beaches and other areas safe for visitation for the summer 2013 season. The NPS and its NYC partners are focusing on rebuilding in a manner that would minimize impacts from future storms. This may include exploring temporary architectural solutions, relocating facilities and using natural buffers to increase resiliency to storm surges.

Taken together, these past, present, and reasonably foreseeable actions have resulted in primarily adverse impacts on the visitor experience of the area's park systems. Park infrastructure, including roads, parking, and circulation systems; facilities and buildings; and visitor amenities and concessions were all badly damaged by Hurricane Sandy, revealing the substantial adverse impacts storm surges and other environmental phenomena related to climate change can have on the park. Regional growth would have noticeable adverse impacts on visitor experience, including night skies and soundscapes, and diminished opportunities to find a sense of solitude and connection to natural resources amid an increasingly urbanized environment. However, New York City's concerted efforts to improve natural resource conditions and water quality at and around the city's waterfront would

result in substantial long-term benefits to the visitor use and experience at Gateway. When the impacts on visitor use and experience under alternative A are combined with the impacts from other projects outside of Gateway's boundaries, alternative A would contribute imperceptible beneficial increments to the overall cumulative impact.

Conclusions

Alternative A would result in long-term beneficial impacts from continued opportunities to access resource-dependent visitor opportunities and experience the natural, historic, and scenic qualities of the park. Visitors would continue to have extensive recreation and beach opportunities, which are some of the most valued activities in the park. Alternative A would contribute imperceptible beneficial increments to the overall cumulative impact.

Impacts of Alternatives B and C

Visitor Use and Characteristics

Under both alternatives, the NPS and its partners would significantly increase the promotion of the park's offerings and outreach to a variety of existing and potential visitors and user groups. Additionally, both alternatives would use orientation portals, new technologies, contact stations staffed by park rangers, and improved signs and wayfinding to better support access to diverse recreation opportunities, and to help connect visitors with the information and support services they need to plan and enjoy their visit to the park. These efforts to promote Gateway, make the park more welcoming, and improve visitor orientation would result in a long-term beneficial impact on experience at the park.

These outreach, wayfinding, and orientation improvements, along with more diverse recreation opportunities, activities, and park experiences under both alternatives, would likely increase visitation and encourage more repeat visits. Although increased visitation numbers and potentially more crowds and congestion may be construed as a negative impact, on balance, the provision of more and improved visitor uses and recreation opportunities would result in a substantial long-term beneficial impact. This long-term beneficial impact is especially likely given that both alternatives would include upgraded facilities and new facilities designed to accommodate larger visitor numbers, as well as improved systems for moving visitors to and through the park as articulated in the "Transportation" section of chapter 3.

Although public access to the vast majority of park lands would be maintained and enhanced through transportation improvements, public access would be restricted in the Sensitive Resources Subzones under both alternatives in order to reduce impacts on sensitive habitat. This may result in a short-term adverse impact on visitors currently using these areas; however, the new, more restrictive management would allow for enhanced opportunities for research, guided tours, and educational programming associated with these highly sensitive and exceptional resources. Therefore, the restricted access would provide a long-term beneficial impact on visitors who value nature study, solitude, and connecting with natural areas.

Visitor Experience: Recreation

In both action alternatives, rehabilitation, expansion, and upgrades to existing facilities, including trails, trailheads, campsites, and picnic areas, as well as improvements to visitor amenities, including building shade structures and upgrading restrooms, would better support visitor and recreation activities throughout the park. In particular, under both alternatives the following areas of the park would see identical improvements to recreation and visitor use facilities, all of which would result in long-term beneficial impacts on visitor experience: Canarsie Pier, Frank Charles Memorial and Hamilton Beach Parks, Breezy Point Tip, and Miller Field.

Canarsie Pier. At Canarsie Pier, the park would be improved to accommodate community events and offer more picnic and gathering space for local residents, and instructional programming would be expanded.

Frank Charles Memorial and Hamilton Beach Parks. At both parks, water access would be improved and current uses would be maintained.

Breezy Point Tip. At Breezy Point Tip, recreational opportunities for fishing, surfing, and other beach-based recreation would be maintained. At the two beach clubs, general visitor uses would be expanded to include more beach recreation opportunities, including watercraft launch sites and equipment rental facilities.

Miller Field. At Miller Field, the fields would be improved to better accommodate the intensive use they already receive. Other improvements at Miller Field would include trail system expansion and upgrades, new recreation facilities in the forest that would appeal to young people and their families, and more facilities to accommodate groups and water-based recreation. Hangar 38 would be stabilized in both alternatives and potentially developed as an indoor recreation facility. Under both alternatives, the existing ball field complex would be removed from Great Kills Park and this use would be consolidated on Staten Island at Miller Field.

Under both alternatives, the management of athletic fields and sports leagues at Miller Field and Frank Charles and Hamilton Beach Parks would be transferred to a third party. Given that the third party would be better versed in managing these recreation uses and facilities than the NPS, this shift in management would result in a beneficial impact on visitor experience under both alternatives.

Water-based recreation would also be enhanced under both alternatives with the development of additional kayak launch and landing sites and the designation of water trails. Opportunities for nature study and experiencing the outdoors and open spaces, including the park's coastlines, would be improved under both alternatives with the expansion of overnight experiences, the creation of more recreational spaces and facilities (such as at existing Pennsylvania Avenue and Fountain Avenue Parks and Spring Creek), and the expansion of trail systems throughout many of Gateway's park lands. The result of this expansion and improvement of recreation opportunities under both alternatives would be a long-term beneficial impact.

The following paragraphs present concise summaries of additional recreation-related proposals common to both action alternatives.

Wetlands Center. Although the scale of the facility development would vary in scale under alternatives B and C, the wetlands center at Floyd Bennett Field is a key new facility development under both alternatives that would result in a substantial long-term beneficial impact on visitor experience. In addition to creating expanded recreational opportunities by offering an extensive trail system and number of outdoor observation facilities, the wetlands center would result in a substantial beneficial impact on visitor understanding of coastal ecology, wetlands, and Jamaica Bay.

Camping. Under both alternatives, the visitor experience at Gateway would benefit substantially from the increase in the number campsites and the expansion of camping programs in the three park units.

Fort Tilden Athletic Fields. At Fort Tilden, sports fields would be removed and relocated to Jacob Riis Park, resulting in an adverse impact on visitors currently using these facilities; however, these uses would not be lost, simply relocated.

Great Kills Marina. Great Kills Marina would be rebuilt and enhanced to offer a variety of visitor services and recreational opportunities (e.g., kayak concessions, water trails, instruction boating zones, and sailing lessons) in addition to typical marina uses such as boat slips. With more uses and improved facilities, the new marina would result in long-term beneficial impacts.

Fort Hancock. Under both action alternatives, buildings at Fort Hancock would be rehabilitated to accommodate a wide variety of uses. By facilitating more and improved uses and experiences of the historic setting, including overnight use, the rehabilitation of Fort Hancock would result in substantial long-term beneficial impacts on visitor experience.

Jacob Riis Park. Following the repairs needed to address damage from Hurricane Sandy, the Jacob Riis bathhouse would be maintained and continue to accommodate park and beach users. Under both alternatives, hard courts on the western side of Jacob Riis Park would be removed in order to soften the site and build resiliency to storm surges. This reduction in court facilities would have an adverse impact on visitors who regularly use these facilities. However, efforts to soften the park by reducing impervious surfaces would potentially reduce the amount of damage from future storms, resulting in a beneficial impact.

Visitor Experience: Night Skies

Creating campgrounds and offering additional overnight experiences at the park under both alternatives may slightly increase night lighting. Camping in lighted structures, such as in established canvas tents and in RV parks, or even where electricity is not available, would result in light from fires, lanterns, and other camping-related equipment. This would increase lighting where it is currently dark, resulting in an adverse impact on visitor experience.

Additionally, reuse of historic buildings at Fort Hancock for overnight accommodations and other historic structures and cultural landscapes for programmatic camping (e.g., Mortar Battery, Battery Weed, and Fort Tompkins) may result in night lighting with adverse impacts on the night sky. However, these same proposed activities would provide unique opportunities to view a more natural night sky than most regional residents are able to see normally, which would be a substantial long-term beneficial impact.

The only substantial new facility development under both alternatives, the wetlands center at Floyd Bennett Field, would result in night lighting, with adverse impacts on the night sky experience at Floyd Bennett Field.

Visitor Experience: Soundscapes

Long-term and sustained adverse impacts on park soundscapes under both action alternatives would result from increased noise levels related to human activity and intensified recreational use at certain park sites, including Floyd Bennett Field, Great Kills Park, and Fort Wadsworth. The wetlands center, in particular, would attract many more visitors to Floyd Bennett Field and would result in adverse impacts on the natural soundscape from visitor transportation and human activity. Also, new or expanded picnic areas and/or community gathering spaces at park lands throughout Gateway would concentrate noise and affect the soundscape.

Although the number of visitors would likely increase under both alternatives, it is also expected that there would be fewer cars because of the availability of public or alternate transportation (which the park would encourage visitors to use), resulting in a beneficial impact on soundscapes.

Loud noises associated with heavy equipment used to remove degraded historic structures, repair Hurricane Sandy damage, create campgrounds, create wetlands, and build new facilities would occur under both alternatives and would result in short-term adverse impacts.

Visitor Experience: Visual Quality

Opportunities to experience scenic views of New York Harbor and other Gateway waters, historic settings, and natural areas would be maintained under both alternatives. Trail expansion and enhancement proposals at Great Kills Park, Fort Wadsworth, the Pennsylvania Avenue and Fountain Avenue Parks, Spring Creek, Fort Tilden, Floyd Bennett Field, and Sandy Hook that include the addition of overlooks, viewing platforms, interpretive signs, and scopes and/or blinds would improve opportunities for scenic viewing. Under both alternatives, rehabilitated historic structures and increased access to more batteries and fortifications would allow for more scenic viewing from the perspective of those who once defended New York Harbor. Finally, increased water-based recreation programming, including kayak instruction and tours as well as guided boat tours, would create additional opportunities to view the park's landscapes and structures form the water. Together, these proposals for facility improvements and expanded access and programming would result in substantial long-term benefits.

Visitor Experience: Education, Interpretation, and Understanding

Under both action alternatives, visitors would have new opportunities to understand the significance of the park's ecological resources as well as its historic structures. This would be accomplished through rehabilitation of historic structures, greater access to coastal defense resources, and/or expanded interpretation of the park's cultural landscapes, buildings, and significance in all three units. As noted above, a wetlands center and the creation of freshwater and saltmarsh wetlands on Floyd Bennett Field would serve as an additional environmental education resource for park staff and park partners. Visitor awareness of Floyd Bennett Field's aviation history would also be elevated under both alternatives through expanded interpretation, airplane exhibits, and rehabilitated hangars. Representing greater access to historic structures, more interpretation of natural and cultural resources, and expanded programming, these proposed actions would result in substantial long-term beneficial impacts.

Further, while the JBSRI would cater to academics and researchers, and not the general visitor, it is likely that research findings from studies conducted at the JBSRI would be translated into interpretive media and/or incorporated into environmental education programming at the park, resulting in an additional beneficial impact.

Health and Safety

Neither action alternative would be expected to increase threats to visitor safety and both include measures that would help ensure safe visitor enjoyment of Gateway's park lands; therefore, impacts on visitor safety would be long term and beneficial. By removing and or stabilizing deteriorating structures throughout the park, the NPS would eliminate potential visitor hazards associated with unauthorized access. Additionally, increased ranger presence throughout the park lands under both alternatives would improve response capabilities for park staff and lend reassurance to visitors. Carefully controlling construction sites and natural resource restoration/construction sites with fencing and monitoring would prevent short-term adverse impacts on visitor safety related to new facility and habitat construction projects.

Reusing former landfill areas for visitors could be dangerous if methane gases and slumping were not managed properly; however, the NPS would ensure that the Pennsylvania Avenue and Fountain Avenue Parks would pass all necessary safety inspections before the public uses them. Similar precautions would be taken before opening the areas of Great Kills Park that have been closed due to radiation, resulting in no additional impacts on visitor health and safety.

Both alternatives would provide increased opportunities for physical activity aimed at improving physical health. The addition of bike lanes, bike and other recreation equipment rentals, campgrounds, trails, and greenways, as well as zoning to increase recreational uses in some areas, would result in more physical activity within and between the park sites and improve physical health. The neighborhoods surrounding Jamaica Bay have some of the highest obesity rates in the city (NYCDOHMH 2011), therefore, by making the Gateway park units more visible and more convenient to access, both alternatives have the potential to

have a beneficial impact on the physical health of local residents. Opportunities for solitude, natural immersion experiences, and overnight camping could increase mental health as well. Throughout the park, shade structures would be constructed in order to enhance visitor comfort. This shade would also contribute beneficially to visitor health by providing shelter and alternatives to excessive exposure to the sun while enjoying Gateway's beaches and open spaces.

Finally, NPS' and its partners efforts to restore and/or reconstruct wetlands and improve water quality in Jamaica Bay and would benefit community health.

In summary, more convenient access to the park sites combined with more recreational facilities and programming and habitat restoration would result in long-term beneficial impacts on visitor health and safety under both alternatives.

Alternative B: Discovering Gateway - NPS Preferred Alternative

Impacts of Alternative B

Visitor Use and Characteristics

Alternative B would greatly increase the diversity of recreational opportunities offered throughout the park and encourage wider visitation and participation by the local and regional population, including those that are not traditional park visitors. Under alternative B, park management would focus on developing a wide range of recreational programming, offered year-round, that would cater to a variety of visitors and skill levels. This wider range of activities, settings, and services would likely appeal to a wider range of participants and would also likely encourage an increase in both new and repeat visitation. In combination with expanded park outreach and publicity and improved access, this expansion in recreation and visitor use opportunities would be expected to result in a 5–10 percent increase in annual visitation over the course of 15 years. This could mean 450,000 to 900,000 more visitors a year. The wetlands center alone is projected to bring in approximately 250,000 a year.

As stated in the "Impacts Common to Both Action Alternatives" section, this increase in visitation and potentially more crowds and congestion may be construed as a negative impact, but on balance the provision of more and improved visitor uses and recreation opportunities would result in a substantial long-term beneficial impact.

Visitor Experience: Recreation

A number of new recreation facilities and opportunities beyond those mentioned in the "Impacts Common to Both Action Alternatives" section are proposed under alternative B. The impacts associated with these new types of recreation development are summarized in the paragraphs below.

Overnight Accommodations. Alternative B would provide the greatest amount of camping experiences and the greatest variety of camping types, with approximately 465–700 permanent campsites, in addition to programmatic camping. This option would offer the greatest distribution of camping, with camping opportunities widely dispersed across multiple sites at each unit. Where appropriate, the NPS would explore opportunities for camping near access points for local communities, adjacent to activities, neighborhoods, shuttle stops, etc. Additionally, buildings at Fort Hancock and the parade ground at Fort Tilden would be rehabilitated to accommodate lodging. Expanding opportunities for overnight use of the park and adding considerably more camping opportunities would result in a substantial long-term beneficial impact on visitor experience.

New Areas for Recreation. Under alternative B, the Pennsylvania Avenue and Fountain Avenue Parks would be opened for recreational uses, including trails and boat launches, observation facilities to take in the views of the bay, a community gathering place, and activities and programming. The parking lot and cricket field at Jacob Riis Park would be reduced in size and transformed into a recreation area that could accommodate sports fields, courts, entertainment venues, and community gathering spaces. The former ball field complex and model airplane field at Great Kills Park would be rehabilitated for new recreational uses, including trails, discovery zones for kids, and camping. At Sandy Hook, recreation would be expanded along the Bayside, including the development of Batteries Kingman and Mills as an activity node for camping, trails, and water-based recreation. In combination, these new areas for recreation would have a long-term beneficial impact on visitor experience by expanding recreation opportunities, creating more opportunities for physical activity, and expanding experiences of Gateway's natural areas and historic setting as well as creating more scenic vistas.

Trails. More miles of trails, including new and expanded trail systems at Floyd Bennett Field, Bergen Beach, Pennsylvania Avenue and Fountain Avenue Parks, Spring Creek, and Fort Tilden in the Jamaica Bay Unit; all parks in the Staten Island Unit; and in the Sandy Hook Unit would result in long-term beneficial impacts. Under alternative B, the expansion of the park's system of trails to include additional miles would be beneficial because the trails provide access to many different types of habitats and historic settings and accommodate a variety of uses, from nature study to equestrian use to mountain biking and walking. Although opening more trails to more uses may impact visitors who prefer to have the trails restricted to walking only, overall, this action would invite more use and expand the enjoyment of Gateway's natural areas and historic settings, resulting in a substantial long-term beneficial impact.

Equestrian Use and Bergen Beach. Equestrian use would be maintained at Bergen Beach, and although facilities there would be improved, the recreational use would not be expanded to other parts of the park. At Bergen Beach, additional types of recreation would be introduced, including programmatic camping, a nature trail to the bay to facilitate fishing and walking, and picnic and open spaces. This proposal would result in a long-term benefit to the majority of visitors and potential visitors who would enjoy expanded access and new facilities at Bergen Beach.

Open Spaces for Gatherings, Picnic Areas, and Outdoor Events. Compared to alternative C, alternative B would include more development of flexible open spaces and community activity areas that could accommodate outdoor play, picnic facilities, group gatherings, and outdoor concerts and performances. This type of development would occur at Floyd Bennett Field, Bergen Beach, Fort Tilden, Jacob Riis Park, Fort Hancock, and Sandy Hook beaches and would have a beneficial impact on visitors looking for spaces outdoors to convene and recreate with their family, friends, and community.

Skill Building Programming. Expanded instructional programming for recreational uses, including equipment rentals and beginner-level facilities, would be provided at Fort Tilden, Floyd Bennett Field, and Fort Hancock. At Jacob Riis Park, a splash park and instructional programming would facilitate water-based recreation skill building. By creating opportunities to introduce visitors to new recreational activities and to build their comfort with these new endeavors and skill level, this proposal would have a substantial long-term beneficial impact. Additionally, it would create ample opportunities in all three units for visitors to progress from beginner-level recreationists to more experienced recreation users.

Water-based Recreation. Under alternative B, opportunities for water-based recreation would be substantially expanded, including enhanced marinas at Great Kills Park and Floyd Bennett Field with more instructional programming and equipment rentals. Additionally, new water-based recreation areas with improved fishing access, water trails, equipment rentals, and landing/launch sites would be established at Bergen Beach, Jamaica Bay Wildlife Refuge (including limited access to select islands), and Fort Wadsworth. At Sandy Hook, a water trail and mooring field would be developed for water-based recreation, and the North Beach facilities would be improved to accommodate more use that would result from the Fort Hancock development under this alternative. Guided tours would provide opportunities to circumnavigate Hoffman and Swinburne Islands and would allow limited access to the islands for wildlife observation, exploration of the historic structures, and programmatic camping. Expanded access to and enjoyment of Gateway's waters, beaches, and coastal environments would result in a substantial long-term beneficial impact.

Visitor Experience: Night Skies

Because alternative B would include the greatest amount of camping and, in particular, the most high-intensity camping facilities, it would result in a greater impact on night skies. New and/or expanded high-intensity camping facilities such as RV campgrounds, structural camping, and drive-in campgrounds proposed for Sandy Hook, Floyd Bennett Field, Jacob Riis Park, Fort Tilden, Great Kills Park, and Fort Wadsworth would introduce new sources of light in areas where there is currently little night lighting from park sources. Although not significant, these sources of night lighting from camping and from overnight use of rehabilitated buildings at Fort Tilden and Fort Hancock would have a long-term adverse local impact on the visitor experience of night skies.

Visitor Experience: Soundscapes

Given the increase in visitor use under alternative B, impacts on the natural soundscape from visitor activity and human voices would be more substantial than under alternatives A and C. Additionally, because this alternative opens new areas to visitor use, including Swinburne and Hoffman Islands, Canarsie Pol and Ruffle Bar, Batteries Kingman and Mills at Sandy Hook, and Pennsylvania Avenue and Fountain Avenue Parks, alternative B would introduce new noises associated with visitor use and recreation to these currently unused and quiet areas. Entertainment venues and/or outdoor spaces for events and performances proposed at Floyd Bennett Field, the Pennsylvania Avenue and Fountain Avenue Parks, and Fort Wadsworth would create additional sources of noise and impact the natural soundscape in their vicinity. Do to an increase in the number of recreation facilities and types of uses, noise from park operations and maintenance activities would be increased. Although not significant, noise associated with human voices and park operations and maintenance would have a long-term adverse local impact on the visitor experience of quiet soundscapes.

Visitor Experience: Visual Quality

With the construction of both the wetlands center and a viewing tower, scenic viewing would be substantially improved at Floyd Bennett Field. Additionally, trail expansions and upgrades incorporating overlooks, boardwalks, and viewing platforms would increase opportunities for taking in views of New York Harbor and other scenic vistas including varied natural environments as well as historic settings. For example, expanded trail systems at Fort Tilden, Fort Wadsworth, and Sandy Hook would afford visitors new opportunities to experience and view coastal defense resources well as natural vistas by recreating among them. Also, the proposal to build a community gathering space and overlook at the Pennsylvania Avenue and Fountain Avenue Parks would take advantage of the site's elevation and provide excellent views of Jamaica Bay and its surroundings. Together, these developments would result in long-term beneficial impacts.

Visitor Experience: Education, Interpretation, and Understanding

Under alternative B, educational and interpretive programming and media developed by park staff and partners would be purposively aimed at engaging a wider audience while also enhancing individual understanding of Gateway's resources and values. This would include different content, translation into different languages, targeting different audiences, and more robust development and communication of interpretive media. Coupled with increased outreach and higher visitation levels, this targeted delivery of media to engage new audiences would lead to an expanded awareness of Gateway and inform more visitors and area residents about its resources and recreation opportunities, resulting in a substantial long-term beneficial impact.

Specifically, the following proposals for expanded interpretive and educational programming and facilities beyond those mentioned in the "Impacts Common to Both Action Alternatives" section would increase visitor understanding of the park's resources and significance and result in beneficial impacts.

Jamaica Bay Wildlife Refuge. Big Egg would be used as an interpretive area, programmatic camping would be introduced at Canarsie Pol, and educational and interpretive programmatic links would be made with the wetlands center, Sunset Cove Park, and other New York City Department of Parks and Recreation (NYCDPR) parks.

Batteries Kingman and Mills and Nike Missile Site at Sandy Hook. The conversion of Batteries Kingman and Mills into a recreation hub would present additional opportunities to expose more Sandy Hook visitors to the park's coastal defense history and significance. In addition, the Nike Missile site would be interpreted and open for self-guided exploration.

Health and Safety

As addressed in the "Impacts Common to Both Action Alternatives" section, alternative B would not be expected to increase threats to visitor safety and would include measures that would help ensure safe visitor enjoyment of Gateway's park lands, resulting in long-term beneficial impacts on visitor safety.

With even greater recreational opportunities and an emphasis on offering entry-level and instructional programming along with providing equipment rentals, alternative B would attract more people and groups to participate in physical activity and would therefore make a larger contribution to community wellness. For example, parks like Fort Wadsworth would be promoted more widely and visibly as a destination for recreation. This increased publicity, in combination with improved connections to the NYC Greenway, an expanded trail system, and more flexible spaces for outdoor recreation and gatherings, would make it more likely for the space to be used more by local residents. This pattern would be repeated across the park, resulting in a substantial long-term beneficial impact.

Cumulative Impacts

Cumulative impacts on visitor use and experience from past, present, and reasonably foreseeable projects would remain the same as described above for alternative A (no action). Collectively, these cumulative actions have contributed or would contribute adverse and beneficial impacts on visitor use and experience. When the impacts on visitor use and experience as a result of alternative B are combined with these other projects in the study area, an overall beneficial cumulative impact would be expected. With a substantial increase in recreational uses, facilities, and enriched and expanded visitor experiences, alternative B would contribute an appreciable beneficial impact, as well as an imperceptible adverse impact.

Conclusions

The variety of recreational opportunities proposed under alternative B, along with new and enhanced recreation facilities and visitor spaces and the purposeful effort to engage a more diverse audience, would have a positive and important impact on visitor experience at Gateway. With a substantial increase in recreational uses, including introducing new uses and instructional programming throughout the park and using media, access, and

facility upgrades to enrich and expand visitor understanding of Gateway's resources and significance, alternative B would contribute an appreciable beneficial increment and an imperceptible adverse increment to the cumulative impacts. The beneficial impacts of Alternative B on visitor experience would be significant.

Alternative C: Experiencing Preserved Places

Impacts of Alternative C

Visitor Use and Characteristics

Under alternative C, visitor use opportunities and recreation facilities would be concentrated and smaller in scale than under alternative B to reduce the footprint of development on park lands and create a more sustainable system of recreation facilities. This clustering of activity nodes and recreational activities would affect visitor use patterns. For example, campgrounds would be smaller and clustered in order to ensure that visitors would have quieter, more secluded nature and overnight experiences. The clustering and limited size of recreational development would result in a beneficial impact because it would leave large expanse of undeveloped open space that would still provide many opportunities for visitors seeking solitude, natural quiet, dark night skies, and other connections with the natural world, which can be challenging to find in Gateway's urban context.

The clustering and limited size of recreational development would result in a beneficial impact because it would leave large expanse of undeveloped open space that would still provide many opportunities for visitors seeking solitude, natural quiet, dark night skies, and other connections with the natural world, which can be challenging to find in Gateway's urban context.

Like alternative B, this alternative would result in an increase in visitation. With the wetlands center drawing approximately 250,000 visitors, expanded park outreach and publicity, improved access, and an increase in recreational opportunities, as well as a considerable increase in volunteer stewardship programs and interpretive and educational programming, it is expected that alternative C would result in a 2–5 percent increase in annual visitation over the course of 15 years. This could mean 180,000 to 450,000 more visitors a year. Similar to alternative B, the wider range of activities and the opportunity to make more and closer connections with the park's resources and unique settings would likely encourage an increase in both new and repeat visitation.

As stated in the "Impacts Common to Both Action Alternatives" section, this increase in visitation and potentially more crowds and congestion may be construed as a negative impact, but on balance, the provision of more and improved visitor uses and recreation opportunities would result in a substantial long-term beneficial impact.

Visitor Experience: Recreation

Most of the existing recreational activities in the park would continue and be better supported through the facilities and access improvements already mentioned in the "Impacts Common to Both Action Alternatives" section. A number of new recreational facilities and opportunities beyond those mentioned in the "Impacts Common to Both Action Alternatives" section are proposed under alternative C. The impacts associated with these new types of recreation development are summarized in the paragraphs below.

Overnight Accommodations. Alternative C would represent a significant increase in camping opportunities, with approximately 215–320 permanent campsites, in addition to programmatic camping. Through an emphasis on programmatic camping, this option would enable visitors to immerse in Gateway's preserved natural and cultural resources through interpretive and low-impact camping opportunities. Camping would be provided in each of the three units but would be concentrated in fewer locations than under alternative B to minimize the development footprint. Buildings at Fort Hancock and the parade ground at Fort Tilden would be rehabilitated to accommodate lodging. Expanding opportunities for overnight use of the park and adding considerably more camping opportunities would result in a substantial long-term beneficial impact on visitor experience.

New Areas for Recreation. Under alternative C, the Pennsylvania Avenue and Fountain Avenue Parks would be open for recreational uses including a coastal trail, a boat launch, and educational and interpretive facilities that would interpret ecosystem recovery and sustainability. Equestrian use would be introduced to Fort Tilden. The former ball field complex and model airplane field at Great Kills Park would be converted into a natural area with trails and other opportunities to experience and explore the restored natural environment. Nature play areas for young people and skill zones would be established at some park sites, including a dune playscape at Jacob Riis Park and a nature play area at the Education Field Center at Great Kills Park. In combination, these new areas for recreation and new uses would have a long-term beneficial impact on visitor experience by expanding recreation opportunities, creating more opportunities for physical activity, and expanding experiences of Gateway's natural areas and historic setting as well as creating more scenic vistas.

Trails. Trail systems would be expanded at Jamaica Bay Wildlife Refuge's East Pond and Sandy Hook's Bayside to increase wildlife observation and nature study opportunities. At Fort Wadsworth, a "Coastal Defense Trail" would be developed, and a similar trail system would be developed at Fort Hancock among the batteries to allow for more guided and self-guided exploration and interpretation of the coastal defense resources. These trail system expansions and the development emphasis on improving nature study and interpretive opportunities along trails would expand the enjoyment and understanding of Gateway's natural areas and historic settings, resulting in a substantial long-term beneficial impact.

Equestrian Use and Bergen Beach. Equestrian facilities at Bergen Beach would be removed and the use relocated to Floyd Bennett Field and/or Fort Tilden. The removal of these facilities could have a short-term adverse impact on their experience of the park for some visitors who have relied on the facilities. However, it could also be beneficial for many more visitors, who would be invited to enjoy Bergen Beach as a natural area where they would find opportunities for both recreation and quiet sensory connections with the natural environment.

Water-based Recreation. Additional improvements to water-based recreation would include limited guided boat access to Canarsie Pol and Ruffle Bar for wildlife observation, as well as water trail connections and/or launch areas at Jacob Riis Park, Fort Tilden, and Fort Wadsworth. These expanded opportunities to experience Gateway's waters, beaches, and coastal environments would result in a long-term beneficial impact.

Most of the park's current recreational activities would be maintained; however, there would be more regulations and restrictions on access to better protect resources under alternative C than under alternatives A and B. Sensitive Resources Subzones on the ocean and Bayside of the Sandy Hook Unit; at Floyd Bennett Field, Bergen Beach, and Fort Tilden in the Jamaica Bay Unit; and at Great Kills Park would require limitations on visitor access to those areas. These restrictions and regulations could have an adverse impact on some visitors in terms of visitor opportunities, with the greatest effect on local visitors who use these areas on a regular basis. However, these restrictions would also create enhanced opportunities for research, nature study guided tours, and volunteer stewardship and environmental education programs in some of the park's most significant natural habitats, which would result in a beneficial impact.

Visitor Experience: Night Skies

As in alternative B, the expansion of camping would result in an adverse impact on the park's natural night skies. However, compared to alternative B, the emphasis in alternative C would be on lower-intensity forms of camping (e.g., programmatic and backcountry camping), which have fewer associated sources of night lighting than RV parks and drive-in campgrounds. Although not significant, night lighting from camping and from overnight use of rehabilitated buildings at Fort Tilden and Fort Hancock would have a long-term adverse local impact on the visitor experience of night skies.

Visitor Experience: Soundscapes

As in alternative B, the increase in visitor use under alternative C in areas where recreation and visitor use is concentrated, such as Floyd Bennett Field, Fort Tilden, Jacob Riis Park, and Fort Wadsworth, would result in impacts on the natural soundscape from visitor activity and human voices. However, because alternative C would include more expansive Sensitive Resources Subzones where visitor access is restricted, noise in these areas associated with human voices would be decreased. The development of a recycling facility and waste generator at Floyd Bennett Field would introduce another source of noise from both the facility itself and trucks. However, the facility would be sited in the park's operations zone, where visitor use is limited. On balance, noise associated with human voices and park operations and maintenance would increase imperceptibly, having only a long-term adverse local impact on the visitor experience of quiet soundscapes.

Visitor Experience: Visual Quality

Scenic viewing would be enhanced under this alternative through improvements to cultural landscapes and the preservation of their character-defining features to create a more authentic historic setting. Maintaining low levels of development, removing some facilities, and restoring landscapes would provide more opportunities for people to retreat from the urban environment of New York City and take in quiet natural environments and historic settings. At Fort Wadsworth, open vistas to the water would be maintained by keeping the forest thinned. At Fort Hancock and Fort Wadsworth, trails would be designated among the fortifications that would highlight views of park's historic resources as well as its natural

resources and views of the harbor. At Fort Hancock, stabilization of additional batteries would also include clearing in order to establish water vistas. This clearing would improve viewing opportunities for visitors as well as helping them understand how the fortifications operated in defense of New York Harbor. Together, these developments would result in long-term beneficial impacts.

Visitor Experience: Education, Interpretation, and Understanding

Under alternative C, the park's natural and cultural resources would be preserved to their highest level of quality, providing the best opportunity for visitors to understand and forge a connection with the resources and values of the park as well as the larger national park system, resulting in a substantial long-term beneficial impact.

Under alternative C, the visitor experience would be expanded to include substantially more stewardship and volunteer activities, and there would be an increase in opportunities for hands-on involvement in natural resource protection, monitoring, and restoration projects as well as historic preservation projects. These activities would allow the park staff to engage a wider audience and better demonstrate the park's fundamental resources and values, particularly its coastal military defense structures and stories. New stewardship and educational and training facilities as well as stewardship projects are proposed at Floyd Bennett Field, Jamaica Bay Wildlife Refuge, and Fort Hancock. For example, Jamaica Bay Wildlife Refuge, in conjunction with the wetlands center at Floyd Bennett Field, would serve as the primary venue for stewardship and participatory science activities with access to programs throughout the park, allowing these opportunities to be better marketed, coordinated, and facilitated.

Specifically, the following proposals for expanded interpretive and educational programming and facilities beyond those mentioned in the "Impacts Common to Both Action Alternatives" section would increase visitor understanding of the park's resources and significance and result in a substantial long-term beneficial impact.

Sustainability. Under this alternative, there would be a greater emphasis on interpreting the park's sustainability practices. The development of a large and innovative composting facility that includes an anaerobic digester at Floyd Bennett Field would create new opportunities to interpret the park's sustainability practices. Ecosystem recovery and resiliency and sustainability practices would also be highlighted under alternative C at the landfill and at Sandy Hook and on the Rockaways. Additionally, the Wetlands Center at Floyd Bennett Field as well as the JBSRI would present interpretive and educational media related to sustainability within Gateway and New York City.

Jamaica Bay Wildlife Refuge. The Jamaica Bay Wildlife Refuge would serve as an educational field station for natural resource protection and restoration training, where a number of research projects would be ongoing and invite visitor participation. Wildlife observation and nature study opportunities would be expanded at the refuge to encourage more self-guided exploration and learning about the area's habitats and wildlife.

Fort Tilden. Expanded education and interpretive programming would be offered at Fort Tilden, including historic preservation and natural resource programming, as well as expanded interpretation along trails and parade ground interpretation.

Fort Wadsworth. Increased interpretive and educational programming and expanded interpretive media would be provided at Fort Wadsworth. Portions of Fort Tompkins would be rehabilitated as a visitor facility with exhibits and spaces for education and interpretive programming.

Great Kills Park Education Field Center. The Education Field Center would be enhanced to include trails and a trailhead, a nature playground, and programmatic camping.

Fort Hancock. Additional tours and educational programming related to Fort Hancock's military history would be provided, as well as increased opportunities for volunteer historic preservation projects and natural resource stewardship activities. The Nike Missile radar site and structures would be converted into an interpreted, visitor-ready site.

Health and Safety

As addressed in the "Impacts Common to Both Action Alternatives" section, alternative C would not be expected to increase threats to visitor safety and would include measures that would help ensure safe visitor enjoyment of Gateway's park lands, resulting in long-term beneficial impacts on visitor safety.

In addition to inviting more recreational use and promoting the park's opportunities for recreation and physical activity, alternative C would encourage and invite volunteer stewardship and active participation in the care of the park's resources. Similarly, under alternative C, the park would promote and facilitate opportunities to recreate in Gateway's natural setting and partake in expanded nature study and environmental education programming. As a result, alternative C would offer expanded opportunities for physical activity and have a beneficial impact on physical health.

Cumulative Impacts

Cumulative impacts on visitor use and experience from past, present, and reasonably foreseeable projects would remain the same as described for alternative A.

Collectively, these cumulative actions have contributed or would contribute adverse and beneficial impacts on visitor use and experience. When the impacts on visitor use and experience from alternative C are combined with these other projects in the study area, an overall beneficial cumulative impact would be expected. With more in-depth interpretive and educational programming and expanded opportunities for enjoyment of the park's natural environments and historic settings, alternative C would contribute a noticeable beneficial impact.

Conclusions

Under alternative C, the Gateway visitor experience would be improved regarding the depth and content of educational programming, interpretation, and resource stewardship, along with the preservation and promotion of visitor activities focused on immersion in the natural and cultural settings unique to the park. Visitors would gain a better understanding of park's coastal defense and maritime history and its connection to national history and find ample opportunities to experience open space and nature. Considering all of these factors in the context of the park's fundamental values, alternative C would contribute a noticeable beneficial increment to the cumulative impacts. While the alternative's more limited recreational facility development and reduced variety of recreational activities might not encourage as much connection to the diverse local and regional population, the beneficial impacts of Alternative C on visitor experience would still be significant.

Social and Economic Environment

The potential social and economic impacts of the GMP/EIS are of importance to the communities surrounding Gateway. Social impacts typically include effects on population growth, housing, and community facilities and services. Economic impacts are often expressed in terms of the number and types of jobs supported by the park, park spending, visitor use at the park, and the associated changes in the surrounding community in the form of visitor spending.

Laws and Policies

The NPS NEPA Handbook (Director's Order 12) notes that while NEPA is only triggered when there is a physical impact on the environment, social and economic impacts are to be included in an analysis (section 1.3). Although the socioeconomic environment receives less emphasis than the physical or natural environment in the CEQ NEPA regulations, the NPS considers it an "integral part of the human environment" (section 9.1).

NPS *Management Policies 2006* (NPS 2006a) states under section 1.6, "Cooperative Conservation beyond Park Boundaries," "Cooperative conservation beyond park boundaries is necessary as the National Park Service strives to fulfill its mandate to preserve the natural and cultural resources of parks unimpaired for future generations." Included under this policy guidance is the recognition that "NPS activities may have impacts outside park boundaries. Recognizing that parks are integral parts of larger regional environments, and to support its primary concern of protecting park resources and values, the Service will work cooperatively with others to:

- Anticipate, avoid, and resolve potential conflicts;
- Protect park resources and values;
- Provide for visitor enjoyment; and
- Address mutual interests in the quality of life of community residents, including matters such as compatible economic development and resource and environmental protection."

This overall policy guidance provides a foundation for assessing social and economic impacts.

Methods

Potential impacts on Gateway's social and economic environment are assessed based on the current description of Gateway's context presented in this GMP/EIS. They are directly related to the proposed levels of visitor use that are anticipated under each alternative. The resource-specific context for assessing the significance of impacts of the alternatives to the surrounding communities includes the following:

- The effect of visitor use and experience improvements on population and housing in the surrounding communities

- The effect of visitor use and experience and partners' programming improvements on the community facilities and services in the surrounding populations

- The effect of changes in park staffing and spending to operate the park

- The effect of changes in the level of visitor use at the park, which contributes to visitor spending in the surrounding communities

Alternative A: No Action

Impacts of Alternative A

Under alternative A, existing visitor uses and experiences would be maintained and other than repairs and/or facilities required due to damage from Hurricane Sandy, no new visitor facilities would be constructed. Implementing the no-action alternative would occur against a backdrop of other economic, demographic, and social changes in the region as outlined in the "Social and Economic Environment" section in chapter 3.

Population and Housing

Under this alternative, it is anticipated that visitation would continue to remain consistent with the 38-year average of 9 million annual visitors. Visitors would continue to have access to most of the sites in Gateway; only a few areas may restrict access to protect sensitive resources or visitor safety. Parkwide, people would continue to find many opportunities to get away from it all and experience the qualities of open spaces and natural areas.

Anticipated annual population increases ranging from 0.3 to 0.81 percent per year have been identified in the communities surrounding each management unit (Jamaica Bay, Staten Island, and Sandy Hook); these increases are not driven directly by the existence of Gateway. The largest increase was anticipated for Staten Island. The Jamaica Bay unit population forecasts were estimated prior to Hurricane Sandy; as such, they may be adjusted downward. Despite the surrounding resident population changes, park visitation has remained somewhat stable (see the "Visitor Use and Experience" sections of the GMP/EIS for more

information). As such, it would appear that even with forecasts of minor population growth, the visitation at Gateway is forecasted to remain consistent with historical trends.

Gateway currently provides open space preservation and recreation opportunities for visitors. Continuing current management would also continue to contribute to a desirable residential housing environment because of these factors. The exact nature of the benefit is not quantifiable, in part because the housing inventory is currently in a state of flux in communities surrounding Jamaica Bay due to the impact of Hurricane Sandy.

Community Facilities and Services

Implementing alternative A, the no-action alternative, would have no impact on local community services and facilities beyond what is the case now. The current visitation and traffic would not impact surrounding the community's services (e.g., utilities, roads, public transportation) beyond current levels and no additional community facilities would be anticipated to be needed.

Park Employment and Spending

Under alternative A, as long as there are no changes in the funding levels contributing to the park operating budget from both the NPS and its other operating partners (e.g., concessioners, cooperating associations) it is anticipated that the park employment levels would remain the same. Additionally, assuming that the current allocation of operating budgets between employment and other operating expenses is maintained, the impact of park spending should not change from what is now the case. Sustaining the park staffing levels and park operating budget at current levels would continue a long-term beneficial impact.

Visitor Use Spending

Visitor use and the accompanying visitor spending would be anticipated to remain at historical levels. Overall, median household income is anticipated to grow at approximately the rate of inflation in the surrounding communities. If it is assumed that the park visitors maintain their household income distribution similarly for recreational and leisure activities, including expenditures at and around Gateway, visitor use spending would continue to provide a long-term beneficial impact.

Cumulative Impacts

Cumulative impacts on the social and economic environment from past, present, and reasonably foreseeable projects would result from park recreation, park improvements, and natural habitats as well as employment shifts.

Park Recreational Improvements and Natural Habitat Restoration Projects

The *Vision 2020: New York City Comprehensive Waterfront Plan* (NYCDCP 2011) and its contribution to the cumulative impacts on visitor use and experience were outlined in the analysis of cumulative impacts under alternative A in the "Visitor Use and Experience" section in this chapter. The existence of these projects outside of Gateway will have a short- and long-term beneficial impact on the local population and housing market because they contribute to the array of community residential amenities. However, as noted in the "Visitor Use and Experience" section, the potential for short-term adverse impacts on visitor use also exists. If it were assumed that there would be a change in expenditures as a result of implementing the Vision 2020 plan, which is undetermined at this point, then the community would also experience a short-term adverse impact in visitor spending. However, if visitors would simply be exchanging their expenditures, overall impacts would be neutral. Alternative A would contribute an imperceptible beneficial increment to the cumulative impact of Vision 2020 plan park recreational improvements and natural habitat restoration projects in an urban context.

Employment Shifts

The Vision 2020 plan (NYCDCP 2011) discusses the opportunity for economic development across the waterfront, particularly in the vicinity of Jamaica Bay and portions of Staten Island. A primary focus of this plan is ensuring that the facilities at the Port of New York and New Jersey are expanded. As outlined in Goal #3, "Support the Working Waterfront," the priorities of Vision 2020 and the Action Agenda items focus on investments that can catalyze investment in waterfront enhancement. For example, a priority project covers evaluating the potential of expanding the container handling capacity at the New York Container Terminal, Staten Island. It is estimated that if this project is completed there could be an additional 300 jobs generated. Within the communities surrounding Gateway, employment in the transportation and warehousing industries represents 5 to 8 percent. Therefore, increases in these employment sectors could have a beneficial short- and long-term impact on employment in the area and would potentially contribute positively to the household income in the surrounding communities. This income would be available for spending on recreational and leisure activities. Continuing current management practices under alternative A would contribute an imperceptible beneficial increment to these cumulative impacts of employment shifts on the social and economic environment.

Conclusion

Alternative A would result in long-term beneficial impacts from continued opportunities to access resource-dependent visitor opportunities and experience the natural, historic, and scenic qualities of the park. These impacts, however, would not be significant. Social and economic effects of the above actions include potential inconsequential adverse impacts from shifts in visitor expenditures resulting from changes in recreational use patterns. The impacts from potential employment changes would have short- and long-term beneficial impacts due to increases in household income available to spend on recreational and leisure

activities. Overall, the no-action alternative would result in minor short- and long-term beneficial effects, but they would not be significant. It would contribute imperceptibly to cumulative adverse and beneficial impacts from implementing the NYC Vision 2020 Plan.

Common to Both Action Alternatives

Under both action alternatives, the NPS and its partners would greatly increase the promotion of the park's offerings; rehabilitate, expand and upgrade existing facilities, including trails, trailheads, campsites, and picnic areas; and support additional new improvements. Additionally, access and transportation options to park amenities would be improved and expanded. Overall, both options would result in increases in visitation ranging from an estimated 2 to 10 percent.

Impacts of Alternatives B and C

Population and Housing

Implementing both alternatives would occur against the same backdrop of economic and demographic conditions in the surrounding communities described in the no-action alternative. The effects of both alternatives would add another set of factors providing support for the surrounding communities' overall quality of life. However, it is anticipated that the alternatives would not directly affect the population and housing inventory.

Community Facilities and Services

Under both action alternatives, it is estimated there would be an increase in visitation as well as overall activity in and around the communities of Gateway. Specifically, recommendations for improvements to transportation infrastructure are contemplated. A focus on affordable transportation options and linkages with public transportation is included in both alternatives and is described in more detail in the "Transportation" sections of the GMP/EIS. The variety and quality of recreational facilities and visitor services would also be enhanced and improved under both alternatives, actions that are likely to increase visitor use and demand for and impact on available transportation facilities and systems. Additionally, for those services that are envisioned for joint management and maintenance between the NPS and New York City, there would be resultant increases in public service costs. Absent understanding the fees and charges for transportation systems and visitor activities, the cost offsets for the benefits provided cannot be determined. As a result, the economic impact is unknown, although the social impact would be beneficial because of the increased availability of community facilities and services.

Park Employment and Spending

Both alternatives would include expansion of operations; however, management strategies for elements of the alternatives to accommodate the expansion are yet to be confirmed. Management options presently identified include the NPS, private sector partners/ concessioners, nonprofit partners, and joint management with New York City. As such, it

is difficult to quantify the overall impact on park employment at this point in the analysis, although it is likely to be beneficial as expansion would be needed to manage increases in visitor use, new or restored facilities, and increased programming. Park spending for improvements and operations would also be anticipated to increase under both alternatives, even though the funding could come from any of the management entities. Overall construction, development, and expanded operations would have a long-term beneficial impact on park spending.

Visitor Use Spending

Under both action alternatives, there would be an increase in annual visitor use at the park over the long term, resulting in a long-term benefit for visitor use spending. The rate of increase would be commensurate with the timing of proposed improvements and expansion. At this time, it is difficult to gauge what percentage of visitors would come from the local area and what percentage would come from outside the area, although several of the improvements (e.g., the wetlands center, expanded and unique campground offerings) would attract additional nonresident visitors. Regardless of whether it is from local or nonresident visitors, the additional recreational visitor use would undoubtedly result in additional retail and recreational expenditures. Depending on the demand profile of visitors drawn by the wetlands center, there may also be additional lodging expenditures. Economic benefits of additional visitor use spending include the potential for additional jobs as compared to the no-action alternative. These jobs may result from increased business opportunities created in the park by concessioners and nonprofit partners, as well as outside the park, to service the increased level of visitation. State and local governments would collect additional sales tax from increased visitor spending, a beneficial impact for these agencies' budgets.

Alternative B: Discovering Gateway - NPS Preferred Alternative

Impacts of Alternative B

Alternative B would greatly increase the diversity of recreational opportunities offered throughout the park and encourage wider visitation and participation by the local and regional population, including those that are not traditional park visitors. The expansion in recreation and visitor use opportunities would be expected to result in an estimated 5 to 10 percent increase in annual visitation over the course of 15 years. This could mean 450,000 to 900,000 more visitors a year.

Population and Housing

Implementing alternative B would provide the surrounding communities an array of recreational and leisure activities, which are considered to enhance the quality of life in the community. However, this alternative occurs against the same backdrop of economic and demographic conditions in the surrounding communities described in the no-action alternative. Therefore, it is anticipated that this alternative would not directly affect the population and housing inventory.

Community Facilities and Services

Alternative B includes the greatest level of development and improvements, and resulting anticipated increases in visitor use, of all the alternatives. The visitor uses identified relate to recreation, community activities, and environmental education, and visitation levels would be highest under this alternative. As such, the impact on the community facilities and services would be greater under alternative B than under alternative C. Transportation improvements would be relatively similar under both alternatives, including affordable transportation options and linkages with public transportation. Like alternative C, the variety, quality, and quantity of recreational facilities and visitor services would be enhanced and improved under alternative B. This would potentially alleviate community expenditures on similar facilities. The impact of additional nonresident visitors in local accommodations would marginally affect water and wastewater treatment plants if there were incremental demand for the local area hotels. However, the distribution of these visitors across the surrounding communities would probably keep any impact from becoming more than negligible, although it would be a long-term impact. Tax revenues generated by visitor spending would help to provide resources to meet these future needs. Overall, there would be long-term beneficial impacts on community facilities and services.

Park Employment and Spending

Alternative B would provide the greatest opportunity for increased park employment overall. This includes employment by all the management entities envisioned (i.e., the NPS, private sector partners/concessioners, nonprofit partners, and joint management with New York City). The distribution of employment increases between the management entities cannot be estimated at this time. As such, the employment dollar impact cannot be quantified but would be beneficial. There is a likelihood, however, that many of the new jobs may be of a seasonal nature (as opposed to year-round), based on the types of activities envisioned and potential management structures and seasonal visitation patterns. Park spending for improvements and operations is likewise difficult to assess at this time. Although the volume of new development under alternative B would be greater than under alternative C, the types of proposed expenditures vary. Additionally, depending on which party is responsible for development and the process for procurement, the levels of expenditures will vary. The beneficial impact on park spending would be anticipated to be higher for alternative B because the amount of activities envisioned would require a higher level of staffing support and accompanying supplies and materials.

Visitor Use Spending

Alternative B would provide the highest estimated visitor use, with an estimated increase of approximately 450,000 to 900,000 over the next 15 years. It would appear that the nature, diversity, and capacity of development under alternative B would also result in higher nonresident visitor numbers. As a result, alternative B is also likely to bring additional retail and recreational expenditures as well as the potential for lodging expenditures. The economic benefits of additional visitor use spending include the potential for additional jobs as compared to the no-action alternative. These jobs may result from increased business

opportunities created in the park by concessioners and nonprofit partners, as well as outside the park, to service the increase level of visitation. State and local governments would collect additional sales tax from increased visitor spending. Overall, the increased visitor use would result in a long-term beneficial impact on visitor use spending.

Cumulative Impacts

Cumulative impacts on the social and economic environment from past, present, and reasonably foreseeable projects would remain the same as described for alternative A (no action).

Collectively, these actions have contributed or would contribute noticeable short- and long-term beneficial effects. When the beneficial impacts on the social and economic environment as a result of alternative B are combined with these other projects in the study area, alternative B would contribute an appreciable long-term beneficial impact.

Conclusion

The increased variety and number of recreational activities and opportunities for community events and environmental education under alternative B would support an increase in anticipated visitor use. Overall, impacts of this alternative on the social and economic environment would be beneficial, due primarily to the increased visitation expected under this alternative. Short- and long-term benefits include potential increases in employment and visitor use spending. Additionally, the alternative would result in long-term benefits for community facilities and services. Overall, alternative B would result in a significant beneficial impact. Actions in alternative B would also contribute appreciable long-term beneficial cumulative impacts when combined with other projects in the study area.

Alternative C: Experiencing Preserved Places

Impacts of Alternative C

Under alternative C, visitor use opportunities and recreation facilities would be concentrated and smaller in scale than under alternative B to reduce the footprint of development on park lands and create a more sustainable, clustered system of recreation facilities. This alternative would result in an estimated 2 to 5 percent increase in annual visitation.

Population and Housing

Implementing alternative C would provide the surrounding communities a more concentrated and smaller scale of development, including more clustering of recreational and leisure activities than alternative B, although it would still be substantially greater than alternative A. Additionally, many of the proposed improvements are focused on preserving historical and cultural activities, which provide settings that are considered to enhance the quality of life in the community. However, this alternative occurs against the same backdrop of economic and demographic conditions in the surrounding communities described in the no-action alternative. Therefore, it is anticipated that this alternative would not directly affect the population and housing inventory.

Community Facilities and Services

Alternative C would include a moderate level of concentrated development of recreational activities. Additionally, the focus on experiencing preserved places would potentially result in less resident visitation and greater nonresident visitation. However, because increases in visitation compared to the no-action alternative are anticipated, there would be some positive impact on community facilities and services. Transportation improvements would be relatively similar under both action alternatives, including affordable transportation options and linkages with public transportation. The impacts on transportation infrastructure would be less under this alternative than under alternative B. The impact of additional nonresident visitors in local accommodations would marginally affect water and wastewater treatment plants if there were incremental demand for the local area hotels. However, the distribution of these visitors across the surrounding communities would probably keep the impacts from becoming any greater than negligible. Tax revenues generated by visitor spending would help to provide resources to meet these future needs. Overall, there would be potentially long-term beneficial impacts on community facilities and services.

Park Employment and Spending

Alternative C would provide an opportunity for increases in employment for park purposes by all management entities envisioned (e.g., the NPS, private sector partners/concessioners, nonprofit partners, and joint management with New York City). However, it is anticipated that the employment levels would be lower because the number of private sector business opportunities would be smaller under this alternative. Because the distribution of employment increases between the management entities cannot be estimated at this time, the employment dollar impact cannot be quantified but would be beneficial. As was the case with alternative B, the employment under this alternative would be more of a seasonal nature (as opposed to year-round), based on the types of activities envisioned and potential management structures and seasonal visitation patterns.

Park spending for improvements and operations is similarly difficult to assess at this time. Although the volume of new development under alternative C would be less than under alternative B, the types of proposed expenditures vary. For example, historic preservation expenditures may be higher than new construction. Overall, park spending for improvements would be considered to provide moderate short- and long-term beneficial impacts on the construction and trade industry, based primarily on the development timeline of projects. Park spending on operations would be anticipated to be lower under alternative C than under alternative B, based on the fact that there would be a smaller number of business opportunities; therefore, employment and accompanying supplies and materials would be less. Overall, the impact on park employment and spending would still be long term and beneficial.

Visitor Use Spending

Alternative C would provide an estimated increase in visitor use of 180,000 to 450,000 over the next 15 years, resulting in a long-term beneficial impact on visitor spending. Overall, the historical and cultural preservation included in alternative C may attract a larger nonresident

population. However, the scale and type of development outside this use may not attract as many nonresident visitors (e.g., size of campground, other overnight accommodations) as alternative B. This alternative would result in additional retail and recreational expenditures and a potentially a slightly smaller portion of lodging expenditures. The economic benefits of additional visitor use spending include a potential for additional jobs that is estimated to be less than under alternative B. These jobs may result from increased business opportunities created in the park by concessioners and nonprofit partners, as well as outside the park, to service the increased level of visitation. State and local governments would collect additional sales tax from increased visitor spending.

Cumulative Impacts

Cumulative impacts on the social and economic environment from past, present, and reasonably foreseeable projects would remain the same as described for alternative A (no action).

When the beneficial impacts on the social and economic environment from alternative C are combined with these other projects in the study area, alternative C would contribute an appreciable beneficial increment to the cumulative impacts.

Conclusion

The preservation of historical and cultural resources, improvement and concentration of recreational activities, and increase in open space under alternative C would support an increase in anticipated visitor use. Overall, impacts of this alternative would be beneficial, due primarily to increased visitation expected under this alternative. Short- and long-term consequences include potential increases in employment and visitor use spending as well as a beneficial short- and long-term impact on community facilities and services. Overall, alternative C would result in a significant beneficial impact. Actions in alternative C would also contribute an appreciable benefit to cumulative impacts when combined with other projects in the study area.

Transportation

Transportation is intricately tied to the varied visitor activities provided at each of Gateway's units. During public scoping meetings conducted in 2009, the public emphasized that transportation improvements should focus on convenience, affordability, and accessibility for all. Specifically, the public expressed support for alternative transportation approaches. Some people also noted that good public transportation connections currently exist for bringing visitors to park unit entrances, but not necessarily into and through the unit areas. This section describes the impacts of the proposed alternatives on transportation access and circulation elements used by visitors to travel both to and through the park units.

Both action alternatives also call for substantial improvements to transportation infrastructure which would result in beneficial impacts. While this section analyzes the impacts of proposed development for the alternatives, it is important to note that the

more detailed Level I (trip generation) and Level II (trip assignment) screening assessments would be presented with specific future development proposals to determine the need for a transportation analysis. Future park development proposals would provide daily and temporal distribution of existing and projected park users by mode of travel for weekdays and weekend days. In addition, the base and future years of the future transportation improvement would be identified.

Laws and Policies

The NPS *Management Policies 2006* acknowledge that "the location, type, and design of transportation systems and their components, and the use of alternative transportation systems, all strongly influence the quality of the visitor experience" (NPS 2006a). As mentioned in chapter 1, the recreation experience provided by Gateway is identified as the park's primary fundamental value, and the park's transportation system is an integral component of upholding that value. Additional guidance provided in NPS *Management Policies 2006,* "Transportation Systems and Alternative Transportation" (NPS 2006a, section 9.2), was incorporated into the methodology and used to help determine the degree of effect of the proposed actions, including how well the alternatives would do the following:

- Meet park management needs and provide for visitor use and enjoyment
- Be designed with extreme care and sensitivity to the landscape through which it passes
- Not cause unacceptable impacts on natural and cultural resources and would minimize or mitigate impacts that cannot be avoided
- Emphasize and encourage alternative transportation systems
- Reduce traffic congestion, noise, air pollution, and adverse effects on park resources and values
- Not cause use in the areas served by proposed changes to exceed the area's visitor carrying capacities
- Incorporate the principles of energy conservation and sustainability
- Provide accessibility for all people, including those with disabilities
- Enhance visitor experience by offering new or improved recreational opportunities, simplifying travel in the park, or making it easier or safer to see park features

Section 9.2 of the NPS *Management Policies* 2006 (NPS 2006a) notes that trails and walkways provide the only means of access into many areas in NPS parks. Regarding these resources, guidance from section 9.2 was also used to determine how well the alternatives would achieve the following:

- Reduce conflicts with automobiles and incompatible uses
- Allow for accessibility by the greatest number of people

Methods

Impacts on transportation were qualitatively assessed by comparing expected changes in visitation patterns and traffic congestion under each alternative for the following:

- Roads and parking facilities in the park
- Public transportation services to and through the park
- Waterborne transportation options
- Bike paths, greenways, blueways, hiking trails, and pedestrian routes that provide access to and through the park

Resource-specific context considerations help determine whether substantial impacts are also significant. There are four resource-specific context factors for assessing impacts of the alternatives to transportation:

- Transportation facilitates visitor access and improves recreation experience, which is a stated fundamental value of Gateway.
- Public access to the bay and ocean shorelines is a named fundamental resource of the park.
- Increasing access by providing bike, water, and pedestrian trails could be the beginning of a different way of moving between park sites.
- Very little public transportation is available to move between park sites; this prevents visitors without cars from fully experiencing the park.

A primary assumption used in this analysis is that the amount of multimodal traffic generated under each alternative would be based on the size, type, and location of proposed Recreation Zones in each. In addition, alternatives allowing for a greater degree of development would be expected to have a greater potential to cause increased local and regional transportation effects. It was also assumed that alternatives providing a greater amount of development and accessibility would attract more visitors, as well as influence length of stay.

Alternative A: No Action

Impacts of Alternative A

Alternative A represents a continuation of current management practices. The NPS would continue to manage the park as it does today, including rehabilitation efforts resulting from Hurricane Sandy. For purposes of analysis, it is assumed that the park's rehabilitation efforts would return the park's transportation facilities to pre-storm conditions to the greatest extent possible.

As noted in the "Visitor Use and Experience" section, substantial increases and a few intermittent decreases in visitor use have occurred since 1974 (the first year that the park reported visitation), but annual visitation has remained around 9 million total visitors over the past 10 years (NPS 2013i). The population of New York City is expected to increase by 1 million by 2030. Therefore, this analysis of the no-action alternative assumes that visitation would increase proportionately.

Visitor experience would remain segmented, with each individual park unit serving local residents and visitors at specific locations. The visitor centers at Sandy Hook, Jamaica Bay Wildlife Refuge, and Floyd Bennett Field would continue to serve as destinations and points of departure for day visitors, tours, and school groups. Improvements and expansions to trails systems would continue under existing management guidelines, and funded projects for additional planning or trails would continue. Most visitors would continue to be dependent on automobiles, and people without cars would remain reliant on limited bus and ferry service.

Parkwide Public Transportation Services

No changes are expected under the no-action alternative that would affect use of public transportation services to access any of the park units. As mentioned above, some visitors believe that good public transportation connections currently exist for bringing visitors to park unit entrances, but not necessarily into and through the unit areas. Under the no-action alternative, no additional services would be offered to bring visitors into and through Gateway using public transportation. Because the dominant mode of visitor access would remain private automobiles, the no-action alternative would not achieve the directives defined in the NPS *Management Policies 2006* (NPS 2006a) for transportation systems, such as emphasizing and encouraging alternative transportation systems, reducing traffic congestion, and providing accessibility for all people. The no-action alternative would continue to prevent visitors without cars from fully experiencing the park, resulting in a long-term adverse impact.

Specific impacts for each unit are described in more detail below.

Jamaica Bay Unit

Overall, the issues identified in the Jamaica Bay Greenway Missing Links Study (NPS 2010g), listed in the "Affected Environment" chapter, would continue to adversely affect pedestrian and bicyclist safety. The lack of direct access to this park unit, restricted pedestrian and bicycle access, inadequate public transportation connections, and inadequate connections to adjacent neighborhoods would continue to result in long-term adverse impacts overall. A lack of wayfinding and confusing travel patterns, as well as high traffic volumes, high speeds, and complex traffic weaving, would also result in long-term adverse impacts. These effects would not support Gateway's fundamental value, provide access to the park's fundamental resources, or support the NPS *Management Policies* 2006 (NPS 2006a) direction to simplify travel in the park and make it safer to see park features.

Floyd Bennett Field

Private Vehicle and Waterborne Transportation Parking Facilities

As noted in the "Affected Environment" chapter, 95 percent of Floyd Bennett Field visitors access the park by private vehicle (NPS 2003d), indicating a high demand for parking. Because Floyd Bennett Field is currently underused by visitors, the existing parking supply would be adequate to meet demand. Aviator Sports has adequate parking for its visitation levels. As mentioned in the "Affected Environment" chapter, several thousand cars could be parked on runways and tarmac areas. These areas could be used to serve as overflow parking areas for camping parking, which reaches capacity during the high season. Maintaining Floyd Bennett Field in its current condition would continue this beneficial impact on parking facilities.

Public Transportation Services

Walking distance from the stop for bus route Q35 in Floyd Bennett Field to visitor destinations is 1 mile or more, which reduces the convenience and therefore the use of public transportation to access this area. Limited public transportation options would prevent visitors without cars from fully experiencing the park and would result in long-term adverse impacts.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

Although a multi-use greenway parallels the Belt Parkway adjacent to Floyd Bennett Field, pedestrian and bicycle access from adjacent communities to the park is restricted by the Belt Parkway and other major roads. No actions would be implemented to address this issue, and this alternative would not provide a different way of moving between park sites. The result would be the long-term continuation of an adverse impact.

Once inside the park, visitors would use existing bike paths, greenways, and pedestrian routes to further explore Floyd Bennett Field. Floyd Bennett Field can also be accessed by boat via the marina and/or by self-propelled watercraft. Visitors can travel from Floyd

Bennett Field to other Gateway sites via both motorized and non-motorized waterborne transportation. Continued use and maintenance of these facilities would continue a beneficial impact, but the effect would be localized in each site. This alternative would not provide an alternative mode of moving between park sites.

Plumb Beach

This alternative includes no changes to private vehicle and waterborne transportation parking facilities or public transportation services. Beneficial impacts would occur at Plumb Beach because of the kayak and bike rentals that would go into effect in the summer of 2013. The NPS is working with the USACE to repair erosion of the Jamaica Bay Greenway at Plumb Beach, and this repair will be result in a beneficial impact on the continued stability of the Belt Parkway, which is currently threatened by erosion related to sand transport and wave energy dynamics. However, the continued lack of public transportation services described above for the park overall, as well as inadequate parking, would continue a long-term adverse impact.

Bergen Beach

Under the no-action alternative, Bergen Beach would remain exclusively for equestrian use. Therefore, there would be no change to transportation services.

Canarsie Pier

Private Vehicle and Waterborne Transportation Parking Facilities

Although no changes would occur to parking at Canarsie Pier, parking for fishing and hand-propelled watercraft would continue to be sufficient, including during demonstration programs.

Public Transportation Services

Impacts on public transportation services would be as described for the park overall.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

Canarsie Pier would continue to be a popular stop for cyclists using the Jamaica Bay Greenway and a launch site for kayakers. No changes are proposed under this alternative that would affect users of these facilities.

Pennsylvania Avenue and Fountain Avenue Parks

Limited public access to these former landfill sites would continue under the no-action alternative. The park would continue to work with New York City on the transfer of these parcels, in which case future potential transportation issues would be evaluated by the city at a later date. Therefore, there would be no change to transportation services at these locations.

Spring Creek, Frank Charles Memorial Park, and Hamilton Beach Park

There would be no change to transportation services under the no-action alternative for these areas.

Jamaica Bay Wildlife Refuge

Private Vehicle and Waterborne Transportation Parking Facilities

Parking availability at this park site is strained. This alternative includes no actions to provide overflow parking when the main visitor parking lot is full. Assuming that existing parking facilities match the carrying capacity of the visitor contact station and the recreational amenities provided nearby, redirecting traffic elsewhere would avoid exceeding the site's carrying capacity, as directed by NPS *Management Policies* 2006 (NPS 2006a). Although some visitors would be turned away, the long-term impact would be beneficial because the visitor capacity of the site would not be exceeded, thus enhancing the visitor experience at that location.

Public Transportation Services

The refuge is the only site in Jamaica Bay that is accessible by subway, although the line's Broad Channel Station is far enough from the park entrance to discourage access by foot. Lack of transportation options that could take advantage of the subway station, such as a park shuttle taking visitors to other park sites, would be a long-term adverse impact, particularly because providing such a connection could help alleviate parking issues described above.

The Q52 and Q53 bus routes provide direct access to the refuge, with a bus stop immediately adjacent to the visitor center. The continued accessibility provided by this route would be a long-term beneficial impact.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

Multi-use pathways parallel to Cross Bay Boulevard and the boardwalk adjacent to East Pond offer alternatives for access these park sites. Continued use and maintenance of these facilities would achieve NPS policy guidance to encourage alternative transportation systems and would incorporate the principles of energy conservation and sustainability, resulting in long-term beneficial impacts. These impacts would be limited because there would still be difficulty in moving between park sites by bicycle or on foot.

Jacob Riis Park / Fort Tilden / Breezy Point

Private Vehicle and Waterborne Transportation Parking Facilities

The parking lot at Jacob Riis Park was used for hurricane debris storage. A portion of the parking lot will be open for the summer 2013 season and extensive repairs will take place

in the fall of 2013 to repair damage sustained from the debris storage. This damage from storage use will adversely affect access to the park and the recreation experience in the short term.

Public Transportation Services

Impacts on public transportation services would be as described for the park overall. In addition, an internal NPS shuttle bus from Jacob Riis Park to Riis Landing planned for the 2013 summer season would provide a beneficial long-term impact in a very localized area.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

In the long term, there would be no change to the north side of the overpass over Beach Channel Drive. Pedestrians and cyclists would continue to be left on an island patch of land without safe means of further travel. This lack of a safe connection would not facilitate visitor access or encourage the use of alternative transportation options such as bikes for travel through the park.

Riis Landing

Private Vehicle and Waterborne Transportation Parking Facilities

Prior to the storm, the parking lot at Riis Landing (Fort Tilden) was not heavily used. However, when the lot was full, Fort Tilden provided overflow parking, which would continue under this alternative. The pedestrian crossing from the Fort Tilden lot to the ferry landing is dangerous because of fast-moving traffic and poor sight lines. No change would be implemented to improve this situation, resulting in the continuation of a long-term adverse impact.

Public Transportation Services

Impacts on public transportation services would be as described for the park overall.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

Impacts would be similar to those described for Jacob Riis Park / Fort Tilden / Breezy Point.

Staten Island Unit

Fort Wadsworth

No management actions are planned under this alternative that would change existing parking facilities or public transportation services.

Miller Field

Private Vehicle and Waterborne Transportation Parking Facilities

Traffic congestion resulting from parking lot turnover at Miller Field resulted in a line of cars forming to enter and exit the park. Assuming that existing parking facilities match the carrying capacity of the site, the area's visitor carrying capacity would not be exceeded, as called for by the NPS *Management Policies* 2006 (NPS 2006a), thus enhancing the visitor experience at the site. If the parking facilities do not match the carrying capacity, redirecting traffic elsewhere would diminish visitors' recreation experience (against Gateway's fundamental value) and would not facilitate visitor access or provide accessibility for all people, resulting in a significant adverse impact.

Public Transportation Services

Impacts would be as described for the park overall.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

The New York City Greenway, which provides a connection to Fort Wadsworth, and access paths to designated fishing areas were damaged by Hurricane Sandy but have been restored. Short-term adverse impacts would occur while access is restricted. No other actions are proposed under this alternative that would affect the use of bike paths, greenways, blueways, hiking trails, and pedestrian routes at Miller Field.

Great Kills Park

Private Vehicle and Waterborne Transportation Parking Facilities

The parking lot and road to Nichols Marina, as well as the marina itself, were heavily damaged by Hurricane Sandy. Efforts are currently (as of May 2013) underway to repair the damage, and the park is offering limited three-year leases available until more permanent changes that may result from selecting an action alternative can be implemented. Until then, access to the park is severely restricted, resulting in adverse short-term impacts. Two parking lots at Great Kills are closed due to the presence of radium, affecting visitor access to the model airplane flying field and restricting visitors' ability to use boat trailer overflow parking when the primary lot is full. These long-term impacts would affect the park's ability to uphold its primary fundamental value and to facilitate visitor access and provide accessibility to all people, including those with disabilities. The result would be long-term adverse impacts.

Because of the extensive damage to the park, short-term commuter use of the temporary ferry service did not measurably affect park visitors. The heavy damage to the marina and the boats themselves preclude use by private boaters, which constitute a minority of park visitors. This alternative includes no plans to reinstate the use of Great Kills parking for

commuters or the temporary boat landing installed for the short-term ferry service, which is consistent with the park's purpose. No other measurable impacts from the no-action alternative would be expected.

Public Transportation Services

Impacts on public transportation services would be as described for the park overall.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

No actions are proposed under this alternative that would affect these facilities.

Sandy Hook Unit

Private Vehicle and Waterborne Transportation Parking Facilities

Adverse impacts related to the inability of existing supply to meet demand at beach parking lots during peak use would continue as described in the "Affected Environment" chapter because this alternative includes no actions to address this issue. These local and regional impacts would affect public health and safety as vehicles attempt to turn around and leave the entrance area when the park closes after reaching capacity and as idling cars caught in congestion elevate air pollution levels. Any decrease in the parking capacity at Sandy Hook associated with Hurricane Sandy repairs and damage would exacerbate the issues associated with closing the park entrance when capacity is reached. As the "Affected Environment" section on transportation indicates, vehicles back up beyond the park entrance, creating congestion, safety, noise, and pollution problems l. Sandy Hook's visitor carrying capacity is altered by the lack of parking supply, particularly because no other options for accessing the park's recreational facilities, such as a shuttle from the entrance, are provided.

In the park, Parking Lot D (which provides spaces for 802 motor vehicles) is particularly problematic during high-use days. These problems are expected to continue, creating congestion and long lines of cars, and requiring traffic management by park staff. Traffic-related incidents would affect public safety, particularly in the evenings as visitors leave for the day.

For these reasons, the no-action alternative would not uphold the park's recreation experience (a fundamental value) at Sandy Hook. Insufficient parking, which in turn would lead to entrance gate closures, would not facilitate visitor access and improve the recreation experience, and would not provide access to the bay and ocean shorelines, which are fundamental park resources. In addition, it would not reduce traffic congestion, noise, and air pollution, and would increase these impacts depending on the degree to which parking can be restored. The result would be a substantial adverse impact at Sandy Hook.

Public Transportation Services

Public transportation services are available to bring visitors to Sandy Hook's entrance, but this alternative provides no services to transport visitors from the entrance to destinations in the park. The result would continue to be heavy reliance on private automobiles to access the park's recreational facilities.

Hartshorne Drive becomes congested during the evenings of peak use days as visitors leave the park for the day. This alternative includes no actions to address this congestion and therefore would not address the NPS *Management Policies 2006* (NPS 2006a) directive to reduce traffic congestion, noise, and air pollution. In addition, NPS *Management Policies 2006* states that alternative destination points or transportation systems or limitations on use must be considered before roads are chronically at or near capacity. This alternative would not incorporate such actions.

Hurricane damage to the ferry dock at Fort Hancock would have no short-term effect on visitors because the ferry is seasonal, operating only during peak visitor use months. Because this alternative includes no provisions to extend the shuttle service from the ferry terminal to the park's entrance, it would not help alleviate congestion issues at that location.

The no-action alternative would not facilitate visitor access and would continue to prevent visitors without cars and visitors who are turned away from the closed entrance gate from accessing Sandy Hook. It would not provide a means of remedying the gate closures. In addition, it would not encourage alternative transportation systems, incorporate principles of energy efficiency and sustainability, simplify travel in the park, or make it easier or safer to see park features. For these reasons, long-term impacts related to public transportation services would be substantial.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

The hurricane interrupted the planned expansion of the multi-use path, delaying the delivery of this recreational and transportation opportunity and the ability to encourage alternative transportation or make it easier or safer to see park features. No other actions are proposed under this alternative that would result in measurable impacts.

Cumulative Impacts

Jamaica Bay Unit

Substantial and rapid growth has occurred in the New York City area, including Queens and Brooklyn, throughout the years, putting intense pressure on transportation systems. The city's population reached 1 million by 1880; that number nearly tripled by 1900. Approximately 1 million more people were added to the city's population each decade for the next 30 years. By 1940, the population was approximately 7.5 million. This explosive growth created a demand for transportation. New York City estimates its current population

of 8.2 million in 2010 will reach 9.1 million by 2030. Brooklyn's population is expected to grow from 2.5 million in 2010 to 2.72 million in 2030, and Queens from 2.2 million in 2010 to 2.57 million in 2030 (NYCDCP 2006, 2013). Growth in the Rockaway Beach area of Queens is also expected to continue, such as the Edgemere Urban Renewal Area. This local and regional growth will put more pressure on the area's transportation system and will adversely affect access to the park.

For the past hundred years, New York City's transportation networks have dictated its centers of population growth, guided its industries and businesses, and shaped the city. Shipping built early New York, and turn-of-the-century ferry service along the Hudson and East Rivers fed and was fed by development in Downtown Brooklyn, Lower Manhattan, and New Jersey. In the early 1900s, subway construction spurred residential development in the farmlands of Queens, Brooklyn, and the Bronx (NYCDCP 2008).

New York City has not been able to grow its transportation to match the city's changing demographics. The city's financial crisis in the 1970s accelerated the decline of its transportation infrastructure. In response, a major infrastructure rehabilitation program was started in 1988 that has been funded by every administration since that time. Although the condition of New York City roads, rails, highways, and bridges has improved dramatically, the city's rapidly growing population poses a new set of challenges. Particularly in Brooklyn and Queens, existing transportation infrastructure is insufficient to meet upcoming demand (NYCDCP 2008). Improvements to John F. Kennedy International Airport may result in more people traveling to the city and putting stress on transportation systems.

People living in New York City and surrounding counties face longer commute times than most of the country. The residents of Queens County have, on average, the longest commute times of residents of any U.S. county with populations greater than 250,000 people. The city's subways run at 85 percent capacity during their busiest hour, which causes delays on all lines. The number of hours of heavy congestion on the city's bridges and tunnels has almost doubled since 1990. In addition, the rush hour peaks have expanded dramatically. In 1990, the hours of heavy congestion were between 7:00 a.m. and 9:00 a.m. and again between 3:00 p.m. and 7:00 p.m. Today, heavy congestion during rush hour starts at 6:00 a.m. and goes until 10:00 a.m. and then starts back up again at 2:00 p.m. and continues until 8:00 p.m. Buses get stuck in traffic, dramatically reducing their appeal and viability as real transit options. In 2005, bus ridership fell by 55 percent, or close to 4 million riders. Congestion is expected to worsen as the population continues to grow. The projected population growth will increase the strain on transportation services, many of which are already at or nearing capacity (NYCDCP 2008).

The elevated or depressed highways built between the 1940s and 1960s to increase New York City's transportation capacity often isolated communities. Many of these highways cut off access to the city's waterways, reducing options for water transportation. Access to the city's waterways, which are largely untapped potential transportation resources, is particularly challenging. For years, city planning practice turned away from New York's rivers, separating them from the city with highways and train tracks. As a result, potentially congestion-reducing transportation systems like ferries are difficult to realize because the waterfront is remote and hard to reach (NYCDCP 2008).

About 9 percent of the city's population has a physical disability that could impair movement. The number of wheelchair-accessible stations limits access in many areas. In 2008, 53 New York City subway stations were wheelchair accessible; that number is expected to increase to 100 by 2020 (NYCDCP 2008).

The New York City Department of Transportation (NYCDOT) has been aggressive about creating more safe bicycle routes and facilities, and built over 60 miles of bike lanes in 2007 alone. NYCDOT is partnering with other agencies such as MTA to encourage multimodal commuting (NYCDCP 2008). Other recent actions have added alternative transportation options in the form of greenways and multi-use paths. Improvements to ferry structures, parking facilities, and bridges, as well as access to NPS sites, are continuing. These improvements are expected to continue in the reasonably foreseeable future, including access improvements to the park districts, marina redevelopment, parkway rehabilitation, and construction of bike and pedestrian paths. The Jamaica Bay Transportation Hub will rehabilitate the Jacob Riis Park boardwalk and change the ferry service to Manhattan.

The National Parks of New York Harbor Conservancy embarked on an initiative focused on improving access through a waterborne transportation system to Gateway's park units (NPNYHC 2010). The organization created harbor transportation strategies that include Jamaica Bay. The purpose of the Inner-Outer Harbor Transportation Strategy is to "identify a series of implementable projects to link harbor-wide destinations through physical improvements and the enhancement or creation of projects and programs" (NPNYHC n.d.), offering a beneficial transportation impact.

Taken together, these past, present, and reasonably foreseeable actions would result in primarily adverse impacts on the area's transportation system because of explosive growth. Development of mass transit eased this impact to a certain degree, but increasing congestion and the addition of another 1 million people by 2030 will put appreciable strains on the city's transportation system. When combined with the beneficial and adverse impacts expected under this plan's no-action alternative, cumulative impacts would remain primarily adverse because any beneficial contributions from the no-action alternative would be imperceptible and would not measurably affect the adverse impacts related to regional growth and congestion.

Staten Island Unit

Staten Island's growth followed a trend similar to that of New York City (NYC Public Information Office 2000). Staten Island's current population is approximately 470,000; that number is expected to reach 552,000 by 2030, the highest growth rate predicted for any New York City borough (NYCDCP 2006). The residents of Richmond County (Staten Island) are, on average, second to Queens County for having the longest commute times of residents of any U.S. county with populations greater than 250,000. Along with Brooklyn and Queens, Staten Island's existing transportation infrastructure is insufficient to meet upcoming demand (NYCDCP 2008).

As the population grew, development of the Staten Island Ferry, the Saint George Ferry Terminal, and the Verrazano-Narrows Bridge provided connections from this New York City borough to Brooklyn and Manhattan. Bus and train service provide transportation options in and beyond Staten Island. More recent development of bike and pedestrian routes provides alternative transportation modes. The National Parks of New York Harbor Conservancy's Inner-Outer Harbor Transportation Strategy would also apply to Fort Wadsworth. Present and reasonably foreseeable actions include rehabilitation of and improvements to these transportation facilities. Overall, these actions are beneficial.

Several additional bike lanes or routes exist and are proposed near park sites in the Staten Island Unit. A proposed route would connect the Class 3 route on Bay Street in Fort Wadsworth with the New York City Greenway. This proposed connection would provide a route for cyclists to continue riding from the greenway through the park and northward on an existing Class 3 bike route. A bicycle path is proposed that would continue south through Miller Field to the beaches just north of Great Kills Park. A bicycle route is also proposed along New Dorp Lane, paralleling Miller Field's southwestern boundary, leading to an existing Class 3 bike route along North and South Railroad Avenue, where a Staten Island Railway stop exists. Other proposed routes would access Miller Field along roads from the south. A new bicycle path is proposed in Great Kills Park following the length of Wetland Road, which would connect with a proposed bike route along Mansion Avenue on leaving the park. Another bike route is proposed along Hylan Boulevard outside the park, which would parallel the park's northwestern boundary and connect to an existing Class 3 bike route on Guyon Avenue.

Similar to the Jamaica Bay Unit, when taken together, these past, present, and reasonably foreseeable actions would result in primarily adverse impacts on the area's transportation system because of growth. When combined with the beneficial and adverse impacts expected under this plan's no-action alternative, cumulative impacts would remain adverse because any beneficial contributions from the no-action alternative would be imperceptible and would not measurably affect the adverse impacts related to growth.

Sandy Hook Unit

The construction of parkways and bridges in the area of Sandy Hook and the development of bus and rail routes created local and regional transportation connections. As part of Route 36, construction of the Highlands–Sea Bright Bridge connected the town of Highlands to Sea Bright across the Shrewsbury River; the eastern terminus of the bridge is at the entrance to Sandy Hook. This greatly increased access to the park and affected visitation levels. Although this bridge was replaced in 2010, there was no expansion to motor vehicle capacity with additional vehicular traffic lanes. The replacement bridge was intended to maintain traffic flow and minimize seasonal impacts and the diversion of traffic to local streets. A notable difference to the replacement bridge is its vertical clearance: the fixed-span bridge provides a 65-foot vertical clearance over the Shrewsbury River channel to eliminate the conflicts between highway and marine traffic and the delays caused by bridge openings. In addition, the new bridge also features two new 8-foot-wide pedestrian sidewalks and two 8-foot-wide bicycle lanes to provide safe crossings from the bridge. The south pedestrian bridge links the sidewalk on the south side of the mainline bridge to the existing multi-use trail along the seawall in Sea Bright. The north pedestrian bridge links

the sidewalk on the north side to the new extension of the multi-use trail in Gateway. The bicycle and pedestrian improvements offer visitors the option of traveling by bike or on foot to the park.

New Jersey's Monmouth County Planning Board identified and classified certain roads in the county with a rating of good, fair, and poor for cycling. The resulting bicycling map shows a multi-use trail starting near the town of Sea Bright, south of Sandy Hook, continuing northward to the park's entrance. The map also identifies Highway 36 from Monmouth Beach north to the park entrance and into Highlands as offering poor cycling conditions due to high traffic volumes and speeds, as well as insufficient road width and other bicycling obstacles. Two roads through Highlands to the Highlands–Sea Bright Bridge are identified as fair condition for cyclists, with heavier traffic and side streets. As mentioned previously, a new bike path connection has been incorporated into the reconstruction of the Sea Bright Bridge (Monmouth County 2011), which should measurably improve the poor condition of that bike travel segment.

Monmouth County developed a plan to manage summer traffic on Route 36 that identifies an "enhanced closure plan" to help address traffic congestion issues when Sandy Hook closes after reaching capacity during peak visitation. This framework was developed to improve road safety, operations, and access along the Highway 36 and Route 520 corridors. The plan was based on a series of alert condition levels, in response to traffic and/or parking monitoring criteria administered by the NPS at Sandy Hook. The majority of the plan's elements consist of signs, including variable message signs. The plan also identified long-range traffic management components, including pedestrian/bicycle linkages and access; dedicated U-turn capabilities at the Sandy Hook access ramp during park closures; enhanced traffic management options for transit shuttles; reversible lanes or movable barriers to increase directional capacity; and traffic management measures to facilitate storm evacuation (Monmouth County 2001).

A summer jitney bus service was implemented in 1999 between Highlands and the Sandy Hook Visitor Center near Parking Lot E. This Bayshore Bus Shuttle route provided basic loop service between the beaches at Sandy Hook and the downtown business district in Highlands, with limited service to Keansburg Amusement Park. The service provided access to Sandy Hook beaches even under full closure conditions when auto access was restricted (Monmouth County 2001). "Park and sail" service between the park and the Belford Ferry Terminal was offered for the summer of 2003, but it is no longer operating (NPS 2003d). However, the National Parks of New York Harbor Conservancy's Inner-Outer Harbor Transportation Strategy would also apply to Fort Wadsworth (NPNYHC n.d.), providing potential beneficial transportation impacts if implemented. Otherwise, lack of consistent shuttle bus or ferry service to the park from New Jersey would be an adverse impact.

Hurricane Sandy destroyed much of the public infrastructure in the community of Highlands, located southwest of Sandy Hook Park. The repair or replacement of the damaged public infrastructure will commence after May 1, 2013. The County is expected to perform in-kind repair or in-kind replacement of certain public infrastructure, including public roads, railroads, culverts, bridges, and shoreline stabilization structures (NJDEP 2012). Because these actions would restore the infrastructure that previously existed (and not improve on it), they would have no effect on accessing the park.

As mentioned above, counties surrounding New York City face longer commute times than most of the country, including those in northern New Jersey. Ranked at number 14, Monmouth County has one of the top 25 worst commute times in the nation (NYCDCP 2008). As the county's population increases, so will commute times. Monmouth County's population was 630,380 in 2010, an increase from 615,301 in 2000. The county's population is expected to reach approximately 670,000 in 2018 (NJDLWD 2012). This population increase will put an additional strain on existing transportation services in the Sandy Hook area.

Because nearly all the storm repair actions for the Highlands area are restorative, not expansionary, these actions, along with the mobility issues presented by County Route 520 across the Shrewsbury River Bridge (for which there are no plans for improvement), would not contribute to cumulative impacts.

For the park overall, impacts from these other past, present, and reasonably foreseeable actions would be both beneficial and adverse. When combined with the appreciable adverse impact related to congestion at the Sandy Hook entrance when the park closes after reaching capacity, these impacts would have various effects. Although closing the park entrance would continue to have appreciable adverse effects on traffic congestion, the implementation of the variable messages signs, alerts, and other warning devices has alleviated what was worse congestion before the bridge rebuild was in place. Because the bridge replacement did not increase capacity, alleviating congestion that had been caused by raising the bridge and adding bike capacity (where connections on either side of the bridge are classified as in fair and poor condition) contributed noticeable beneficial impacts by reducing congestion. Similarly, Monmouth County's plan to manage summer traffic at Sandy Hook's entrance provided noticeable beneficial impacts for congested bridge traffic. Discontinuation of ferry service from New Jersey to Sandy Hook, a noticeable contribution, would combine with the no-action alternative to further increase adverse impacts. Inadequate parking and closure to park visitors, coupled with a lack of public transportation to Sandy Hook, would result in a substantial and widespread adverse effect that would be only partially and imperceptibly offset by benefits from other actions. Overall, the contribution of these other actions to the no-action alternative would be imperceptible and would not be sufficient to lessen the significant adverse effect expected under this alternative. Therefore, cumulative impacts would be adverse.

Conclusion

Damage to the park's transportation infrastructure from Hurricane Sandy had a substantial impact on the ability of visitors to access all of Gateway's units, and repair may have caused some increase in congestion or closures with adverse impacts to transportation.

Impacts of continuing the current management at Gateway would be primarily adverse because no improvements would be made to the transportation infrastructure to address transportation issues or apply the directives of the NPS *Management Policies 2006.* As a result, the adverse impacts on transportation from Alternative A would be significant.

This alternative would not facilitate visitor access, provide public access to the park's fundamental resources, provide a different way of moving through park sites, or provide car-free options for accessing the park. It also would not meet several of the directives provided in section 9.2 of the NPS *Management Policies 2006*, particularly emphasizing and encouraging alternative transportation systems; reducing traffic congestion, noise, and air pollution; not causing the area's visitor carrying capacity to be exceeded; incorporating the principles of energy conservation and sustainability; providing accessibility for all people; offering new or improved recreational opportunities; simplifying travel in the park; or making it easier or safer to see park features. Cumulative impacts of alternative A would be adverse primarily due to extensive growth in the region.

At Sandy Hook, impacts would affect public safety from congestion and unsafe maneuvers as visitors are turned away from the entrance when the unit reaches capacity, and as visitors leave the park at the end of the day. In addition, the recreation experience, which is the park's fundamental value, would not be supported by the transportation actions in this alternative. The traffic congestion and associated impacts that occur during peak visitation would not be addressed when the unit is reopened for visitors. The results from insufficient parking capacity at Sandy Hook would be an adverse impact on transportation in the park unit, particularly if Parking Lots C, D, and E, which provide 1,916 of the unit's approximately 4,000 parking spaces, cannot be fully restored. These impacts would affect the local area and communities adjacent to the park entrance, and would have regional effects along Highway 36.

Common to Both Action Alternatives

Impacts of Alternatives B and C

Under both alternatives, Gateway would continue to support and plan enhanced regional trail linkages to improve access to the park. This would include filling gaps in current facilities and expanding connectivity to New York City greenways. In addition, wayfinding from local transit stops to parks would be improved to and throughout Gateway. Transportation information would be incorporated into outreach materials to make reaching the park clearer and more convenient. Bike infrastructure, including bike rentals, bike parking, and bike route mapping, would also be included in all action alternatives. Different types of facilities and media (e.g., kiosks, social media, signs, contact stations) would be employed to create a more welcoming sense of arrival, orient visitors, and increase the visibility of NPS and Gateway resources and recreational opportunities. Both alternatives emphasize using alternative modes of transportation to access Gateway, including bikes, public transit, waterborne transportation, and shuttles.

Development of facilities called for under the action alternatives would also result in short-term adverse impacts during construction. For example, as new recreational facilities are constructed, traffic may need to be rerouted and parking supply may be temporarily diminished. These short-term impacts would not have a significant impact on the park's transportation systems.

Alternative B: Discovering Gateway - NPS Preferred Alternative

The focus of alternative B is on Gateway becoming a popular destination for recreation, education, and interpretive experiences, which would increase the importance of the transportation system to efficiently and effectively bring people to a variety of places. Under alternative B, the NPS is focused on expanding outreach to neighboring communities and improving direct and safe access to park units from the surrounding neighborhoods.

Impacts of Alternative B

Jamaica Bay Unit

Recreational developments would attract substantially more visitors to Jamaica Bay, including national and international visitors (particularly given the unit's proximity to John F. Kennedy International Airport), and local residents from nearby neighborhoods. Access to and through the unit would be more affordable and convenient through improved bike infrastructure, public transportation, ferry service, and park shuttles, thus facilitating visitor access. An internal NPS shuttle (originating) at Floyd Bennett Field would link Gateway and other New York City park lands. All these improvements would support the park's recreation experience (a fundamental value) and the NPS *Management Policies* 2006 regarding transportation systems, resulting in a long-term beneficial impact.

Floyd Bennett Field

As the primary location for orientation and information about the Jamaica Bay Unit, Floyd Bennett Field would also be the most accessible district in the unit. Floyd Bennett Field would be established as a multimodal transportation hub where visitors could embark via waterborne transportation, shuttles, greenways, and public transit to access other Gateway parks and other nearby destinations. With a marina as well as launch sites, Floyd Bennett Field would support waterborne access and transportation. This expanded variety of access and transportation opportunities would provide extensive benefits to visitors traveling to and through Jamaica Bay.

Private Vehicle and Waterborne Transportation Parking Facilities

Floyd Bennett Field includes the vast majority of Jamaica Bay's non-permit public parking. However, the additional recreational options that would be offered under this alternative would increase use of these facilities. Many visitors are expected to use the alternative transportation connections and hubs, thus reducing the demand for private motor vehicle access and parking at Floyd Bennett Field. The extensive network of trails from adjacent parks and neighborhoods into Floyd Bennett Field would also reduce reliance on private vehicles to access the area, thus reducing the demand on parking facilities. New parking facilities would be created to accommodate the additional campsites and cabins, the

converted hotel, and the JBSRI. Current parking facilities for camping and for water-based activities would be augmented to accommodate more visitors and increased camping and boating uses. These impacts would support the park's recreation experience (a fundamental value), facilitate visitor access, and support NPS *Management Policies* 2006 regarding transportation systems, resulting in a long-term beneficial impact.

Public Transportation Services

The multimodal transportation hub at Floyd Bennett Field would enhance use of public transit to access the park and reduce reliance on private vehicles, particularly MTA's Q35 bus route, which provides access from Brooklyn College, and two subway routes to Floyd Bennett Field, Fort Tilden, Jacob Riis Park, and the Rockaway Park Beach 116 Street Station. In addition, locating a central multimodal connection that includes public transit in the park would improve the ability of visitors to not only reach the park but also travel within it, which was an issue identified by the public. This would support the park's recreation experience (a fundamental value), facilitate visitor access for all people (particularly those without cars), and incorporate energy conservation and sustainability. The result would be a beneficial impact.

An internal NPS shuttle originating at Floyd Bennett Field and looping through the Jamaica Bay Unit would link Gateway and other New York City park lands and result in a long-term beneficial impact on visitor access and transportation.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

This alternative would include new trails and boardwalks, as well as an extensive trail network connecting to adjacent parks and neighborhoods. These facilities would increase pedestrian access to and through not only Floyd Bennett Field but also other areas of Jamaica Bay. The enhanced marina would provide a portal to increase water-based transportation. New transportation connections would include the marina and greenway, enhancing their use and the extent of their transportation service. Increasing bike and pedestrian access from Flatbush Avenue into the park would provide another alternative transportation method of accessing the park. All these actions would result in long-term beneficial impacts and would support the park's recreation experience (a fundamental value), incorporate energy conservation and sustainability, reduce conflicts with automobiles and incompatible uses, and provide accessibility for all people.

Plumb Beach

Private Vehicle and Waterborne Transportation Parking Facilities

The parking lot at Plumb Beach would be improved, which would help accommodate the increased visitation expected to result from the new visitor amenities that would be provided, resulting in a long-term beneficial impact.

Public Transportation Services

Although Plumb Beach is located immediately adjacent to the Belt Parkway, no public transit services access the park. The NPS shuttle proposed in alternative B, however, would provide convenient access to Plumb Beach, resulting in a beneficial impact.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

The Jamaica Bay Greenway parallels the Belt Parkway and provides direct access to Plumb Beach. This alternative would improve the greenway, as well as improving connections to it from the parking lot and the park trails. Connections from Marine Park and the adjacent neighborhood would also be improved, including a new water trail. The improved connections from neighborhoods and city parks to Plumb Beach, as well as Floyd Bennett Field and Dead Horse Bay, would be a long-term beneficial impact that would uphold the park's fundamental value, facilitate visitor access, encourage alternative modes of moving between park sites, and meet the directives of NPS *Management Policies* 2006. These actions would improve access both to and through the park.

Bergen Beach

Private Vehicle and Waterborne Transportation Parking Facilities

Although access from the Belt Parkway would be improved, no changes to parking facilities are planned under alternative B at Bergen Beach, resulting in no impacts.

Public Transportation Services

There would be no change to public transportation services to Bergen Beach. However, Bergen Beach would be accessible by the NPS shuttle, resulting in a beneficial impact.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

New physical connections to New York City parks and adjacent neighborhoods would be developed, including a new water trail to Paerdegat and Mill Basin Inlet. A new nature trail would also be established. These facilities would improve access to the park through alternative travel modes, resulting in long-term beneficial transportation impacts.

Canarsie Pier

Private Vehicle and Waterborne Transportation Parking Facilities

This alternative would increase visitation and provide expanded recreational amenities. No changes are planned for the existing parking lot, which can accommodate 230 motor vehicles. If this number were insufficient to handle increased visitation, the NPS would work with Canarsie Pier to mitigate this issue.

Public Transportation Services

The NPS would work with NYCDPR to manage public transportation. Teaming with partner agencies to broaden the range of transportation services provided would be a beneficial impact. Additionally, Canarsie Pier would be accessible by the NPS shuttle, resulting in a beneficial impact.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

Under this alternative, the NPS would actively recruit local visitors from adjacent communities. Dense housing is located adjacent to Canarsie Pier, providing an opportunity for neighbors to walk to the park. Canarsie Pier would include a hub for waterborne transportation and would continue to provide water trail connections to other areas of Jamaica Bay. Enhancing water-based transportation in Jamaica Bay from a central location would be a long-term beneficial impact by facilitating visitor access and providing different modes of travel between park sites.

Pennsylvania Avenue and Fountain Avenue Parks

Private Vehicle and Waterborne Transportation Parking Facilities

No changes to parking facilities have been identified under this alternative, resulting in no impacts. The park would consider potential ferry parking demand and supply in conjunction with exploring the possibility of a ferry connection at a later date.

Public Transportation Services

Several bus routes currently provide direct access to the Pennsylvania Avenue and Fountain Avenue Parks. This service would continue under this alternative, providing a long-term beneficial impact. Physical connections with neighborhoods would be improved, thus enhancing the public's ability to access these park areas. A ferry connection would be explored, with potential to further improve public access. These improved connections along with the NPS shuttle access would be a long-term beneficial impact.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

Under this alternative, the new hiking trail system that would be developed on roads traversing the Pennsylvania Avenue and Fountain Avenue Parks would provide a long-term beneficial impact. This trail system would take advantage of the existing Rockaway–Gateway Greenway, which currently provides bicycle access to the Jamaica Bay shoreline, increasing park access.

Spring Creek

Private Vehicle and Waterborne Transportation Parking Facilities

Substantially more visitor use would occur at Spring Creek, which would act as a gateway to Jamaica Bay for adjacent communities and would provide access to the water. No parking facilities have been identified for this alternative because it is anticipated that most visitors would access the park via other alternative modes from adjacent neighborhoods. Therefore, there would be no impact.

Public Transportation Services

The Q41 bus route currently provides access to Spring Creek. This service would continue under this alternative, providing a long-term beneficial impact. Physical connections with neighborhoods would be improved, thus enhancing the public's ability to access these park areas. A ferry connection would be explored, with the potential to further improve public access. These improved connections along with the NPS shuttle would be a long-term beneficial impact.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

New greenway and trail connections to Spring Creek would provide additional ccess both through and to this district, taking advantage of existing bike routes in the area. Accommodating alternative modes of transportation would be a long-term beneficial impact.

Frank Charles Memorial Park and Hamilton Beach Park

Private Vehicle and Waterborne Transportation Parking Facilities

New boat launching sites would be developed under this alternative, and associated parking would be designed to meet demand, resulting in a long-term beneficial impact.

Public Transportation Services

Several bus routes currently provide direct access to the Pennsylvania Avenue and Fountain Avenue Parks. This service would continue under this alternative, providing a long-term beneficial impact. Physical connections with neighborhoods would be improved, thus enhancing the public's ability to access these park areas. A ferry connection would be explored, with potential to further improve public access. These improved connections plus the NPS shuttle would be a long-term beneficial impact.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

Water access would be improved with trails and boat launching/landing sites at each park. These actions would provide new methods of accessing the park, resulting in long-term beneficial impacts.

Jamaica Bay Wildlife Refuge

Private Vehicle and Waterborne Transportation Parking Facilities

As mentioned in the "Affected Environment" chapter, there is no overflow parking for visitors to use when the main visitor parking lot is full at the wildlife refuge, and none is planned under this alternative. Active recreation opportunities would be expanded at the refuge, such as a network of trails and more water-based recreation, drawing more visitors and placing additional demand on already limited parking facilities. However, the NPS would improve multimodal transportation to and from the refuge, linking it to other park lands by additional bike connections and public transportation. Physical connections to the refuge would be provided in the form of boat and water-based shuttles. Use of these facilities to access the refuge would ease the demand for parking, potentially offsetting adverse impacts on parking facilities that would occur from increased visitation, resulting in a long-term beneficial impact.

Public Transportation Services

As mentioned above, multimodal connections to and from the refuge would be improved, linking it to nearby areas through public transportation. Doing so would take advantage of the two bus routes that travel Cross Bay Boulevard, as well as the train routes that parallel it. One bus route and both train routes terminate at Rockaway Park Beach 116 Street Station, which provides connections to buses to several other sites in the Jamaica Bay Unit, including Floyd Bennett Field. An internal NPS shuttle originating at Floyd Bennett Field and looping through the Jamaica Bay Unit would further improve access to the refuge. These long-term beneficial actions would support the park's recreation experience (a fundamental value), provide access to all people (particularly those without cars), and support NPS *Management Policies* 2006 guidance.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

This alternative includes a network of trails and boardwalks, as well as water trails, offshore docks, and additional watercraft landing and launch sites. These facilities would provide long-term beneficial impacts on the park's transportation system through the provisions of additional alternative transportation modes, thus supporting the park's fundamental value and NPS *Management Policies* 2006 guidance, and encouraging a different way of moving between park sites.

Jacob Riis Park / Fort Tilden / Breezy Point

Private Vehicle and Waterborne Transportation Parking Facilities

Under this alternative, Jacob Riis Park would become a center for recreation and would draw visitors through new recreation facilities and visitor services. The existing 5,000-space parking lot at Jacob Riis Park would be redesigned to include sports fields. Sufficient parking supplies would remain to accommodate the new recreational facilities.

Depending on the degree of adaptive reuse of structures in the eastern area of Fort Tilden, additional parking may be required to meet the needs arising from greater use and more overnight stays. New parking for the new backcountry trail system would also be developed on the west side of Fort Tilden to accommodate trail and camping uses. These changes would be sized to meet the expected demand, resulting in long-term beneficial impacts. All seven of the parking lots in this area of the park require permits. Under this alternative, fewer parking lots would require permits (with the exception of Breezy Point Tip), removing an obstacle to use. Opening these facilities to more use would improve transportation efficiency and parking distribution, resulting in a long-term beneficial impact.

Public Transportation Services

New links to public transportation would be provided, making it easier to access MTA routes Q35 and Q22. This would improve travel both to and through the park.

An internal NPS shuttle originating at Floyd Bennett Field and looping through the Jamaica Bay Unit would further improve access to the Rockaways and create convenient connections between Fort Tilden, Jacob Riis Park, Riis Landing, and Breezy Point Tip. The result would facilitate access for all visitors. All these improvements would be a long-term beneficial impact.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

Bike infrastructure at Jacob Riis Park would be improved by adding bike parking, bike rentals, and/or a bike sharing station. Improving the Jamaica Bay Greenway would improve access for local residents, who use it as a bicycle commuter path. Although Shore Road would no longer be used for motor vehicle transportation, its conversion to a trail corridor would be a long-term beneficial impact by providing a new means of alternative transportation.

Riis Landing

Private Vehicle and Waterborne Transportation Parking Facilities

The 84-space parking lot at Riis Landing is not heavily used, although when it does fill because of ferry use, visitors park at the Fort Tilden lots. The buildings at Riis Landing would be used for several purposes, including ferry services, which would continue. Ferry use would also increase, leading to more use of the Fort Tilden parking. Circulation between Riis Landing and Fort Tilden would be improved and made safer for visitors walking to and from the ferry, resulting in a beneficial effect.

Public Transportation Services

No changes to public transportation services are planned for Riis Landing under this alternative.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

Redesigning Riis Landing would be considered in order to improve safety and pedestrian access.

Staten Island Unit

The park sites in the Staten Island Unit would become more connected through shuttle systems and more bike and pedestrian trails and blueways. Alternative transportation modes would be stressed for potential park visitors, and more recreational opportunities would be provided. All these improvements would support the park's recreation experience (a fundamental value) and NPS *Management Policies* 2006 regarding transportation systems, resulting in a long-term beneficial impact overall.

Fort Wadsworth

Private Vehicle and Waterborne Transportation Parking Facilities

Fort Wadsworth would be promoted as a recreation destination and would provide additional camping facilities to encourage overnight stays. The parking lot on New York Avenue is the largest lot at the site, and can accommodate 190 vehicles. There is ample parking at Fort Wadsworth and increased uses would not impact parking facilities.

Public Transportation Services

Multimodal transportation connections would provide transit linkages to other parks, as well as the Staten Island Ferry. Such linkages would take advantage of the existing transit routes that skirt Fort Wadsworth's north and west boundaries, providing a long-term beneficial impact by offering more ways to get to and through the park.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

A coastal water trail would be developed to connect to Great Kills and nearby islands and other launch sites, providing a new transportation option to reach Fort Wadsworth. The East Shore and New York City Greenways would provide improved access to the park from adjacent neighborhoods. These actions would provide a long-term beneficial impact by improving transportation access to the park and providing a different way of moving between park sites on Staten Island.

Substantial improvements to bike facilities under this alternative would increase transportation benefits to park users. The multi-use trail system would be designed to cater to different physical abilities, supporting the NPS *Management Policies 2006* directive to provide accessibility for all people. Multimodal transportation connections would provide bike linkages to other parks and the Staten Island Ferry. The NPS would work with partners to build a bike route closer to the water rather than on Bay Street (where a Class 3 bicycle route currently exists) to connect Fort Wadsworth to the Staten Island Ferry terminal north of the park. Providing an alternative route to Bay Street would increase safety for cyclists

and would reduce conflicts with automobiles and incompatible uses. Closing USS North Carolina Road to convert it to a bike route would also provide a safer route for cyclists through Fort Wadsworth. These actions would improve transportation both to and through the park. Long-term beneficial impacts would result from improvements to these human-powered transportation modes, which would uphold the park's fundamental value, as well as several NPS *Management Policies 2006* directives. These actions would also encourage use of alternative modes of traveling through the park.

Miller Field

Private Vehicle and Waterborne Transportation Parking Facilities

A new parking area would be provided near the water that would address increased visitation under this alternative, particularly the new kayak launch site, resulting in a long-term beneficial impact.

Public Transportation Services

No changes to public transportation services are planned for Miller Field under this alternative.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

A new kayak launch site would provide a new transportation option for reaching Miller Field. Expanded trails and roads, with clearly delineated signs, would improve use of hiking trails and pedestrian routes. These improvements would be a long-term beneficial impact, because they would provide a different way of moving in and between park sites.

Great Kills Park

Private Vehicle and Waterborne Transportation Parking Facilities

This alternative includes several new recreational amenities that would draw substantially more visitors to Great Kills. A secondary access road off Hylan Boulevard and new parking at the new marina location would accommodate this increase in use and compensate for those lots that are currently closed due to radiation. The marina and parking facilities would be designed to accommodate visitation, including the possibility of a future ferry operation. Improving parking and access would be a long-term beneficial impact.

Public Transportation Services

Under this alternative, the NPS and New York City would advocate for improved public transit connections to make accessing the park more convenient and less dependent on cars.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

On implementation of this alternative, the rebuilt Nichols Marina would be open to the public and would include a water-based recreational facility that provides additional transportation options in the form of water trails.

Bike infrastructure would be improved to encourage more bike use both to and through the park. Expanding the multi-use pathway to include a system of looped routes and to connect to outlying greenways and bike routes would also promote their use as a transportation option to the park. New trails in the park, particularly at the park entrance, would encourage neighbors to walk to the park and hike these routes. All these actions would promote different modes of moving in and between park sites. They would also support the park's fundamental value and would meet many of the directives of the NPS *Management Policies 2006,* resulting in long-term beneficial impacts.

Sandy Hook Unit

As with the other Gateway units, new recreational opportunities would be provided that would increase visitation to the site. Under this alternative, a variety of transportation modes would provide access to Sandy Hook, including expanded ferry service and a shuttle system, resulting in long-term beneficial impacts.

Private Vehicle and Waterborne Transportation Parking Facilities

Visitation would increase with the new recreational opportunities provided under this alternative, and parking supply would be redesigned to handle this capacity. New recreational destinations would be created, such as areas for concerts and festivals, and duration of stay would be changed through provision of additional overnight accommodations, such as expanded camping opportunities and lodging at Fort Hancock's repurposed buildings. These actions would redistribute visitor use geographically and temporally, and parking would be designed to accommodate these changes.

Some of the significant parking issues identified under the no-action alternative would be addressed by providing new or expanded methods of accessing the park. Expanded ferry and water taxi use, combined with an internal shuttle, would provide visitors with a car-free option for both getting to and through the park. A shuttle would also bring visitors to and through the park, and would be designed to address congestion issues at a regional and local level, which would also ease demand on parking. Development of a marina on the bay side of the park, in conjunction with a walkway or trail to the beaches on the ocean side, would have a similar effect on parking demand. These distinct changes in recreational amenities would provide the NPS with an opportunity to design parking to meet visitor capacity, thus reducing or eliminating the significant parking impacts that currently exist. The park would uphold its fundamental value and would reduce traffic congestion as directed by NPS *Management Policies* 2006, thus facilitating visitor access. This would be a long-term significant beneficial impact.

Public Transportation Services

As mentioned above, several alternative public transportation options would be provided to reduce reliance on private vehicle access to the park. These include expanded ferry and water taxi use, a new shuttle system, and a new marina on the bay side. Even if parking is designed to meet the carrying capacity identified for a site, a sudden influx of visitors arriving by boat or bus could overwhelm the site and exceed its capacity. Therefore, when planning the operation of these transportation modes, the NPS would consider visitation surges at particular sites in order to avoid exceeding the area's carrying capacity. Providing a variety of alternative methods to access and travel through the park would address the public's concern about this issue, and would uphold the park's fundamental value. This alternative would also emphasize and encourage alternative transportation systems; reduce traffic congestion, noise, and air pollution; would not cause carrying capacity to be exceeded; would incorporate the principles of energy conservation and sustainability; would provide accessibility for all people; and make it easier and safer to see park features. In addition, this alternative would meet the NPS *Management Policies* 2006 directive to consider alternative destination points or transportation systems to address roads that are at or near capacity. This alternative would also facilitate visitor access, particularly for visitors with disabilities and those without cars. Long-term significant beneficial impacts would result.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

This alternative includes enhancements to expand the existing trail network and development of a water trail network. These actions would provide additional transportation options in the park. The trail connection from Fort Hancock to North Beach would be improved and would help disperse visitor use by encouraging more use at Fort Hancock. These actions would also enhance the visitor experience and thus uphold the park's fundamental value. Long-term impacts would be beneficial.

Cumulative Impacts

The same past, present, and reasonable foreseeable actions that would occur outside the scope of this plan would apply to this alternative as well. However, when combined with the impacts expected under alternative B, they would yield different results, as described below.

Jamaica Bay Unit

Beneficial impacts would occur throughout the Jamaica Bay Unit under alternative B from improvements to parking, public transportation (including ferry service and multimodal hubs), and alternative human-powered transportation modes (such as bike paths and water trails). These impacts would be combined with the improvements to ferry structures, parking facilities, and bridges outside the park, and with the existing public bus, subway, and ferry services offered outside the park, including any plans for future improvements. The result would be a beneficial effect. Although the contribution of alternative B would be a

noticeable effect on access to and through the park, it would be imperceptible in proportion to the adverse impact of regional population growth, which is expected to continue. Therefore, cumulative impacts would be adverse.

Staten Island Unit

Beneficial impacts would occur throughout the Staten Island Unit under alternative B from improvements to parking, public transportation, and alternative transportation modes. In particular, expanded bike and water route options would be a focus at this unit. These impacts would be combined with the existing and proposed bike routes outside the park, as well as the existing public bus and train services offered outside the park. The result would be a beneficial effect. Although the contribution of alternative B would be a noticeable effect on access to and through the park, it would be imperceptible in proportion to the adverse impact of regional population growth, which is expected to continue. Therefore, cumulative impacts would be adverse.

Sandy Hook Unit

The new alternative transportation systems proposed for Sandy Hook under this alternative would reduce reliance on private vehicle access to the park. These beneficial actions would be combined with the other efforts outside the park to address these issues, including the replaced Highlands–Sea Bright Bridge, which was designed to minimize seasonal traffic impacts and would also provide bike access to the park's entrance. The impacts of alternative B would also combine with the effects of the county's summer traffic plan to help ease congestion at Sandy Hook. The incremental effect contributed by the alternative to these other past, present, and reasonably foreseeable actions would constitute an appreciable portion of the overall cumulative impact. Therefore, cumulative impacts would be beneficial.

Conclusion

The actions called for under this alternative would increase visitor use throughout Gateway. New and redesigned parking areas would help alleviate congestion and address visitor capacity issues. New public transportation options and new and improved bike paths, greenways, blueways, hiking trails, and pedestrian routes would provide additional modes of travel to and through the park. These transportation options would also help concentrate and distribute use where needed in order to protect park resources and values. The wayfinding actions that are common to all action alternatives would also provide a beneficial impact by improving how visitors access and travel through the park. Overall impacts would be beneficial compared to existing conditions, particularly at Sandy Hook, where public health and safety issues resulting from severe congestion would be addressed at both a local and regional level. The beneficial impacts expected would uphold the park's fundamental value and abide by the guidance in the NPS *Management Policies* 2006 at all park units. These beneficial impacts would offset adverse cumulative impacts resulting from future regional growth outside the park boundaries. For these reasons, beneficial impacts would be significant.

Alternative C: Experiencing Preserved Places

The focus of alternative C on high levels of natural and historic resource preservation and restoration would increase the importance of integrating Gateway's transportation system into the park as unobtrusively as possible.

Impacts of Alternative C

Jamaica Bay Unit

A transportation hub would be created at Floyd Bennett Field to improve access and provide more multimodal options throughout the unit. More water-based transportation options would be provided throughout Jamaica Bay.

Floyd Bennett Field

Private Vehicle and Waterborne Transportation Parking Facilities

Under this alternative, limited facilities would be developed. Attention would be paid to carrying capacity, and visitor facilities would be concentrated in specific areas to allow for more undeveloped landscapes. A comprehensive trail system would provide access for a variety of visitor interests and transportation modes (hiking, running, biking, and horseback riding). Trailhead parking would be designed to accommodate the modes allowed (e.g., horse trailers), support the carrying capacity at each developed site, and fit in the footprint of the concentrated developed areas. Through these improvements, alternative C would uphold the park's visitor experience (a fundamental value) and facilitate visitor access. This alternative would not cause visitor use to exceed an area's carrying capacity. Parking for this alternative would also be designed with extreme care and sensitivity to the landscape and would not cause unacceptable impacts on natural and cultural resources, thus meeting the directives of the NPS *Management Policies* 2006. Long-term impacts would be beneficial.

Public Transportation Services

Public comments note that it is relatively easy to get to the park, but it is challenging to get through the park. No internal public transportation services would be provided under this alternative to facilitate such movement at Floyd Bennett Field, which would not support the NPS *Management Policies* 2006 guidance to emphasize and encourage alternative transportation systems regarding public transportation. Long-term impacts would be adverse.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

As mentioned above, a comprehensive trail system would provide access for a variety of visitor interests and transportation modes. Bike infrastructure, including wayfinding, maps, and bike rentals, would facilitate use of the trails and greenways. The expanded trail system would provide a new human-powered transportation option for visitors to travel through the park, supporting NPS *Management Policies* 2006 guidance to emphasize and encourage

alternative transportation systems, reduce conflicts with automobiles and incompatible uses, and provide accessibility for all people. It would also provide a different way of moving in and between park sites at Jamaica Bay, resulting in a long-term beneficial impact.

Plumb Beach

The same actions described for alternative B would apply to alternative C for Plumb Beach, with the same long-term beneficial impacts.

Bergen Beach

Private Vehicle and Waterborne Transportation Parking Facilities

No changes to parking facilities are planned under alternative C at Bergen Beach, resulting in no impacts.

Public Transportation Services

There would be no change to public transportation services to Bergen Beach.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

Equestrian uses would be relocated and Bergen Beach would become accessible to all visitors. More visitors would make use of the Rockaway–Gateway Greenway to reach this natural area, resulting in a long-term beneficial impact.

Canarsie Pier

Alternative C would be the same as alternative B for Canarsie Pier, with the same overall long-term beneficial impacts.

Pennsylvania Avenue and Fountain Avenue Parks

Private Vehicle and Waterborne Transportation Parking Facilities

Impacts would be the same as alternative B.

Public Transportation Services

Impacts would be the same as alternative B.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

A new coastal trail would be developed along the water's edge, and launch areas and a water trail to Spring Creek would be developed, as well as a trailhead. These facilities would improve transportation at the Pennsylvania Avenue and Fountain Avenue Parks, resulting in a long-term beneficial impact.

Spring Creek, Frank Charles Memorial Park, and Hamilton Beach Park

Impacts would be the same as alternative B.

Jamaica Bay Wildlife Refuge

The same actions to provide access to the refuge described for alternative B would apply to this alternative. Due to the greater emphasis on research, parking demand may be lower, and the overflow parking issues that currently exist may no longer occur. The result would be decreased congestion and an appropriate correlation between parking and carrying capacity, as called for by NPS *Management Policies 2006,* thus facilitating visitor access. Parking supplies would be designed with sensitivity to the landscape and would not cause unacceptable impacts on the natural resources at the refuge, thus supporting the natural resource restoration and training focus for the refuge under this alternative—a long-term beneficial impact. Other impacts would be as described for alternative B: long term and beneficial.

Jacob Riis Park / Fort Tilden / Breezy Point Tip

Transportation access to and through these areas would be similar to alternative B. However, the expansion of visitor uses and recreational amenities would be substantially less intensive, requiring less expansion of parking. As with the other areas of Jamaica Bay mentioned above, parking would be designed to correspond to planned use areas and would incorporate carrying capacity and landscape sensitivity considerations, resulting in long-term beneficial impacts. Other impacts would be as described for alternative B: long term and beneficial.

Riis Landing

Transportation access to and through these areas would be similar to alternative B and impacts would be as described for Jacob Riis Park / Fort Tilden / Breezy Point Tip.

Staten Island Unit

Although alternative C places more importance on nature-oriented recreation and historic interpretive experiences than alternative B, the sites in the Staten Island Unit would become more connected through shuttle systems and more bike and pedestrian trails and blueways, similar to alternative B.

Fort Wadsworth

Private Vehicle and Waterborne Transportation Parking Facilities

New recreational opportunities would be provided, some similar to alternative B, but on a smaller scale overall. This alternative includes a transportation hub at Fort Wadsworth that would provide connections via shuttle to other Staten Island and Gateway park sites.

Therefore, larger parking supplies would be required to accommodate visitors leaving vehicles at Fort Wadsworth while they use the alternative transportation services provided at the hub. The parking lot off New York Avenue, the largest at Fort Wadsworth, can accommodate 190 vehicles. This lot would be evaluated to determine its ability to provide parking for the transportation hub and other new visitor facilities at Fort Wadsworth in order to facilitate visitor access. Any redesign of parking facilities would be conducted to uphold the park's recreation experience (a fundamental value) and would be in accordance with NPS *Management Policies* 2006, particularly the directive to design with extreme care and sensitivity to the landscape, resulting in long-term beneficial impacts.

Public Transportation Services

The transportation hub that would be located at Fort Wadsworth would provide visitors with an alternate means of accessing the other Gateway sites in the Staten Island Unit, providing connectivity between them and a new transportation option. Locating the hub at Fort Wadsworth would take advantage of its proximity to three public bus routes, including two from Brooklyn via the Verrazano-Narrows Bridge. The hub would provide a car-free option for visitors to access not only Fort Wadsworth but also other Staten Island Unit destinations as well. This long-term beneficial impact would encourage alternative transportation systems by providing different modes of access between sites and would uphold the park's recreation experience (a fundamental value).

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

Like under alternative B, the NPS would work with partners to develop a bike route closer to the water, providing an alternative to Bay Street for connecting Fort Wadsworth to the Staten Island Ferry terminal. Similar to alternative B, a water trail would provide connections to Miller Field and Great Kills Park. The new Coastal Defense Trail would provide a new hiking route, potentially increasing access in the park. These facilities would result in long-term beneficial impacts by providing new transportation options to visitors.

Miller Field

Alternative C would be similar to alternative B for Miller Field for all transportation categories. The transportation hub described for Fort Wadsworth would provide access to Miller Field from Fort Wadsworth and would also connect visitors to Great Kills Park, providing an additional long-term beneficial impact compared to those expected under alternative B.

Great Kills Park

Private Vehicle and Waterborne Transportation Parking Facilities

New parking facilities would be developed to accommodate the relocated marina (which would be developed as described for alternative B) to compensate for those lots that are currently closed due to radiation. Like under alternative B, a new access would be opened off

Hylan Boulevard. New parking facilities would be designed to accommodate redistributed visitation, including the enhanced education field center. Improving parking and a secondary access would be a long-term beneficial impact.

Public Transportation Services

The transportation hub described for Fort Wadsworth would provide access to Great Kills Park from Fort Wadsworth and would also connect visitors to Miller Field, resulting in long-term beneficial impacts.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

As with alternative B, new water trails would be developed in conjunction with the rebuilt marina, and bike infrastructure would be improved to encourage more bike use both to and through the park. These actions would encourage use of alternative transportation systems, a long-term beneficial impact.

Sandy Hook Unit

As with the other Gateway units, the emphasis under this alternative would be on preserving natural resources at Sandy Hook. Like alternative B, a variety of transportation modes would provide access to Sandy Hook, including expanded ferry service and a shuttle system.

Private Vehicle and Waterborne Transportation Parking Facilities

This alternative includes the same shuttle and alternative transportation system included with alternative B, which would address some of the significant parking issues identified under the no-action alternative. Overall impacts on parking would be beneficial in the long term.

Public Transportation Services

The same shuttle and alternative transportation system included with alternative B would apply to alternative C, resulting in the same long-term beneficial impacts as described for alternative B.

Bike Paths, Greenways, Blueways, Hiking Trails, and Pedestrian Routes

A hub for waterborne transportation and water trail connections would be developed, which would incorporate the expanded ferry and water taxis use described for alternative B. The existing trail system would be improved. All these improvements would encourage the use of alternative transportation systems, resulting in a long-term beneficial impact.

Cumulative Impacts

Although the specific transportation actions called for under alternative C would differ from alternative B, the impacts from both would be beneficial overall for all park units. These

impacts would combine with the other past, present, and reasonably foreseeable actions in similar ways. At the Jamaica Bay Unit and the Staten Island Unit, any differences would not affect the contribution of alternative C, which would be imperceptible compared to the effects of regional growth. Resulting cumulative impacts would be adverse. Because the same alternative transportation system described under alternative B for Sandy Hook would be also incorporated in alternative C, cumulative impacts for Sandy Hook would be beneficial.

Conclusion

The actions called for under this alternative would refocus visitor use, resulting in an emphasis on natural resource education and preservation. Like alternative B, this alternative would result in similar beneficial impacts resulting from new and redesigned parking areas, new public transportation options, and new and improved bike paths, greenways, blueways, hiking trails, and pedestrian routes, although to a lesser degree. These transportation options would help concentrate and distribute use where needed in order to protect park resources and values. The wayfinding actions that are common to all action alternatives would also provide a beneficial impact by improving how visitors access and travel through the park. Like in alternative B, the beneficial impacts from Alternative C on transportation would offset adverse cumulative impacts resulting from future regional growth outside the park boundaries. In sum, beneficial impacts from Alternative C on transportation would be significant.

Park Management, Operations, and Facilities

Laws and Policies

NPS *Management Policies 2006* (NPS 2006a) includes sections on park and facilities management. Section 9.1.1, for example, instructs parks to avoid the future operations and maintenance cost of unnecessary or ineffective facilities, and to be able to sustain ongoing operations and maintenance costs of its facilities. When structures are no longer functional, they are to be removed. Many other sections provide guidance on energy sources, infrastructure, design, integration into the park landscape, and the preference of adaptive use of historic (and non-historic) buildings over new construction. Other sections (notably 1.9) direct park and staff management, including recruiting and using volunteers.

Methods

Impact analyses are based on the current description of park operations and park facilities presented in the “Affected Environment” chapter of this GMP/EIS. Park operations and park facilities includes both the quality and effectiveness of the infrastructure and the park’s ability to maintain the infrastructure used in the operation of the park in order to adequately protect and preserve vital resources and provide for an effective and safe employee and visitor experience.

The resource-specific context for assessing impacts of the alternatives on park operations and park facilities includes the following:

- Parks must operate within the constraints of the unit-specific budget and number of staff positions that have been allocated by Congress and the NPS Director's Office.

- Park staff members are not only responsible for activities within their own unit but must also provide for an effective and safe visitor experience and protect resources in the entire park.

- The effects of Hurricane Sandy cleanup, temporary construction, and/or demolition affect the ability of park staff to complete maintenance activities and ensure a safe environment.

- The 2012 NPS Green Parks Plan articulates a vision for reducing the NPS's carbon footprint and outlines approaches for sustainable park management. All three GMP/EIS alternatives are strongly focused on making Gateway a model of sustainability within the New York Metropolitan Area and within the national park system. The NPS envisions future efforts to integrate comprehensive energy savings and green business practices into all aspects of park operations, management, transportation, waste management, and visitor behavior.

Alternative A: No Action

Across the park, the NPS would continue to maintain occupied buildings that are currently used for visitor, administrative and/or operational uses. Below is a summary of actions involved in continuing the current management of park assets and the associated impacts on park operations.

Impacts of Alternative A

Under alternative A, the park would continue to maintain or secure all structures in shared-use areas and seek occupancy for adaptive reuse of selected historic or other prioritized structures. Non-historic structures, such as the Education Field Center at Great Kills and the Visitor Center at Jamaica Bay National Wildlife Refuge, would remain in operation and existing levels of maintenance and staffing would remain consistent across the park. For example, buildings within the cantonment area of Fort Tilden would continue to be adaptively reused to house community organizations while the fortifications would continue as unmaintained assets. Generally, historic assets such as Battery Weed and Battery Tompkins at Fort Wadsworth would continue to be managed by stabilizing and preserving the structures only as funding is available. Over the term of the GMP, the slow deterioration of unmaintained historic buildings parkwide would continue, resulting in long-term or permanent adverse impacts (see the "Cultural Resources" section of this chapter under "Historic Districts and Historic Structures" for more information).

Staffing and Funding

Staffing levels would remain the same for all park units under alternative A. Although Hurricane Sandy recovery money will continue to be used to repair damage from the storm, the park's annual operating budget would likely remain the same and would continue to be inadequate to conduct all needed repair and rehabilitation efforts on park buildings and facilities. Once Hurricane Sandy restoration and improvement actions are completed, the operational capability of park facilities to accommodate visitors would be reestablished under existing staffing levels. Overall, the impact of Hurricane Sandy restoration funding on deferred maintenance would be beneficial because it would reduce funding demands for building maintenance. However, the benefit would be short lived as ongoing demand for maintenance would continue after all hurricane-related funding has been used.

The overall ability of park staff and funding to meet the continued demands of alternative A would be minimal over the short term, with adverse impacts on park operations increasing gradually over the long term.

Sustainability

In 2013, the Gateway Criteria Air Pollutant and Greenhouse Gas (GHG) Emissions Inventory was produced. The report inventoried the park's greenhouse gas emissions from various sources and established a baseline for monitoring GHG and measuring the park's sustainability initiatives. In 2012, the NPS released the Green Parks Plan, which articulates a vision for reducing the agency's carbon footprint and outlines approaches for sustainable park management. The plan applies to all units of the NPS and calls for a reduction in energy consumption of 35 percent per square foot of building space by 2016. To accomplish this objective, Gateway would conduct energy assessments on the most energy-consuming facilities every four years, improve energy use tracking, maximize efficiency in new construction, and prioritize the use of energy sources that are renewable and appropriate. These mandates come from both the Energy Independence and Security Act and Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance."

Under alternative A, the park would continue to incorporate new sustainable business practices and technologies into park operations, facilities management, and park development to the extent that existing budgetary resources allow and as opportunities for integrating new technologies and practices emerge. Adoption of the Green Energy Plan for Gateway would result in appreciable beneficial impacts on the park's operations and maintenance budgets and staffing requirements.

Cumulative Impacts

Maintenance activities would have a greater impact on allocation of limited staff resources. To the extent that Hurricane Sandy funding reduces maintenance backlog, this funding would relieve the demand on staffing to address other park operational needs. However, the extensive backlog of repairs, although reduced by Hurricane Sandy funding, would continue to impact staffing and funding and would continue to grow over the long term under the no-action alternative.

Although climate change is not the result of an agency or single person undertaking an action, it is a powerful force with substantial additive effects on most or all of the resources at Gateway. Sea-level rise as well as other potential changes from climate change including extreme precipitation events, heat waves, and increases in severe winds or other phenomena related are likely to continue to have substantial long-term adverse impacts on park assets and operations.

In 2012, the NPS and New York City entered into an innovative agreement to collaborate on many aspects of park and recreation operations, especially because the two have overlapping and adjacent facilities across the metropolitan area. As a result of these initiatives, Gateway has been in the process of implementing and integrating numerous greening and energy conservation actions into its daily operations that will produce noticeable beneficial impacts by making park operations more sustainable over time. The long-term environmental and greenhouse gas reduction impacts for the environment of the park and the New York metropolitan area would be substantial, but not to the extent of the more comprehensive sustainability programs envisioned for Gateway in alternatives B and C.

Taken together, these past, present, and reasonably foreseeable actions would increasingly result in a primarily adverse impact on park operations. The effect of continuing current management of the deferred maintenance problem and not proactively addressing the potential impacts of climate change would contribute noticeable adverse increments to the cumulative impact on park operations.

Conclusion

Under alternative A, park operations and management would continue under existing funding and staffing levels. Except to the extent that Congressionally appropriated funds for Hurricane Sandy restoration are used to repair specific structures and landscapes, maintenance needs and associated maintenance backlog issues will continue to increase over the term of the GMP.

Continuing existing efforts to enable alternative modes of transportation for visitors, adopt Leadership in Energy and Environmental Design (LEED) standards for new building projects, adaptively reuse existing structures, and increase the fuel efficiency of park fleet vehicles would have a noticeably beneficial impact on park operations.

Overall, the lack of funding, continued deferred maintenance, and constant deterioration of these unrestored, unrepaired park assets would result in a significant adverse impact on park operations.

Common to Both Action Alternatives

Impacts of Alternatives B and C

Alternatives B and C differ from the no-action alternative in that the park would focus its staff and budget on the highest-priority buildings for maintenance and rehabilitation,

and would allow other structures to deteriorate. Although this means the loss of several buildings, among them historic structures, it would also result in substantially more effective preservation of the remaining buildings.

Across the park, the same number of structures would be preserved under alternatives B and C. Differences, if any, would be in the extent of adaptive reuse, degree of interior building restoration, amount of interpretive exhibits and activities, and level of cultural landscape treatments. Through a parkwide prioritization and preservation effort, the alternatives would create more usable spaces for administrative and visitor uses, preserve remaining structures, and reduce maintenance backlog through reuse. By designating certain assets as "managed ruins" and either letting them deteriorate naturally or documenting and removing them, the deferred maintenance backlog would be decreased substantially and park maintenance staff would be able to focus their time and resources on a smaller number of assets. The removal of facilities not contributing to the mission of the park and the intentional neglect of facilities whose condition is beyond repair would have a significant, beneficial effect on park operations and result in cost savings. While documentation, removal, and/or fencing off of these assets would require additional staff time initially, the long-term effect would be a reduced need for maintenance and other staff attention. The benefits of this approach to park management and operations would be substantial.

Both alternatives also include additional development for visitor facilities and amenities, which would bring additional visitor use. Without adequate funding or staff, the impact of additional visitor management would be adverse. This impact is described in more detail under alternative B and alternative C.

In both alternatives, the consolidation and relocation of Gateway maintenance areas would improve operational efficiency. For example, moving the maintenance operations at Sandy Hook from Fort Hancock to a new facility would reduce site impacts on the historic setting and benefit park operations by providing for a more modern facility from which to base maintenance activities at Sandy Hook.

In both alternatives, park operations would benefit from a strengthened partnership with New York City and other partners. The NPS's commitment to working with partners would have a continued positive impact on the park's ability to complete projects and programs in all areas of park operations. Across all three units of the park, partners would play an increasing role in supporting park cultural and natural resources and occupying, maintaining, and preserving some buildings. Facility rehabilitation and restoration, and even maintenance, could not be accomplished at the levels proposed in alternative B or alternative C without partner funding and volunteer efforts. Because partnerships and the resulting co-management of programming and facilities would eliminate duplicative use of personnel and equipment, it would benefit park operations by allowing for the redistribution of staff and greater operational efficiency. For example, as a result of partner involvement in building preservation, park management would be able to reallocate staff and budget resources to the preservation and maintenance of fewer buildings, improving the management of maintenance backlog issues and assets.

Sustainability

Actions common to both action alternatives would improve energy efficiency or conservation practices or reduce greenhouse gases. In accordance with the Green Parks Plan, both alternatives would adopt the following objectives and strategies for reducing greenhouse gas emissions and integrating sustainable practices into park operations: improve environmental performance to meet and exceed requirements of all applicable laws, reduce greenhouse gas emissions, improve facility energy performance, increase reliance on renewable energy, improve facility water use efficiency, adopt greener transportation methods and greening the fleet, purchase environmentally friendly products, decrease waste diversion and recycling, and adopt sustainable best practices in facility operations (NPS 2012d). Implementing these strategies through park practices and through the NPS's expanded partnership with the New York City Office of Long-term Planning and Sustainability and NYCDPR would offer several opportunities to implement features of the Green Parks Plan and to expand sustainability throughout Gateway, resulting in appreciable beneficial impacts.

The following proposed actions common to both action alternatives would represent important steps in reducing the park's greenhouse gas emissions and improving sustainability practices and long-term energy conservation:

- Establishing multimodal transportation hubs at Floyd Bennett Field, Fort Wadsworth, and Sandy Hook that will facilitate alternative modes of transportation to and between the park lands, including walking and biking, waterborne transportation, land-based shuttles, and public transportation

- Transportation-related facility development, such as bike lanes, trails, kayak launches, and pedestrian paths, coupled with expanded outreach that will encourage the use of public transit and shuttles instead of individual cars

- Continued greening of the park vehicle fleet to include hybrid and other efficient vehicles

- Park staff encouraging suppliers, permittees, and contractors to follow sustainable practices and addressing sustainable park and partner practices in interpretive programs

The following proposed actions in both action alternatives would increase energy requirements, resulting in adverse impacts on the park's budget and staffing, as well as energy reduction goals:

- New visitor facilities, including the wetlands center, as well as expanded use and occupancy of Fort Hancock buildings and hangars at Floyd Bennett Field

- Overnight camping, which would require an energy source not currently needed (especially structural camping and RV campgrounds with utility hookups)

- Fuel used by heavy equipment to excavate and grade for new buildings and campgrounds and for restoration and wetland construction projects

- New modes of motorized transportation bringing visitors to the park (e.g., ferries and shuttles), increasing fuel usage

In summary, the proposals common to both alternatives would have a substantial beneficial impact on park operations in that they would result in improved operational efficiency through partnerships, a reduction in the deferred maintenance backlog due to a more focused parkwide preservation effort, and an increase in the sustainability of park operations, building practices, and energy utilization. These impacts would be widespread, and in combination with partnership management of programming and other features at several park sites, would provide significant benefits for park management and operations. However, if funding and staffing levels remain inadequate, these benefits would not be realized and park operations would be adversely impacted due to the continued decline of the condition of park assets. Adverse impacts from development and use of new visitor facilities would result in some localized adverse impacts to park budget and staffing.

Alternative B: Discovering Gateway - NPS Preferred Alternative

Impacts of Alternative B

As stated under "Common to Both Action Alternatives," alternative B would result in substantial beneficial impacts on park operations. The parkwide banding and preservation effort would create more spaces for administrative and visitor uses, preserve structures, and reduce maintenance backlog through both the adaptive reuse of buildings and the designation of managed ruins that would be allowed to deteriorate. The consolidation and relocation of Gateway maintenance areas would improve operational efficiency. Also, increased partner involvement in operations and maintenance as well as building preservation, and especially adaptive reuse, would have a beneficial impact on park operations, allowing for the redistribution of staff and more operational efficiency given the reduction of the duplicative use of personnel and equipment.

Staffing and Funding

The emphasis of alternative B is to work with partners to develop revenue-generating visitor and recreation programming. This focus could result in additional funding sources for rehabilitation and preservation of park assets, and therefore provide substantial benefits for park operations by potentially offsetting operations and maintenance costs and creating more financially self-sustaining visitor facilities and programs. This additional source of revenue, in combination with greater support and coordination with partners, would also offset the adverse impacts on park operations that the addition of new visitor and recreation facilities could create.

Sustainability

The following actions proposed in alternative B for new or enhanced facility development and visitor uses would have an adverse impact on energy and resource conservation in the

park, as well as on staff time and budget involved in developing visitor facilities and visitor management, beyond those articulated under "Common to Both Action Alternatives."

Bergen Beach would be developed to invite more uses, which would require the construction and operation of new facilities such as trails, picnic facilities, concessions, and staging areas for water-based recreation. Similarly, the Pennsylvania Avenue and Fountain Avenue Parks would be developed and include new facilities such as a performance venue, trails, and observation platforms. On Sandy Hook, Batteries Kingman and Mills would be transformed into visitor activity nodes and would therefore introduce new energy requirements and life-cycle maintenance costs. Consequently, these new developments would carry substantial additional operational and maintenance costs, with concomitantly adverse impacts on staffing and budgets.

Alternative B would represent a substantial increase in the amount of camping available parkwide. This alternative would include an emphasis on higher-intensity forms of camping than alternative C, including more RV parks and drive-in campgrounds. These car-dependent forms of camping are more energy intensive than tent and walk-in camping, resulting in additional adverse impacts on the park's goals for energy conservation and sustainability. The following proposed actions would increase energy requirements, resulting in adverse impacts on the park's budget and staffing and on the park's energy reduction goals:

- New visitor facilities, including the wetlands center, as well as expanded use and occupancy of Fort Hancock buildings and hangars at Floyd Bennett Field

- Overnight camping, which would require an energy source not currently needed (especially structural camping and RV campgrounds with utility hookups)

- Fuel used by heavy equipment to excavate and grade for new buildings and campgrounds and for restoration and wetland construction projects

- New modes of motorized transportation bringing visitors to the park (e.g., ferries and shuttles), increasing fuel usage

Alternative B would likely result in an increase in visitation and more motorized transportation bringing visitors to the park (e.g., personal vehicles, ferries, land-based shuttles), which would likely increase energy consumption required by park operations, resulting in adverse impacts on park sustainability goals for energy conservation.

Cumulative Impacts

Cumulative impacts on visitor use and experience from past, present, and reasonably foreseeable projects beyond those in the GMP would remain the same as described for alternative A. Cumulative impacts related to sustainability and energy and resource conservation for alternative B would be greater than under alternative A (no action). The park's contribution to greenhouse gas emissions in the New York metropolitan area from park operations would be minimally reduced in the short term and significantly reduced over time as sustainable business practices are integrated into all park activities.

These cumulative actions have contributed or would contribute both adverse and beneficial impacts on park operations. When the impacts on park operations from alternative B are combined with the impacts of other projects in the park and region, and assuming growing partnership participation and appropriate funding, an overall beneficial cumulative impact would be expected. In furtherance of NPS-wide policy, the park would pursue public–private partnerships to assist with the reuse and preservation of fundamental resources (historic structures) for a wide variety of uses, including visitor services such as lodging, administrative and partner needs, and recreational business opportunities, with resultant beneficial impacts on park operations because partners would help ensure building preservation and upkeep.

With a substantial increase in rehabilitation and adaptive reuse, more staff, increased budget, and an expanded operational capability would be required to manage the proposed new park activities and to ensure upkeep and protection of renovated and reused park buildings and assets. Assuming that operational capacity is expanded, alternative B would contribute an appreciable beneficial impact to park operations and management.

Conclusion

The focus of alternative B on working with partners to develop revenue-generating visitor and recreation programming would provide important and potentially significant benefits for park operations and budgets. With partner participation and adequate funding, and refocusing on maintaining the highest-priority assets, the proposed substantial increase in rehabilitation and adaptive reuse included in alternative B would result in long-term beneficial impacts on park operations as deferred maintenance would be addressed and the overall condition of park resources would be improved. These benefits would be significant.

Adverse impacts on park budget and staffing from increased management of visitor use facilities and visitor experience would result from adding facilities and improving access and programming, and some increase in energy needed to sustain these facilities would adversely affect energy conservation goals. Neither of these impacts would be significant. However, over the term of the GMP, direct impacts related to sustainability and energy and resource conservation would be beneficial for this alternative, substantially greater than those under the no-action alternative, and significant. While the cumulative adverse impacts on sustainability from urban development, climate change and more intensive development would be noticeable, they would be balanced by NPS commitment to pursuing sustainable facility development and building the resiliency of the parks and their surrounding communities.

Implementation of alternative B would result in a minimal reduction in short-term energy use and a more extensive long-term reduction as proposed sustainable business practices become integrated comprehensively into all park activities. The park's contribution to greenhouse gas emissions in the New York metropolitan area from park operations would be minimally reduced in the short term and significantly reduced over time as sustainable business practices are integrated into all park activities.

Alternative C: Experiencing Preserved Places

Impacts of Alternative C

In alternative C, park management would be more focused on the long-term preservation, research, and interpretation of fundamental coastal defense and maritime cultural resources, focusing staff and budgetary involvement on both the preservation and interpretation of the park's fundamental natural and cultural resources. More so than in alternative B, the park would pursue public–private partnerships to assist with the reuse and preservation of fundamental historic structures for a wide variety of uses, including visitor services such as lodging, administrative and partner needs, and recreational business opportunities. This strategy would result in substantial beneficial impacts for park operations, and less need for increases in park budget and staffing levels to maintain operational integrity.

In partnership with New York City, the NPS would develop and operate a composting facility that includes an anaerobic digester. The impacts of operating this facility would be environmentally beneficial by diverting trash destined for landfills and reducing greenhouse gases. Operational impacts of these modified trash and recycling initiatives would be minimal, because the management of the facilities would be contracted under cooperative agreements with New York City.

As stated under "Common to Both Action Alternatives," alternative C would also result in substantial beneficial impacts on park operations from the parkwide banding and preservation effort, the consolidation and relocation of Gateway maintenance, and increased partner involvement in operations and maintenance as well as building preservation.

Staffing and Funding

Alternative C is less recreation oriented than alternative B, providing a greater emphasis on resource preservation. Under alternative C, facility development would be less intensive and visitation would be lower than in alternative B, resulting in a less adverse impact on park staff and operations budgets. Whereas alternative B may affect interpretive or law enforcement staff at the park, alternative C is likely to increase the workload for resource management division personnel.

Sustainability

The following actions proposed for facility development and visitor uses in alternative C would have a beneficial impact on energy and resource conservation in the park beyond those articulated under "Common to Both Action Alternatives."

In alternative C, there is a stronger emphasis than in alternative B on adopting innovative sustainable practices, resulting in beneficial impacts, as evidenced by the proposal for improved parkwide recycling and waste management including a large composting facility and anaerobic digester at Floyd Bennett Field.

Under alternative C, equestrian facilities at Bergen Beach would be removed and the area would be managed as a natural area with less facilities and energy requirements than exist today, with beneficial impacts on sustainability.

Alternative C would include fewer new facilities than alternative B, with beneficial impacts. Some actions that would result in greater energy demands than are currently required include rehabilitating portions of Fort Tompkins as a visitor facility and converting Sandy Hook's Nike Missile site into an interpreted, visitor-ready site.

Compared to alternative B, camping-related facility development would result in lower energy requirements. Alternative C would emphasize lower-intensity forms of camping, such as backcountry/beach, programmatic, and walk-in tent camping and would have fewer RV and drive-in campsites.

Cumulative Impacts

Cumulative impacts on park management, operations, and facilities under alternative C from past, present and reasonably foreseeable projects would remain the same as described for alternative A.

Collectively, these cumulative actions have contributed or would contribute to both adverse and beneficial impacts on park operations due to an increased emphasis on restoration and a lesser emphasis on increasing recreational visits. When the impacts on park operations from alternative C are viewed in combination with impacts from these other projects in the park and region, an overall appreciable beneficial cumulative impact would occur. In furtherance of NPS-wide policy, the park would pursue public–private partnerships to assist with the reuse and preservation of fundamental historic structures for a wide variety of uses, including visitor services such as lodging, administrative and partner needs, and recreational business opportunities, resulting in appreciable beneficial impacts on park operations because partners would help ensure building preservation and upkeep.

The proposed substantial increase in rehabilitation and adaptive reuse would require more staff, increased budget resources, and enhanced operational capability. Park operations and staffing would experience an imperceptible adverse impact in the absence of compensating funding to offset additional demands.

Cumulative adverse impacts related to sustainability and energy and resource conservation would be greater for this alternative than alternative A (no action), but beneficial compared to alternative B. Implementation of alternative C would result in a minimal reduction in short-term energy use and a greater long-term reduction as sustainable business practices become integrated comprehensively into all park activities. The park's contribution to greenhouse gas emissions in the New York metropolitan area from park operations would be minimally reduced in the short term and substantially reduced over time as sustainable business practices are integrated into all park activities.

Conclusion

With partner participation and adequate funding, and refocusing on maintaining the highest-priority assets, the proposed substantial increase in rehabilitation and adaptive reuse included in alternative C would result in long-term beneficial impacts on park operations as deferred maintenance would be addressed and the overall condition of park resources would be improved. These benefits would be significant. An additional focus on preservation of cultural and natural resources and a more aggressive pursuit of public–private partnerships for reuse of historic structures in alternative C would provide additional potentially significant benefits for these park assets. Increases in visitor facilities, recreational opportunities, resource preservation and protection, and visitor use would have potential adverse impacts on park management and operations budgets and staffing. However, the operational efficiencies of partnering with New York City and others and the increased visibility in preservation communities could compensate for gaps in staffing or budgets associated with these increases in amenities or services. Also, proposed actions common to both action alternatives to improve energy efficiency and sustainability, in combination with a greater emphasis on sustainable facilities and operations in alternative C than B (such as including an anaerobic digester), would add to significant beneficial impacts on park operations expected under either alternative.