FIGURE 28: TIDAL AND NON-TIDAL WETLAND RESOURCES AT ANACOSTIA PARK EVALUATED DURING THE APRIL 2008 SURVEY, NORTH AREA

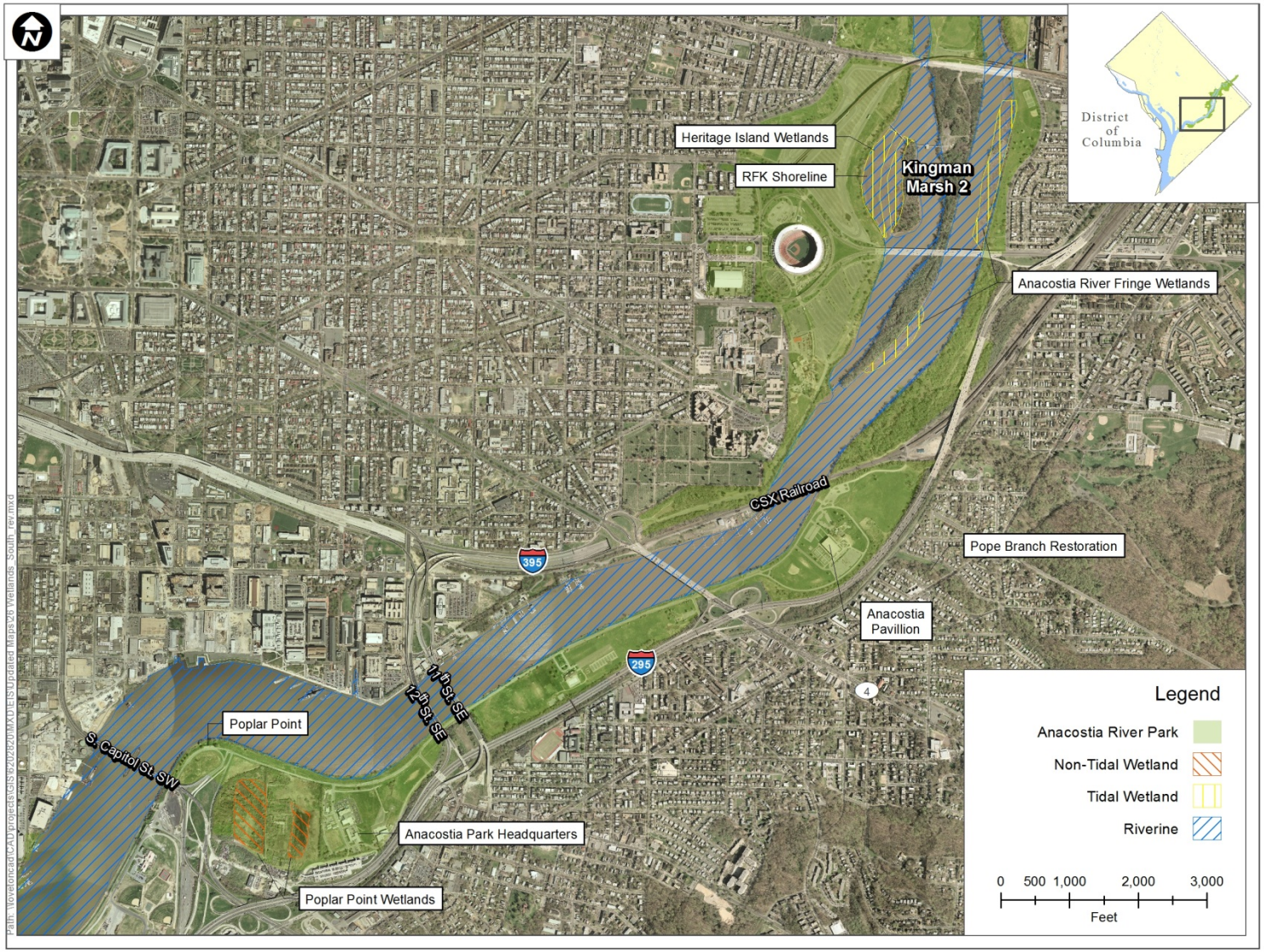

FIGURE 29: TIDAL AND NON-TIDAL WETLAND RESOURCES AT ANACOSTIA PARK EVALUATED DURING THE APRIL 2008 SURVEY, SOUTH AREA

Anacostia River Fringe Wetlands—The goal of this project was to restore 16 acres of tidal wetlands along the shores of the Anacostia River adjacent to Kingman Island (figure 28) (DCDOH undated). The Anacostia River Fringe Wetlands were created by temporarily installing sheet piling that contained the dredge material until it settled and vegetation was fully established. As with the Kingman Marsh wetlands, these wetlands increased the number of beneficial plants and fish in the river and improved the water quality of the Anacostia River. Restoration of the wetlands was completed in the fall of 2003 (DCDOH undated), but the sheet piling was never removed as originally intended. Removal of the sheet piling would require additional NEPA compliance.

Heritage Island Wetlands (Heritage Marsh) —The goal of this project was to create an additional 6 acres of emergent wetlands in Kingman Marsh adjacent to the RFK parking lot (figure 29) (USACE 2002). These wetlands complement the existing Kingman Marsh wetlands and provide additional habitat and water quality treatment (USACE 2002). An additional goal of this project was to create a deeper tidal channel that would allow for canoe and fish passage though the lake at low tide.

Lower Anacostia Park Enhancements-Pope Branch Restoration—The goal of this project was to restore habitat and improve water quality in lower Anacostia Park (DCDOH undated). Restoration efforts included planting of native trees, restoring tidal and non-tidal wetlands, and opening a portion of Pope Branch that is currently piped under portions of Anacostia Park (DCDOH undated) (figure 28).

Hickey Run Restoration—The objective of this project was to improve water quality and habitat conditions of Hickey Run, much of which runs through The U.S. National Arboretum (DCDOH undated) (figure 28). Improvements included installation of a stormwater management facility to filter pollutants such as oil and grease, trash traps to capture floatables, instream restoration to rebuild channelized portions of the stream as well as community and business outreach in the highly urbanized upper reach of the stream in order to reduce pollutant loading. This project has not yet been completed, but is scheduled to occur in the near future (DCDOH undated).

Watts Branch Restoration—The goal of this project was to restore the in-stream habitat and improve the water quality of Watts Branch (DCDOH undated) (figure 28). Restoration was achieved through reconstructing stream sections to better accommodate stormwater flows and addressing source control of runoff through implementation of low impact development projects (DCDOH undated).

Poplar Point—The goal of this project was to conduct an environmental assessment, site remediation and wetlands restoration of property under the jurisdiction of the District (DCDOH undated) (figure 29). The project includes constructing an entrance to Anacostia Park from Poplar Point (DCDOH undated).

Benning Power Plant Inlet—In 1996 PEPCO replaced the old intake inlet with an intake pipe system that extended to the main Anacostia River channel. The NPS worked with the utility company to use sediment displaced by the new intake system to reconstruct approximately 0.50 acre of emergent tidal marsh in the old inlet and along a small fringe area of the River just above Benning Road Bridge. Interpretive waysides and a brochure titled "Ecology of the Anacostia River" were developed.

WETLAND DELINEATION METHODOLOGY

Wetlands within Anacostia Park and adjacent areas administered by the NPS were field-investigated by wetland biologists in April 2008 to collect information related to the existing conditions of the current wetlands (figures 28 and 29). The National Wetland Inventory data provided by USFWS and information provided by park staff were incorporated into the survey strategy.

Both tidally influenced (referred to as tidal) freshwater wetland systems and the non-tidal wetland systems are present within Anacostia Park on lands administered by NPS. The majority of the tidal wetlands are represented by the degraded wetland areas either enhanced or restored by the NPS in cooperation with USACE and other entities. The tidal wetlands are located within the channel of the Anacostia River or have a direct connection to the river through the seawall that exists along the majority of the Anacostia Park's shoreline. Non-tidal wetlands within Anacostia Park are typically smaller in size than the tidal wetlands. Forested, scrub-shrub, emergent, and open water non-tidal wetlands are present. Many of these wetlands appear to be remnant wetlands that have been cut off from their historic connections to the Anacostia River by dredging and realignment of the river, construction of the seawall along much of the Park's shoreline, and the construction of embankments for transportation projects, such as Route 50 – New York Avenue and the railroad tracks used by Amtrak. The tidal and non-tidal wetlands of Anacostia Park support native plant and animal species. However, common reed and purple loosestrife are present in both types of wetlands within Anacostia Park; these plants are characterized as invasive plant species and pose management difficulties for the wetland areas within Anacostia Park.

EVALUATION OF WETLAND FUNCTIONS AND VALUES

The existing wetland conditions were evaluated during the April 2008 field investigation, based on wetland functions and values described in three locally applicable functional assessment methodologies or guidelines: 1) NPS Procedural Manual #77-1: *Wetland Protection* (NPS 2008b); 2) the Wetland Evaluation Technique (WET) (Adamus et al. 1987); and 3) the Descriptive Approach or New England Method (NEM) (USACE 1995). While all three procedures include numerous similarly defined function and value variables, they also include several unique variables specific to that methodology. To be consistent with NPS guidelines, all of the variables evaluated in the field were grouped into three categories, including Biotic Functions, Hydrologic Functions, and Cultural Values. Variables unique to a specific procedure are also noted in the definitions provided below.

The wetland functions and values evaluation for the Anacostia Park wetlands are presented in table 9 and described in more detail in the following paragraphs. See figures 28 and 29 for the locations of the tidal and non-tidal wetlands at the park. NPS Procedural Manual #77-1: *Wetland Protection* includes two additional categories, Research/Scientific Values and Economic Values. Because the variables listed for these categories overlap with several of the variables listed for the three categories described above, they have been incorporated into these other described categories. The definitions for what was considered for the wetland function and value variables evaluated are described in more detail below.

TABLE 9: COMPARISON OF FUNCTIONS AND VALUES FOR ANACOSTIA PARK WETLANDS

		Wetland Site Name										
		Non-Tidal Wetlands				Tidal Wetlands						
		West Bank Wetlands				Kenilworth Marsh	Kingman Marsh	Kenilworth Marsh			Fringe Wetlands	
	Functions and Values	North	Central	South	Poplar Point	River Trail	RFK Shoreline	South Fill Area - 1st Platform	South Fill Area - Island	South Fill Area - Viewing Platform	North	Number of Sites that Provide Function or Value
Biotic Functions	Fish/Shellfish Habitat, Aquatic Diversity/ Abundance, and Economic Fisheries Value	X	---	X	---	---	X	X	---	X	X	**6**
	Wildlife Habitat, Wildlife Diversity/ Abundance, and Faunal Productivity	X	X	X	X	X	X	X	X	X	X	**10**
	Native Species, Habitat Diversity, and Floral Productivity	X	X	X	X	X	X	X	X	X	X	**10**
	Threatened & Endangered Species	---	---	---	---	X	---	---	---	---	---	**1**
Hydrologic Functions	Flood Attenuation/ Alteration and Economic Flood Protection Value	X	X	X	---	X	X	X	X	X	X	**9**
	Ground Water Discharge & Streamflow Maintenance	X	X	X	---	X	X	X	X	X	X	**9**
	Ground Water Recharge	X	X	X	X	X	---	X	X	X	---	**8**
	Sediment/Toxicant/ Pathogen Retention	X	X	X	X	X	X	X	---	X	X	**9**
	Water Supply	---	---	---	---	---	---	---	---	---	---	**0**
	Nutrient Removal/ Retention/Transformation & Water Purification	X	X	X	X	X	X	X	---	X	X	**9**
	Production Export & Detrital Export to Downstream Systems	X	X	X	---	---	X	X	X	X	X	**8**
	Sediment/Shoreline Stabilization & Erosion and Sediment Control	X	X	X	---	X	X	X	X	X	X	**9**

Functions and Values		Wetland Site Name										Number of Sites that Provide Function or Value
		Non-Tidal Wetlands				Tidal Wetlands						
		West Bank Wetlands				Kenilworth Marsh	Kingman Marsh	Kenilworth Marsh			Fringe Wetlands	
		North	Central	South	Poplar Point	River Trail	RFK Shoreline	South Fill Area - 1st Platform	South Fill Area - Island	South Fill Area - Viewing Platform	North	
Cultural Values	Recreation/Economic Tourism Value	X	---	---	X	X	X	X	X	X	X	**8**
	Uniqueness/Heritage	---	---	---	---	---	---	---	---	---	---	**0**
	Education, Research/Scientific Value, and Interpretation	---	---	---	---	X	X	X	X	X	X	**6**
	Visual Quality/Aesthetics	X	X	X	X	X	X	X	X	X	X	**10**
	Historical Value	---	---	---	---	---	X	X	X	X	---	**4**
	Archeological Value	---	---	---	---	---	---	---	---	---	---	**0**
Total # of Functions and Values		12	**10**	**11**	**7**	**12**	**13**	**14**	**11**	**14**	**12**	**N/A**

Biotic Functions

- **Fish/shellfish habitat (NPS/NEM) and aquatic diversity/abundance (WET)**—the effectiveness of seasonal or permanent watercourses associated with a wetland to provide habitat and the essentials necessary for life for a diversity of types and abundance of populations of fish/shellfish and other aquatic organisms. The economic value of the fishery (NPS) was also considered in this variable. Both resident and migratory species were considered.
- **Wildlife habitat (NPS/NEM) and wildlife diversity/abundance (WET)**—the effectiveness of a wetland to provide habitat and the essentials necessary for life for a diversity of types and abundance of populations of wildlife species typically associated with wetlands, their associated water bodies, and the wetland edge. Both resident and migratory species were considered. Faunal productivity (NPS) has also been included in this variable.
- **Native species and habitat diversity (NPS)**—the potential of a wetland to yield and support a wide variety of native plant species and diverse habitat types. Floral productivity (NPS) has also been included in this variable.
- **Threatened and endangered species**—the suitability of a wetland to support and/or provide the habitat requirements specific to threatened and/or endangered species.

The assessment for the biotic functions category revealed that all of the wetland sites provided wildlife habitat, native species, and habitat diversity/abundance. Fish/shellfish habitat and aquatic diversity/abundance functions were provided at two of the five non-tidal wetland sites and four of the five tidal wetland sites. Threatened and endangered species were observed at one non-tidal wetland site only.

Hydrologic Functions

- **Flood attenuation/alteration**—The effectiveness of a wetland in reducing flood damage from prolonged periods of precipitation by storing and desynchronizing (i.e., gradually releasing at lower heights/velocities) floodwaters. The economic value of flood protection (NPS) has also been included in this variable.
- **Ground water discharge**—The potential of a wetland to discharge groundwater to the surface. The wetlands ability to help maintain stream base flow (NPS) has also been included in this variable.
- **Ground water recharge**—The potential of a wetland to contribute water to an aquifer.
- **Sediment/toxicant/pathogen retention (NEM/WET)**—The effectiveness of a wetland to reduce or prevent degradation of water quality by acting as a trap for sediments, toxic substances or pathogens in runoff water that could adversely affect aquatic and terrestrial life.
- **Water supply (NPS)**—The possibility that a wetland can contribute water for human consumption.
- **Nutrient removal/retention/transformation (NEM/WET)**—The effectiveness of a wetland to serve as a trap for nutrients carried by runoff from surrounding uplands or contiguous wetlands, and the wetlands ability to process these nutrients into other forms. The wetland also functions to prevent the adverse effects associated with excess nutrients entering aquifers or surface waters, including streams, rivers, lakes, ponds or estuaries. Water purification (NPS), or the potential of a wetland to decontaminate and refine water, has been included in this variable.

- **Production export (NEM/WET)**—The effectiveness of a wetland to produce food or other usable products for living organisms (including humans). Detrital export to downstream systems (NPS) has been included in this variable.
- **Sediment/shoreline stabilization (NEM/WET)**—The effectiveness of a wetland to stabilize streambanks against shear stresses and/or protect shorelines against erosion by reducing forces caused from waves. Other erosion and sediment control functions (NPS), such as reduction of water velocities and binding of the soil, have been included in this variable.

For the non-tidal wetlands assessed, all five sites provided groundwater recharge, sediment/toxicant retention, and nutrient removal/transformation. Four of the five non-tidal wetland sites provided flood attenuation/alteration, groundwater discharge, water purification, and sediment/shoreline stabilization and three non-tidal wetland sites provided production export. For the tidal wetlands assessed, all five sites provided flood attenuation/alteration, groundwater discharge, production export, and sediment/shoreline stabilization. Four of the five tidal wetland sites provided sediment/toxicant retention, and nutrient removal and three of the five sites provided groundwater recharge. None of the non-tidal or tidal wetlands assessed provided water supply.

Cultural Values

- **Recreation (consumptive/non-consumptive) and tourism**—The suitability of a wetland and associated watercourses to provide active and/or passive recreational opportunities for both local and non-local populations. Consumptive use includes activities such as hunting and fishing that diminish the plants, animals, or other resources that are intrinsic to the wetland. Non-consumptive use includes activities such as hiking, birding, boating and canoeing, that do not diminish the resources of the wetland. The economic value of tourism (NPS) has also been included in this variable.
- **Uniqueness/heritage (NEM/WET)**—The effectiveness of a wetland or its associated water bodies to provide certain wetland attributes or special functions and values related to aspects of public health, recreation and habitat diversity. This may include the wetlands overall health and appearance, its role in the overall ecology of the area, or its relative importance as a typical wetland class for the geographic location. It should be noted that both the NEM and WET procedures typically include sites with archeological and historical significance, and sites providing critical habitat for endangered species under this variable, but for the field evaluation efforts, these characteristics were each included as separate variables.
- **Education/scientific value (NPS/NEM)**—The suitability of a wetland to serve as an "outdoor classroom," as a "reference site" for scientific study or research on un-impacted ecosystems, or for interpretation (NPS).
- **Visual quality/aesthetics (NPS/NEM)**—The effectiveness of a wetland in contributing to the visual or aesthetic quality or pleasing nature of the surrounding landscape.
- **Historical value**—The possibility that a wetland contributes to the historical significance and value of a site or region.
- **Archeological value**—The possibility that a wetland contributes to the archeological significance (e.g., shell mounds, burial sites, etc.) and value of a site or region.

All of the non-tidal and tidal wetland sites provided visual quality/aesthetics. For the non-tidal wetlands assessed, three of the five sites provided recreation/tourism and one site provided education/scientific value. None of the non-tidal wetland areas assessed had historical value. For the tidal wetlands assessed

all five of sites provided recreation/tourism and education/scientific values; four of the tidal wetland sites provided historical value. None of the non-tidal or tidal wetlands provided uniqueness/heritage or archeological value.

TIDALLY INFLUENCED FRESHWATER WETLANDS

Historically, the Anacostia estuary was a fully functional freshwater tidal marsh system (USGS 2006b). Freshwater tidal wetlands occur in sites where flooding occurs in response to lunar or wind tides, but where the water has less than the 0.5 parts per thousand salt content used to define fresh water (NCDENR 2010). Tidal fresh waters occur in rivers, where freshwater flow keeps out salt water, and along the large sounds where distance from seawater inlets keeps the water fresh. Freshwater tidal wetlands are structurally diverse and can support a variety of different habitat types as well as numerous wildlife species, including breeding bird habitat. Along the Anacostia River, the habitat types supported by freshwater tidal wetlands can include low marsh, high marsh, mud flats, substrate that supports SAV, and further inland wet meadows and forested wetlands. The plant species diversity and vegetation of tidal freshwater marshes vary with salinity, duration of inundation, and disturbance. Mud flats are important components of tidal freshwater marshes and include areas fully exposed only at low tide. Mudflats can be bare or sparsely vegetated with either emergent vegetation or SAV. Like mudflats, SAV is an important component of tidally-influenced wetlands, provides a wide array of ecological services, and is very sensitive to water depth and substrate (Strange et al. 2008). SAV is a resource topic that was considered but dismissed as discussed in detail in Chapter 1. Limited SAV occurs in the study area and the establishment of new areas of SAV is outside of the scope of this plan/EIS. Tidally-influenced wetlands at Anacostia Park include the Anacostia River Fringe Wetlands, RFK shoreline, Kingman Marsh, and the wetlands within the Kenilworth Aquatic Gardens (figures 28 and 29). Wetland functions were evaluated in April 2008 for the following tidally-influenced freshwater wetland areas:

Kenilworth Marsh—Kenilworth Marsh is a restored freshwater tidal marsh on the Anacostia River located adjacent to the Kenilworth Aquatic Gardens. The current marsh has a direct connection with the Anacostia River via a breach in the seawall along the river and supports diverse plant and animal communities. A walking trail (River Trail) borders the wetland to the north and makes its way to the breach in the seawall, while a boardwalk extends from the Kenilworth Aquatic Gardens to the southern portion of the marsh. The boardwalk and adjacent River Trail currently provide opportunities for visitors to interact with the environment. Public access to this type of habitat is rare, especially in the context of a large metropolitan city. Native plant species present in the Kenilworth Marsh include cattails, willow, pickerelweed, reed canary grass (*Phalaris arundinacea*), marsh hibiscus (*Hibiscus moscheutos*), jewelweed (*Impatiens capensis*), and yellow pond lily. Wild rice is also present but was not observed during the field visit due to the time of year of the survey. Non-native, invasive plant species were also present. Common reed and purple loosestrife are present, as well as other invasive species being managed by NPS.

Kingman Marsh—Kingman Marsh has been the site of two recent large-scale restoration efforts. The first effort restored 40 acres of tidal wetland at Kingman Marsh and was completed in 2000 through support by the USEPA, USACE, NPS, and the District and Prince George's County governments (USGS 2006b). In the past several decades, sediment had accumulated in this area, turning the man-made open freshwater lake into an unvegetated mudflat. The restoration process involved using a hydraulic dredge to pump Anacostia River channel sediments into two separate containment cells at Kingman Marsh, as described below.

The northern portion of Kingman Marsh (Kingman Marsh 1) is located north of Benning Road and includes about 30 acres surrounded by the Langston Golf Course. Following the completion of sediment and contouring activities at this area, the following wetland species were planted in June of 2000: arrow

arum, soft-stemmed bulrush, soft rush, pickerelweed, duck potato, common three-square, and yellow pond lily. This area was deliberately reconstructed lower than Kenilworth Marsh (mostly mid and low marsh less than 2.0' NGVD '29), so as not to incur as many invasive, non-native species establishment (particularly common reed and purple loosestrife) as occurred at the higher elevations of Kenilworth Marsh (USGS 2006b). It is likely that resident Canada geese were responsible for the initial vegetation declines in this area, but that in succeeding years, eroding and consolidating sediment along with higher water levels in 2002 and 2003 made it difficult for the marsh to recover from grazing effects of resident Canada geese (USGS 2006b).

The southern portion of Kingman Marsh (Kingman Marsh 2) is located south of Benning Road and consisted of about 5 acres adjacent to RFK Stadium to the west and Heritage Island Wetlands to the east. Heritage Island Wetlands were included within the analysis of Kingman Marsh for this plan/EIS. Following dewatering and consolidation, the resultant sediment flats covered about 35 acres. After sediment deposition had occurred, the site was contoured and graded and then planted with 700,000 plugs, which were comprised of seven native wetland plant species. In May of 2000 the same wetland plant species that were planted in Kingman Marsh 1 were also planted in the Kingman Marsh 2: arrow arum, soft-stemmed bulrush, soft rush, pickerelweed, duck potato and common three-square, as well as yellow pond lily in lower spots around the restored marsh edges. Similar to the northern area, the planted marsh at the southern wetland initially performed well, but soon began to decline. The initial cause of decline is believed by many to be the herbivory of the plantings by resident Canada Geese (USGS 2006b). Since initial restoration, the elevation of the marsh surface subsided and made the area unsuitable for re-colonization by wetland plants. The presence of the resident Canada Geese and the erosion of the marsh surface have caused the area to be dominated by mudflat habitat.

RFK Shoreline—This wetland area was restored inside Kingman Marsh along the shoreline of the Anacostia River and adjacent to the RFK Stadium parking lot. It is the most recently restored wetland in Kingman Marsh and has benefited from lessons learned through past wetland creation projects along the Anacostia River. Past experience with lack of wetland success caused by herbivory by resident Canada geese and erosion of the marsh surface has influenced the design of this wetland. This wetland was restored by the placement of dredged material behind a dike constructed from coir logs. The coir logs hold the sediment in place so that the elevation of the marsh surface remains stable. The sediment is stabilized by the coir logs and the vegetation growing in the marsh so the elevation of the marsh surface remains at a level capable of maintaining plant growth. The area was planted with native species including yellow pond lily, cattails, pickerelweed, hibiscus, and *Scirpus* species. Common reed is present but is limited to a relatively small area immediately adjacent to the landward edge of the marsh. Additionally, this marsh is protected by a goose exclusion perimeter fence as well as internal and overhead barriers to keep resident Canada geese from entering the wetland and grazing on the plant material.

Anacostia River Fringe Wetlands—The River Fringe Marsh is comprised of two separate areas. The northern portion of the Anacostia River Fringe Wetlands is located in the Anacostia River approximately between Benning Road and East Capital Street. This area was created by temporarily bulkheading a portion of the mainstem of the Anacostia River with sheet piling. The sheet piling was originally installed as a temporary measure to contain the dredged material until it adequately settled and vegetation became fully established to hold the material in place. The sheet piling has been in place since the original construction of these marshes. Since these wetlands are now vegetated, the NPS intends to remove the sheet piling in the near future. Removal of the sheet piling would require additional NEPA compliance. The tide inundates this wetland regularly and a combined sewer outfall is located within the wetland. The wetland was planted with native species, including cattail, willow species, soft rush, and jewelweed; the invasive species common reed has been observed at this wetland. The southern portion of the Anacostia

River Fringe Wetlands is located in the Anacostia River along the southeastern shoreline of Kingman Island. This wetland was not evaluated in detail during the April 2008 fieldwork.

NON-TIDAL WETLANDS

The following non-tidal or freshwater wetlands were evaluated in Anacostia Park in April 2008 (figures 28 and 29):

Westbank Wetlands (WB)—The Westbank wetlands are generally located opposite Kenilworth Marsh on the west bank of the Anacostia River and include three separate wetlands (north, central, and south). These wetlands are non-tidal and difficult for the public to access. The north Westbank wetland is the northernmost wetland within Anacostia Park and borders the Maryland-District boundary. It is a backwater area within the floodplain that receives floodflow from the Anacostia River and drainage from the stormwater management facility located west of the wetland. Vernal pools were observed within the scrub shrub and forested habitat between the river and the wetland. The fringe of the pond includes red maple (*Acer rubrum*), river birch (*Betula nigra*), black willow, and sweetgum (*Liquidambar styraciflua*). The central Westbank wetland is a narrow wooded stream system on the north side of the Amtrak tracks. The stream flows east to the Anacostia River and possibly receives flow during extreme flood events. There is a large area of ponding due to beaver activity. Tree species present include red maple and various oak species (*Quercus* spp.). Herbaceous species present include cattails, reed canary grass, cinnamon fern (*Osmunda cinnamomea*) and royal fern (*Osmunda regalis*). The south Westbank wetland was the largest non-tidal wetland complex visited during the April 2008 fieldwork. This wetland is located within the floodplain of the Anacostia River. This system receives flow from two unnamed tributaries to the Anacostia River and is comprised of open water, emergent, scrub-shrub, and forested wetlands. A man-made berm is present along the Anacostia River in the area of this wetland. The berm is breached at the outlet of one of the streams; however, there is little tidal influence on the system. Common reed is present within the emergent wetland areas; other plants present include reed canary grass, purple loosestrife, boxelder (*Acer negundo*), and green ash (*Fraxinus pennsylvanica*).

River Trail Wetland—The River Trail wetland is located north and east of Kenilworth Marsh. The forested and open water wetland is located between berms and the River Trail embankment. It flows into the Kenilworth Aquatic Gardens through a metal pipe beneath the River Trail. The wetland buffer species present at the site include red maple, flowering dogwood (*Cornus florida*), cattails, spicebush (*Lindera benzoin*), and southern arrowwood.

Poplar Point Wetland—The wetland at Poplar Point is an emergent wetland located south of the Anacostia Park Headquarters building and along the southern shoreline of the Anacostia River. The Poplar Point Wetland is comprised of two separate wetland areas located immediately adjacent to each other. This wetland has a levee on the east and is located at a former facility that was operated by the Architect of the Capitol. A Metro subway tunnel passes beneath this area, which was recently disturbed by the construction of the Metro tunnel. The wetland is isolated from the Anacostia River and its hydrology appears to be sustained by groundwater and precipitation. The plant species present includes soft rush, black willow, and common reed grass.

WETLANDS AND THE ROLE OF CLIMATE CHANGE

Wetlands are currently being affected by and would continue to be affected by climate change, specifically sea level rise. Sea level rise is projected to permanently inundate low-lying coastal areas and increase shoreline erosion and wetland loss (NPS 2009d). For example, an elevation that may support high marsh plants under current conditions may become dominated by low marsh species in 50 years as a result of rising water levels. Chronic sea-level rise is also advancing the salinity gradient upstream in

rivers on the Atlantic Coast. A salinity gradient refers to the difference in the salt concentration between saltwater and freshwater. When the salinity gradient advances, it means that a higher salt concentration is moving into the more upstream, typically freshwater areas. This phenomenon could lead to changes in vegetation types and the conversion of some tidal freshwater marshes into more salt-tolerant marshes from the increased salinity. Tidal freshwater marshes are also threatened by invasive plants such as common reed grass (*Phragmites australis*) which displace native vegetation (MDNR 2005). Specifically, climate change may increase opportunities for invasive plant species such as common reed to spread because of this species' adaptability to disturbance and efficiency to colonize (Erwin 2009), although water levels also influence the distribution of common reed. Restored wetland areas that are currently at the lower end of the elevation scale, such as Heritage Island wetlands, may suffer loss of vegetation and community health. Upper elevation wetlands, some of which currently invaded by common reed, might benefit from an increased water level. For example, Kenilworth Marsh is currently at an elevation that makes it susceptible for common reed invasion; this location may benefit from increased water levels, with the expectation that common reed would be precluded by increased water levels. Other areas such as lower Kingman Lake may no longer support emergent wetland vegetation because these areas could be inundated as a result of sea level rise. It is known that changes in climate significantly affect vegetation phenology, morphology, distribution, growth, and reproduction (NPS 2009d). In general, coastal wetlands would survive if increase in sediment surface elevation equals the rate of relative sea level rise or if they are able to migrate inland or to areas of higher elevation (NPS 2009d). For example, shoreline protection structures can block inland migration of wetlands (Strange et al. 2008). In areas where neither sufficient accretion nor migration can occur, increased tidal flooding can stress marsh plants through waterlogging and changes in soil chemistry, leading to a change in species composition and vegetation zones (Strange et al. 2008). There is also a prediction of increased storm events, which cause flooding and scouring, resulting in erosion of vegetation. The science team for this project considered climate change and predicted that the Anacostia River could rise approximately 2 inches during the 15-year life of this plan. Tidal elevations, even changes as small as inches, are extremely important parameters to consider in wetland restoration and management as well as long-term planning for this project.

NATURAL RESOURCES

This section discusses the natural resources within the study area, including aquatic resources (benthic invertebrates, finfish, and shellfish), terrestrial resources (vegetation and wildlife) as well as resident Canada geese. NPS has broad authority to manage wildlife and other natural resources within the boundaries of units of the national park system. Please see chapter 1, "Authority to Manage Resident Canada Geese," for a description of laws and regulations allowing NPS to manage wildlife and natural resources.

AQUATIC RESOURCES

Historically, the Anacostia River was a valuable spawning ground and nursery area for anadromous fish and provided habitat for other aquatic species as well. Today the fishery remains below its potential because of poor water quality, such as low DO concentrations. Aquatic life including, fish, shellfish, and macroinvertebrates can be harmed when DO levels decrease below 5 milligram per liter (mg/L) of DO (USEPA 2000). Dissolved oxygen levels typically decrease due to high levels of nutrients, particularly nitrogen, in the water column (USEPA 2000). Excessive nutrients enter the system through runoff and stimulate algal growth, which in turn uses up the oxygen needed to maintain healthy fish and shellfish populations. The Anacostia River's DO regularly fall below the standard and at times it approaches zero (DCFWD 2001). Aquatic resources that have been observed within Anacostia Park such as benthic invertebrates, shellfish, and finfish are discussed in more detail in the following sections.

Benthic Invertebrates

Generally, the benthic invertebrate fauna of the Anacostia River consists of species that are typically tolerant of a variety of water quality and structural habitat conditions (USACE 2002). Species commonly found include pollution-tolerant oligochaetes (segmented aquatic worms) and chironomids (non-biting midge larvae). A benthic macroinvertebrate survey documenting the pre-and post-restoration status of urban freshwater tidal wetlands in the Anacostia River was completed from the period of 2002 through 2004 (USGS 2006a). During this survey, both Kingman Marsh and Kenilworth Marsh showed that over 95 percent of the organisms counted at Kingman were either chironomids or oligochaetes and the count was over 85 percent at Kenilworth (USGS 2006a). These recent benthic surveys have supported the conclusion that the absence of less pollution tolerant species indicates the existence of environmental stressors such as lack of cover in unvegetated areas and likely polluted sediments (contaminated with stable organic chemicals like PCBs, chlordane and PAHs as well as some metals) (USGS 2006a). The existing bottom of Kingman Marsh is commonly associated with lentic systems, which appear sterile due to the lack of structural cover available, the lack of sand or silt substance, and the absence of SAV (USACE 2002).

Overabundant resident Canada geese have grazed and caused the major loss of vegetation and community richness at Kingman Marsh. It has been concluded that the loss of vegetation and the subsequent erosional substrate at the restored Kingman Marsh (2000) due to wildlife grazing (primarily resident Canada geese) has affected the macroinvertebrate community development (USGS 2006a). This has created open areas in the marsh, which in turn has led to sediment scouring. Even though erosional substrates are not ideal conditions for most macroinvertebrates, and can suppress the overall taxa richness of the marsh, the substrate is ideal for pollution-tolerant macroinvertebrates such as chironomids and oligochaetes. The macroinvertebrate communities present at Kingman Marsh is a good indication of a disturbed, somewhat polluted area being composed of the extremely large concentrations of pollution tolerant chironomids and oligochaete families (USGS 2006a).

Finfish

The finfish species that inhabit the Anacostia River consist primarily of resident and migratory fish species that are generally at least moderately tolerant of pollution (USACE 1994). The three main types of fish that have been observed in the Anacostia River include resident inhabitants of the freshwater tributaries and main channel; anadromous fish (such as shad species [*Dorosoma* and *Alosa* sp.] or striped bass [*Morone saxatilis*]), which live in marine or estuarine waters but return to freshwater to spawn; and catadromous fish (such as the American eel [*Anguilla rostrata*]), which live in freshwater but migrate to the sea to spawn (NOAA 2007b). Historically, the Anacostia was a valuable spawning ground and nursery area for anadromous fish. Today, the fishery remains below its potential due to poor water quality. Generally, most of the river's problems come from excess sediment and bacteria as well as low DO. Aquatic life, including fish, requires a minimum DO of 5 mg/L. DO levels typically decrease due to high levels of nutrients, particularly nitrogen, in the water column (USEPA 2000). The river's DO regularly falls below the standard and at times approaches zero. However, the District fisheries biologists recorded a total of 52 different fish species in the Anacostia mainstem during a survey conducted from 1990 through 1999. Today, biologists routinely document on average of about 34 different fish species common in the mainstem of the river within the boundaries of the District (DCFWD 2001). Table D-1 in appendix D presents the fish species that have been recorded by the NPS as occurring in the Anacostia River within Anacostia Park. Both Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) and shortnose sturgeon (*Acipenser brevirostrum*) have been possibly extirpated from the District according to the District DOE Wildlife Action Plan (DCDE 2006). However, NOAA-Fisheries stated in a letter dated November 22, 2005 that shortnose sturgeon have been documented in the Potomac River, but are only transient species in the Anacostia River; these species are therefore not discussed further in this plan/EIS.

It has been demonstrated that Kingman Marsh provides tidally influenced habitat (USACE 2002). The existing fish fauna consists of species that are typically tolerant of a variety of water quality conditions. Species commonly found in Kingman Marsh include gizzard shad (*Dorosoma cepedianum*), common killifish (*Fundulus* sp.), eastern silvery minnow (*Hybognathus regius*), pumpkinseed (*Lepomis gibbosus*), white perch (*Morone americana*), and spottail shiner (*Notropis hudsonius*). The nature of the existing lake bottom is commonly associated with lentic systems, or non-flowing or standing water bodies, such as lakes or ponds even though fish in Kingman Marsh move with the ebb and flood of the tide of the Anacostia River (USACE 2002). The bottom composition of Kingman Marsh consists of mud and silt, with very little cobble or gravel. Therefore, appropriate substrate materials required for the spawning success of many fish species (gravel, cobble, and/or boulder) are absent in Kingman Marsh and many portions of the Anacostia River (USACE 1994). Natural and artificial structures submerged in the water provide adequate escape cover for many fish species. However, structural cover within Kingman Marsh is limited to the bridge supports of the Benning Road and East Capitol Street Bridges as well as the bridge supports for the pedestrian walkway that connect Heritage Island with Kingman Island and the riprap along the shorelines of the marsh and the islands (USACE 1994).

Shellfish

Only two species of mussels have been identified in Anacostia Park. The eastern floater mussel (*Pyganodon cataracta*) and the tidewater mucket mussel (*Leptodea ochracea*) have been observed in the park and both are included on a June 24, 2003 list of Animals of Anacostia Park and Kenilworth Park and Aquatic Gardens (NPS 2003).

VEGETATION AND WILDLIFE

This topic includes terrestrial vegetation and habitat, wildlife species, as well as invasive species.

General Vegetation and Habitat

Within Anacostia Park, the types of terrestrial vegetation and habitat include riparian buffers, upland forests, open meadows, and planted landscaped areas.

Within Anacostia Park, the types of terrestrial vegetation and habitat include riparian buffers, upland forests, open meadows, and planted landscaped areas (NPS 2004a). There are also emergent wetlands and forested wetland habitats in the park; these habitats are discussed in detail in the “Wetlands” section.

- Riparian buffers which can sometimes be encompassed in the forested wetland category, exist along the shoreline of the Anacostia River in the floodplain. In particular, areas north of Benning Road are heavily forested and provide a natural riparian buffer that protects the river from erosion, filters stormwater runoff, and provides habitat for numerous wildlife species. Common plant species that have been observed along the shoreline of Kingman Marsh in the park include black cherry (*Prunus serotina*), black willow, silky dogwood (*Cornus amomum*), dwarf sumac (*Rhus copallinum*), and staghorn sumac (*Rhus typhina*). Common non-native invasive species observed along the shoreline of Kingman Marsh include Asian bittersweet (*Celastrus orbiculatus*) and Japanese honeysuckle (*Lonicera japonica*) (USACE 2002).
- Upland forests are also located within Anacostia Park north of Benning Road. These habitats are generally located beyond the floodplain and the riparian buffers in the more upland (less wet) areas. Dominant plant species that have been observed within Anacostia Park in this habitat include white mulberry (*Morus alba*), black locust (*Robinia pseudo-acacia*), willow oak

(*Quercus phellos*), box elder (*Acer negundo*), northern catalpa (*Catalpa speciosa*), and slippery elm (*Ulmus rubra*). Common non-native invasive species observed in upland forest habitat include tree-of-heaven (*Ailanthus altissima*), tartarian honeysuckle (*Lonicera tatarica*), princess tree (*Paulownia tomentosa*), and mimosa (*Albizia julibrissin*) (NPS 2004a).

- Landscaped areas within Anacostia Park include maintained right-of-ways along roads and bridges that span across the park, and several maintained recreational fields. Typical vegetation in these areas includes various grass species, white clover (*Trifolium repens*), and English plantain (*Plantago lanceolata*).
- Open meadows are another habitat located within Anacostia Park – there are approximately 27 acres of managed meadows within Anacostia Park, not including the 15 acres that exist at Kenilworth Gardens (NPS 2004a).

The NPS definition of an exotic species (commonly referred to as non-native, alien, or invasive) is: 1) those species that occupy or could occupy park lands directly or indirectly as a result of deliberate or accidental human activities and 2) a species that is not a natural component of the natural ecosystem at that place (NPS 2006b). Invasive species can be plants, animals, or other organisms such as microbes. In accordance with the "Removal of Exotic Species Already Present" section of NPS *Management Policies 2006* and EO 13112, "Invasive Species," all exotic plant species that are not maintained to meet an identified park purpose will be managed up to and including eradications if the exotic species meet any of the following situations:

- Interferes with natural processes and the perpetuation of natural features, native species or natural habitats, or
- Disrupts the genetic integrity of native species, or
- Disrupts the accurate presentation of a cultural landscape, or
- Damages cultural resources, or
- Significantly hampers the management of the park or adjacent lands, or
- Poses or creates a public health or safety hazard (NPS 2006a).

Invasive plant species pose a serious threat to the natural environment because normally, there are no natural conditions to keep them under control. Invasive plant species can out-compete native vegetation for sunlight, nutrients, and moisture. Invasive plant species tend to have relatively rapid growth rates and often survive in disturbed areas or drought conditions; however, not all exotic plant species are necessarily characterized as invasive species.

In order to manage invasive plants on park lands, the NPS have deployed seventeen Exotic Plant Management Teams throughout the country, including the NCR-EPMT. The team uses chemical, mechanical, and biological methods to control the non-native, invasive plant species in the area. The NCR-EPMT top ten target species include bush honeysuckles (*Lonicera* spp.), common reed, English ivy (*Hedera helix*), Japanese barberry (*Berberis thunbergii*), Japanese honeysuckle, Japanese knotweed (*Polygonum cuspidatum*), mile-a-minute (*Persicaria perfoliata*), multiflora rose (*Rosa multiflora*), tree of heaven, and wisteria (*Wisteria sinensis*).

In 2001, the NCR-EPMT based out of the CUE of the NPS began controlling non-native invasive (exotic) plants in National Capital Parks - East with surveys and treatment in Kenilworth Aquatic Gardens. Treatments began in Anacostia Park in 2002. More recently (in 2005), the team began survey and treatment in the Arboretum corridor. Park staff and the EPMT identified two "target" species of primary

interest - common reed and purple loosestrife for treatment at Kenilworth Aquatic Gardens and Anacostia Park. During initial surveys, the team only documented these two species. The target species for the Arboretum Corridor was kudzu (*Pueraria montana*). Any additional exotic species found within the treatment areas were treated; however, they have not been monitored as intensely as the target species (NPS 2006b). Table D-2 in appendix D presents a list of exotic plant species that have been treated within Anacostia Park from 2001 through 2006 (NPS 2006b). Treatment areas include portions of Kenilworth Aquatic Gardens, areas within Anacostia Park (along eastern shoreline of Anacostia River, south of I-295 bridge), and areas within the Arboretum Corridor (western shoreline of Anacostia River, across river from Kenilworth aquatic gardens rugby fields).

Additional invasive plant species that have been identified by the park within Anacostia Park include the following: hydrilla, spotted knapweed (*Centaurea stoebe*), yellow star thistle (*Centaurea solstitialis*), leafy spurge (*Euphorbia esula*), medusahead rye (*Taeniatherum caput-medusae*), musk thistle (*Carduus nutans*), porcelainberry (*Ampelopsis brevipedunculata*), dalmatian toadflax (*Linaria dalmatica*), yellowflag iris (*Iris pseudacorus*), barberry species (*Berberis* sp.), euonymus species (*Euonymus* sp.), and bamboo species (*Phyllostachys aurea*). In addition, the District DOE WAP is targeting the invasive plant species known as lesser celandine (*Ranunculus ficaria*) (DCDE 2006). The District DOE WAP has stated that invasive and alien plant and animal species are the overall biggest threat across both terrestrial and aquatic habitat types within the District (DCDE 2006).

Wildlife Species

The diversity of habitat within Anacostia Park, including riparian floodplains, emergent and forested wetlands, upland forests, and open meadows provide a unique natural environment to wildlife in an otherwise urban area. Kingman Marsh and other habitat features of Anacostia Park are located in a highly urbanized area of the city, which reduces habitat suitability for secretive or interior dwelling species adequate food sources, escape cover, and breeding habitats available. The National Capital Parks - East has documented 188 bird, 50 butterfly, 30 fish, 24 reptile, 18 amphibian, and 17 mammal species as either residents within or migrants passing through Anacostia Park as well as numerous other invertebrates (NPS 2003). Canada geese are specifically discussed in a separate below.

Birds

Anacostia Park is a refuge for birds within this urban area. The marsh areas provide good quality habitat to many birds that are not seen elsewhere in the District. Most birds in the area have become accustomed to regular human visitor presence and in some areas pollution, such as large amounts of trash. The NPS has listed 188 species of terrestrial, riparian, and aquatic birds in the lower Anacostia watershed, of which over 50 are associated with the aquatic environment (NOAA 2007b). Aquatic birds using the river include year-round residents, local breeding populations, and highly migratory species that either overwinter in the area or pass through to northern or southern destinations. Most breeding areas are limited to Kenilworth Marsh, Kenilworth Park, and Kingman Marsh. Other areas, including much of the mainstem Anacostia River, Washington Channel, and Tidal Basin, have developed shorelines and are only used for foraging. This section concentrates on the aquatic-dependent bird species, because this plan/EIS would ultimately manage wetland areas within Anacostia Park. The habitat use and feeding strategies of the aquatic birds that occur in the lower Anacostia River are summarized in table D-3 of appendix D (NOAA 2007b).

The largest groups of aquatic birds on the river are ducks and geese, loons, grebes, coots, and rails. Nearly 30 species represent these families in the study area, most of which are associated with Kenilworth Marsh, Kingman Marsh, and the mainstem of the Anacostia River in the upper river zone. The ducks, geese, coots, and rails are largely grazers and eat plants and insects (omnivorous). Canvasback duck

(*Aythya valisineria*), ringnecked duck (*Aythya collaris*), ruddy duck (*Tadorna ferruginea*), widgeon (*Anas americana*), wood duck (*Aix sponsa*), Canada goose, and snow goose (*Chen caerulescens*) are primarily grazers of aquatic and terrestrial plants. Several other species, such as mallards (*Anas platyrhynchos*), goldeneye (*Bucephala clangula*), bufflehead (*Bucephala albeola*), and long-tailed duck (*Clangula hyemalis* are omnivorous, feeding on vegetation, insects, and small aquatic invertebrates. The mergansers, loons, and grebes are strong divers and swimmers and feed on fish and aquatic invertebrates. The ducks and geese primarily use the Anacostia River for overwintering, although a few species such as wood duck, mallard, and rails may breed during the spring and summer in the upper river (NOAA 2007b).

Nine species of wading birds within the family Ardeidae, which includes the herons, bitterns, and egrets, have been documented in less developed shoreline habitats along the Anacostia River. The great blue heron (*Ardea herodias*) primarily eats fish, while the smaller herons, bitterns, and egrets feed on fish, frogs, crustaceans, other aquatic invertebrates, and insects. Most of the wading birds are permanent residents, although cattle egrets (*Bubulcus ibis*) are largely an inland species that happen to breed near water. Eight species of sandpiper have been documented in the area. Most of the sandpipers breed in the Arctic or sub-Arctic and overwinter in Central to South America, so they are transient within the area. The exception is the spotted sandpiper (*Actitis macularia*) which breeds locally. The sanderling (*Calidris alba*) and dunlin (*Calidras alpina*) also overwinter in the region, but usually occupy coastal beaches. All of the sandpipers feed primarily on benthic invertebrates found in shallow water sediments. Marsh wrens (*Cistothorus palustris*) and green herons (*Butorides virescens*) are commonly found nesting or foraging in the marsh. When mudflats are exposed at low tide, they serve as ideal feeding areas for great blue herons, great egrets (*Ardea alba*), spotted sandpiper, solitary sandpiper (*Tringa solitaria*), semi-palmated sandpiper (*Calidris pusilla*), Wilson's snipe (*Gallinago gallinago*), least sandpiper (*Calidris minutilla*), pectoral sandpiper (*Calidris melanotos*) and killdeer (*Charadrius vociferous*); yellowlegs (*Tringa* sp) are also common and semipalmated plovers (*charadrius semipalmatus*) are occasionally observed (NOAA 2007b).

Three species of gulls and three species of terns have been seen along the Anacostia River. The laughing gull (*Larus* atricilla) eats fish, while the herring gull (*Larus* argentatus) is a scavenger. Both are permanent residents of the region. The ring-billed gull (*Larus delawarensis*) overwinters in the area, but breeds inland. The terns eat primarily fish, with the exception of the small least tern (*Sterna antillarum*), which also feeds on aquatic invertebrates. The terns and gulls are colony breeders with most breeding in the region, but it is not known whether colonies are present along the river. The least tern is not known to breed within the District. Two species of blackbird are common year-round residents of marshes and bogs of the upper river zone. The blackbirds are omnivores, feeding on aquatic invertebrates, grains, and seeds (NOAA 2007b).

Three other important fish-eating, permanent area residents include the osprey (*Pandion haliateus*), belted kingfisher (*Ceryle alcyon*), and double-crested cormorant (*Phalacrocorax auritus*). The osprey is one of the few raptors that have a strong association with water and an osprey that occupies the upper river zone likely has a very large home range. Osprey feed almost exclusively on fish, although they have been observed on occasion taking other prey such as birds, frogs, and crustaceans. The kingfisher lives in areas of Kenilworth Marsh and Kingman Marsh in the upper river zone. The kingfisher is also highly dependent on fish. The double crested cormorant breeds in both coastal and inland areas and eats fish almost exclusively (NOAA 2007b).

The USGS Patuxent Wildlife Research Center studied the bird communities at the Kingman and Kenilworth Marshes from 2001 to 2004. This study was conducted to use bird populations to track the health and progress of the reconstructed Kingman Marsh. Birds, especially marsh birds have been used as indicators for degree of wetland restoration success in the past (USGS 2004). Together 177 bird species were identified at both marshes comprising 14 taxonomic orders and 16 families, 137 species at Kingman

Marsh and 164 at Kenilworth Marsh (USGS 2004). At both wetlands, winter usage was notably greater than at other seasons; however, there were more species present during spring and summer. Three functional guilds were looked at in particular: wetland users, freshwater marsh users, and mudflat/shore users. Mudflat users were greatest during the winter while marsh users were greatest in the fall (USGS 2004).

Mammal Species

The NPS has recorded 17 species of mammals that have resided in or currently reside in Anacostia Park (appendix D, table D-1). As with the aquatic birds, these mammals are found primarily in the upper river zone and Kenilworth Marsh (NOAA 2007b).

The most common mammal species associated with either aquatic or riparian environments that have been observed within Anacostia Park include beaver (*Castor canadensis*), river otter (*Lutra canadensis*), muskrat (*Ondatra zibethicus*), and raccoons (*Procyon lotor*). Minks (*Mustela vison*) have also been observed within Anacostia Park, but are rarer than the aforementioned species. Foxes, squirrels, and opossums are also common mammalian residents of the surrounding woodland and white-tailed deer (*Odocoileus virginianus*) have been increasingly seen in recent years (NPS 2004a). The following paragraphs provide a more detailed description of these aquatic-dependent species, including preferred habitat (NOAA 2007b).

Beaver are almost exclusively aquatic, occupying rivers, streams, and wetlands. The species has been seen within Anacostia Park and may be a common inhabitant of the upper zone of the Anacostia River. Beaver eat only plants (herbivorous), most commonly consuming bark of certain hardwoods such as poplar, aspen, birch, cherry, willow, maple and alder, and also consume aquatic plants.

River otter are almost exclusively aquatic, occupying rivers, lakes, and other waters, but only those that show little human impact. The species has been documented within Anacostia Park, but are likely limited to less developed areas in the upper zone of the Anacostia River, although there have been recent reports of river otter utilizing the section of the Anacostia River adjacent to Kenilworth Marsh (NPS 2004a). Otter eat mainly fish, but will opportunistically eat crustaceans, insects, amphibians, birds, mammals, and turtles.

Muskrat inhabit freshwater streams, lakes, wetlands, ponds, brackish marshes, and salt marshes. They may occur in surface waters of Kingman Marsh, Kenilworth Marsh, and the upper zone of the Anacostia River. Muskrats are primarily plant eaters, feeding on roots and basal portions of plants, as well as shoots, stems, and leaves. Omnivorous populations, which supplement their diet of vegetation with crayfish, fish, frogs, turtles, and young birds, are also known to exist.

Mink are found associated with aquatic habitats of all kinds, including rivers, streams, lakes, and even ditches, as well as wetlands, and backwater areas. Within the project area, they are most likely to be found in the River's upper zone, Kenilworth Marsh and Kingman Marsh. Mink are opportunistic predators, taking whatever prey is abundant but are particularly fond of eating other mammals. Mink also hunt aquatic prey such as fish, amphibians, and crustaceans.

Raccoons are the most abundant and widespread medium-sized mammal in North America associated with riparian habitats. Raccoons are found near virtually every aquatic habitat, particularly various freshwater wetlands and salt marshes. The raccoon is an omnivorous and opportunistic feeder, eating fruits, nuts, grains, insects, frogs, crayfish, eggs, and virtually any animal and vegetable matter. The proportion of different foods in their diet depends on location and season, although plants are usually a more important component. They may focus on a preferred food when it is available.

Reptiles and Amphibians

The National Capital Parks - East has documented 24 reptile and 18 amphibian species at Anacostia Park (appendix D, table D-1). Most amphibian species and many reptiles spend all or critical parts of their life in wetlands. Reptiles including snakes and turtles that are able swimmers are likely found in wetland habitats. Many reptile species depend on wetlands for breeding and foraging for food including fish, frogs, and macroinvertebrates. Common turtle species that may be found in the wetland areas or within the Anacostia River include the common snapping turtle (*Chelydra serpentina*), eastern painted turtle (*Chrysemys picta picta*), red-bellied turtle (*Pseudemys rubriventris*), eastern mud turtle (*Kinosternum subrubrum*), and the common musk turtle (*Sternotherus odoratus*). These turtle species use the land adjacent to the wetlands and river for nesting habitat. Common snake species that may be found within the wetlands and Anacostia River include the northern black racer (*Clumber constrictor*),black rat snake (*Elaphe obsoleta*), northern water snake (*Nerodia sipedon*), queen snake (*Regina serpemvittata*), northern brown snake (*Storeria dekayi*), and the eastern garter snake (*Thamnophis sirtalis*).

Amphibians are a natural wetland species and are sensitive to disturbances such as pollution and habitat alterations; therefore, amphibians have a great potential of acting as ecological indicators to assess the overall health of a wetland. Frog species that have been found within the marsh areas of Anacostia Park include the spring peeper (*Pseudacris crucifer*), bull frog (*Rana catesbeiana*), green frog (*Rana clamitans*), northern cricket frog (*Acris crepitans*), and wood frog (*Rana sylvatica*). These species breed within the wetland areas from early spring to early summer and aquatic larvae (tadpoles) remain within the wetlands throughout the metamorphous period of their life cycle. Salamander species that use the wetland areas within Anacostia include the spotted salamander (*Ambystoma maculatum*), marbled salamander (*Ambystoma opacum*), and the red spotted newt (*Notothalmus viridiscens*). The spotted and marbled salamanders are typically only found during the breeding season as they spend much of their lives underground. The red spotted newt uses the wetland areas during their larval stage, and then moves to terrestrial habitat during the juvenile stage, returning to the wetland habitat to breed.

Invertebrates

The National Capital Parks - East has documented 50 butterfly species and various other invertebrates at Anacostia Park (appendix D, table D-1). Invertebrates are common prey of many birds, reptiles, amphibians, and some small mammals throughout the park. Ducks rely heavily on invertebrates as a major source of food, especially during protein demanding periods, such as egg laying or molting (USFWS 1988). Many invertebrates species rely on wetlands for breeding and for larvae development. Common butterfly species at the park include the least skipper (*Ancyloxypha numitor*), summer azure (*Celastrina ladon*), clouded sulphur (*Colias philodice*), monarch (*Danaus plexippus*), Eastern tailed blue (*Everes comyntas*), and Eastern tiger swallowtail (*Papilio glaucus*). Common dragonfly species include the common green darner (*Ana junius*), Eastern amberwing (*Perithemis lenera*), and the black saddlebag (*Tramea lacerate hagen*). Other invertebrates using the wetland and riverine habitat throughout the park include the Eastern floater mussel (*Pyganodon cataracta*), praying mantis (*Mantis religiosa*), crayfish (*Orconectes* sp.), and Asiatic clams (*Corbicula fluminea*).

Invasive Wildlife Species

The District DOE WAP has stated that invasive (and exotic or alien) plant and animal species are the overall biggest threat across both terrestrial and aquatic habitat types within the District. Invasive species can include both plant and animal species and are described as species that are not native to the area and are likely to threaten the native biodiversity of the habitat. Examples of invasive wildlife within the urban areas of the District include mice and rats (USDA undated), which have become invasive in urban areas due to reasons associated with human development. The District DOE WAP addresses factors that can

have substantial impact on wildlife conservation, such as management of invasive species (DCDE 2006). While the threat of invasive species is not unique to the District, the District does have a unique dilemma. Because all wildlife species are protected by District regulation – the Water Pollution Control Act of 1984, wildlife agencies are extremely limited in management actions for invasive animal and alien species.

Species of Greatest Conservation Need in the District

In 2001, Congress addressed the need for wildlife conservation and developed new conservation funding legislation that includes the *Wildlife Conservation and Restoration Program* and *State Wildlife Grants Program*. Each of these programs required all states, including the District, to submit a WAP to the USFWS by October 2005. The District WAP identifies species of greatest conservation need and their habitats as well as listing and giving the status and trends of these species and priority habitat types. Currently there are 148 species and 13 priority habitat types listed for the District. A listing of the District species of greatest conservation need is located in appendix D, table D-4. Of the listed species of conservation need, a total of 15 birds, five mammals, 13 reptiles, 13 amphibians, four fish, and nine invertebrates have been identified within Anacostia Park. These species are listed in table 10.

TABLE 10: SPECIES OF GREATEST CONSERVATION NEED NOTED IN THE DISTRICT WILDLIFE ACTION PLAN THAT HAVE BEEN IDENTIFIED AT ANACOSTIA PARK

Common Name	Scientific Name
Birds	
Acadian Flycatcher	*Empidonax virescens*
American Bittern	*Botaurus lentiginosus*
American Black Duck	*Anas rubripes*
Bald Eagle	*Haliaeetus leucocephalus*
Black-crowned Night-Heron	*Nycticorax nycticorax*
Bobolink	*Dolichonyx oryzivorus*
Brown Thrasher	*Toxostoma rufum*
Eastern Meadowlark	*Sturnella magna*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammodramus savannarum*
Least Bittern	*Ixobrychus exilis*
Northern Bobwhite Quail	*Corlinus virginianus*
Ovenbird	*Seiurus aurocapilla*
Red-shouldered Hawk	*Buteo lineatus*
Scarlet Tanager	*Piranga olivacea*
Wood Duck	*Aix sponsa*

Common Name	Scientific Name
Mammals	
Eastern Chipmunk	*Tamias striatus*
Eastern Cottontail	*Sylvilagus floridanus*
Gray Fox	*Urocyon cinereoargenteus*
Northern River Otter	*Lutra canadensis*
Virginia Opossum	*Didelphis virginiana*
Reptiles	
Common Musk Turtle	*Sternotherus odoratus*
Eastern Box Turtle	*Terrapene carolina*
Eastern Fence Lizard	*Sceloporus undulates*
Eastern Garter Snake	*Thamnophis sirtalis*
Eastern Hognose Snake	*Heterodon platirhinos*
Eastern Mud Turtle	*Kinosternon subrubrum*
Eastern Painted Turtle	*Chrysemys picta picta*
Five-lined Skink	*Eumeces fasciatus*
Northern Black Racer	*Coluber constrictor*
Northern Brown Snake	*Storeria dekayi*
Northern Ringneck Snake	*Diadophis punctatus edwardsii*
Redbelly Turtle	*Pseudemys rubriventris*
Spotted Turtle	*Chrysemys guttata*
Amphibians	
American Toad	*Bufo americanus*
Bullfrog	*Rana catesbeiana*
Fowler's Toad	*Bufo fowleri*
Marbled Salamander	*Ambystoma opacum*
Northern Cricket Frog	*Acris crepitans*
Northern Dusky Salamander	*Desmognathus fuscus*
Northern Spring Peeper	*Pseudacris crucifer*
Northern Two-lined Salamander	*Eurycea bislineata*
Pickerel Frog	*Rana palustris*
Redback Salamander	*Plethodon cinereus*
Red Spotted Newt	*Notophthalmus viridescens*
Upland Chorus Frog	*Pseudacris feriarum feriarum*
Wood Frog	*Rana sylvatica*

Common Name	Scientific Name
Fish	
Alewife	*Alosa pseudoharengus*
American Eel	*Anguilla rostrata*
American Shad	*Alosa sapidissima*
Blueback Herring	*Alosa aestivalis*
Invertebrates	
Crossline Skipper Butterfly	*Polites origenes*
Eastern Comma Butterfly	*Polygonia comma*
Great Spangled Fritillary Butterfly	*Speyeria cybele*
Little Glassywing Butterfly	*Pompeius verna*
Monarch Butterfly	*Danaus P. plexippus*
Question Mark Butterfly	*Polygonia interrogationis*
Red Admiral Butterfly	*Vanessa atalanta rubria*
Tidewater Mucket	*Leptodea ochracea*
Variegated Fritillary Butterfly	*Euptoieta claudia*

RESIDENT CANADA GEESE

Canada geese are federally protected by the Migratory Bird Treaty Act (16 USC 703-711).

Canada geese are federally protected by the Migratory Bird Treaty Act (MBTA) (16 USC 703-711). Regulations governing the issuance of permits to take, capture, kill, possess, and transport migratory birds are authorized by the MBTA, promulgated in Title 50 CFR 13:21, and issued by the USFWS. Regulations governing the take, possession, and transportation of migratory birds under sport hunting seasons are authorized by the MBTA and annually promulgated in 50 CFR 20 by the USFWS. The MBTA provides for the protection and conservation of migratory birds (including resident Canada geese), while at the same time providing opportunities for people to use the resource for sport, recreation, and scientific endeavors (USFWS 2005). The MBTA also provides considerable flexibility for dealing with situations where birds may come into conflict with human interests, such as those posed by the increasing numbers of resident Canada geese (USFWS 2005). On August 10, 2006 a final rule was published in 50 CFR 20:21 authorizing state wildlife agencies, private landowners, and airports to conduct indirect and/or direct population control management on resident Canada goose populations. On August 20, 2007, a final rule was published expanding hunting methods during special September hunting seasons (50 CFR 20:21).

Migratory Canada geese typically arrive in the park in the early fall and migrate north toward Canada by the end of winter (mid-March) to breed in the summer. The resident subspecies giant Canada geese were captive birds that were released to restock the depleted migratory populations along the Atlantic Flyaway. Giant Canada geese from Minnesota and Wisconsin were introduced to Pennsylvania, Georgia, Maine, West Virginia, North Carolina, and South Carolina. In addition, local hunt clubs released geese east of the Appalachians after wildlife managers restricted the use of live decoys to attract wild flocks (Harris 2002). The geese became non-migratory in their new habitats due to the length of time in captivity and formed year-round resident populations including the extensively urbanized area in the District, including Anacostia Park. For the purposes of this EIS, and for management purposes, the geese nesting within the

conterminous United States in the months of March, April, May, or June or residing within the conterminous United States in the months of April, May, June, July, or August are collectively referred to as "resident" Canada geese (USFWS 2005).

General Ecology

Resident Canada geese are typically larger than the migratory type, ranging from twelve to fourteen pounds, but may be as large as eighteen pounds. In addition, resident Canada geese have longer necks and longer wingspans then their subspecies. The main behavioral differences between resident and migratory Canada geese involve nesting behavior, and life history strategies. The life history strategy of migratory Canada geese accommodates a short growing season and harsher conditions at breeding areas, and the rigors of migration. Resident Canada geese have adopted a strategy that allows for a greater allocation of energy to reproduction through forgoing migration and utilizing areas with ample and secure food sources. This results in higher potential population growth rates for resident Canada geese (USFWS 2007).

Resident Canada geese avoid hunting mortality through their extensive use of urban environments. Urban environments can provide all resident Canada goose life cycle requirements, at least for short periods, and allow geese to remain in urban "refuges" and avoid peak harvest periods (i.e., weekends). Urban resident Canada geese also likely benefit from the less dangerous predator communities within cities. Additionally, the larger size of resident Canada geese likely makes them even less susceptible to the predators they do encounter in both urban and rural areas (USFWS 2005, III-9).

Canada geese are herbivores, obtaining nutrition from plants, including their leaves, roots, seeds, and fruits. Geese prefer to feed on young and actively growing portions of plants that are high in protein. The geese are primarily grazers especially during the preparation of spring nesting, rapid growth of goslings, and during the post-nesting replacement of feathers. In order to obtain adequate levels of protein during these times, geese will feed constantly during daylight hours. When actively feeding, geese may defecate every three to four minutes. Resident Canada geese typically remain in areas associated with human activity and longer growing seasons year round. Their residency depends upon the consistent availability of food including crops, pastures, lawn vegetation, waste grains, and wetland vegetation.

In the spring and summer of 2000, approximately 700,000 emergent wetland plants consisting of six native species were planted over 35 acres at Kingman Marsh. Five years of post-reconstruction monitoring (2000-2004) was conducted by the USFWS and USGS for two elements: food chain accumulation of contaminants and vegetation establishment. The goals of the vegetation establishment monitoring were to measure and evaluate several parameters and processes to document both the status and degree to which the marsh achieved a wetland condition similar to what might be expected compared to local and reference wetlands (emergent freshwater tidal wetland habitat). To determine the vegetation status and trends, 17 one-meter wide transects were randomly established at Kingman Marsh to be read each year in May, July, and September for species and cover. The following parameters were analyzed during the study: vegetation biomass, soil structure, organic material in soil, soil pH, soil redox potential, seed source potential, bird use, hydrologic and sediment deposition, sediment elevation processes, and benthic and macroinvertebrates use.

Shortly after the plantings, the resident Canada geese ate entire sections of the new plants (USGS 2006b). Fencing was placed around the vegetation to keep geese out of the vegetated areas (USGS 2006b). Once the fencing was removed the following spring, the vegetation was almost completely eaten by the resident Canada goose population (Harris 2002). Of the species originally planted at Kingman Marsh, geese preferred pickerelweed and broad-leafed arrowhead (*Sagittaria latifolia*), but not arrow arum or soft rush (Harris 2002). Resident Canada geese exert a higher degree of grazing pressure on wetlands over migratory geese, because they typically feed year round on seedlings, plants, propagules, and roots. The five year monitoring project concluded that marsh establishment at Kingman was severely impacted from grazing by over-abundant resident Canada geese (USGS 2006b). In addition, longer periods of inundation reduce the ability of wetland vegetation to rebound from grazing as seedling germination is reduced and plant growth slowed, and erosion linked to grazing and subsidence led to lower than planned sediment elevations, which further hindered the ability of grazed wetlands to rebound (USGS 2006b). The District DOE WAP states that locally, one of the top five threats to emergent tidal wetlands is overbrowsing by resident Canada goose populations (DCDE 2006). A study of goose herbivory at Kingman marsh was completed from 2009 to 2011. The study involved monitoring fenced (exclosed) plots and unfenced control plots to document the effects of Canada goose herbivory on vegetation in Kingman Marsh. The exclosed plots used elevated fencing to permit access by herbivores such as fish and turtles but exclude mature Canada geese, whereas Canada geese had full access to the unfenced control plots. An analysis of the data collected from 2009-2011 documents that vegetation in the exclosed plots had significantly greater vegetative cover and species richness when compared to the vegetation in the unfenced control plots that were exposed to full Canada goose herbivory for three years (Krafft et. al 2012). Although the full U.S. Geological Survey study report must still undergo peer review, once completed, the NPS will make the final report available to the public.

June 2009

August 2009

Canada Goose Herbivory at the Park

Winter populations (including the migratory geese) are less important on marsh grazing impacts than the resident populations, which are present throughout the spring and summer growing periods (Paul et al. 2004).

Pair bonds are formed in the spring and are long-lasting until one of the pair dies. Pairs copulate over water during the spring and establish territories and build nests approximately 50 meters from a body of water. Nests are associated with raised areas that afford good visibility and include islands, hummocks, pond banks, muskrat houses, cliffs, trees, and other man-made structures. Resident Canada geese are highly philopatric (propensity to return to) to their previous nesting areas and often use the same nest site year after year. The average age of resident Canada geese during their first nesting is 2 to 3 years (4-5 years in migratory geese). Resident Canada geese typically have a higher concentration of nests in an area, and have slightly higher clutch sizes and lower hatchling mortality (Smith et al. 1999). Clutches of one to eight eggs are laid approximately one per day until the clutch is complete. Females spend 91 to 99 percent of their time incubating the eggs from 24 to 30 days. Ganders provide protection for the female during nesting, incubation recesses, and to assist in defending the nest against predators. After spending less than 24 hours in the nest following hatching, goslings are lead to brood-rearing areas with protein-rich vegetation and open water to provide escape from predators. The goslings will spend nearly all day feeding for six to eight weeks in order to build body tissue, replace natal down with juvenile body feathers, and grow wing feathers.

Adult resident Canada geese undergo a complete replacement of flight feathers each summer, which takes up to a month for most individuals. During this period, the birds are flightless and are vulnerable to predators and nuisance goose management practices. Molting geese select areas near open water that have good grazing and unobstructed views, namely parks and golf courses (Smith et al. 1999).

Migratory geese move south from their nesting or molting areas during the fall and winter in response to freezing temperatures, snowfall, and food availability. Fall migration may start as early as August for geese in northern areas. The migrating geese are extremely gregarious and are attracted to areas that provide adequate foraging opportunities, water, protection, and other Canada geese. The geese leave their wintering grounds in early spring and arrive at breeding grounds mid-April to mid-May. The spring migration flight requires about 12 times as much energy as loafing/resting. The average spring migration is a flight of 600 miles.

Resident Canada geese undertake short or no migration during the fall and winter. The geese that do migrate typically move to another area within the same state as their breeding ground or to a neighboring state where the weather is more feasible. Resident Canada geese use a variety of habitats in winter, including agricultural fields, parks, golf courses and open lawns in urban/suburban areas. Resident Canada geese often remain in urban areas during winter because those areas are typically not hunted, contain good roosting sites that remain ice-free well into winter, and have readily available foods, such as lawn grasses, supplemental feeding by local citizens, or waste grain on nearby croplands (USFWS 2005, III-16).

The USFWS (2006) stated that resident Canada geese have adapted well to living in habitats found in suburban and urban development and fly relatively short distances to winter compared with other migratory Canada goose populations. This combination of factors contributes to consistently high annual production and survival (USFWS 2006). In addition, the virtual absence of predators and waterfowl hunting in urban areas also increases survival rates in those urban portions of the population. Given these characteristics, most resident Canada goose populations are continuing to increase in both rural and urban areas (USFWS 2006).

Home Range

The annual distribution of migrant Canada geese along the Atlantic Flyway includes Quebec, Newfoundland, St John's, New Brunswick, Nova Scotia, and the eastern United States from Maine to northern South Carolina. The breeding range of the migratory geese extends from Labrador and Newfoundland westward to the Ungava Peninsula of Quebec. Nesting concentration occurs around Ungava Bay and along the northeastern shore of the Hudson Bay. Migratory geese winter from southern Ontario eastward to Prince Edward Island and southward to North Carolina. Wintering concentrations occur mainly in the Chesapeake Bay region and extend northward to New Jersey and New York (USFWS 1997).

The annual distribution of resident Canada geese includes southern Quebec, New Brunswick, Nova Scotia, and the eastern United States from Maine to northern Florida. Resident Canada geese breed locally throughout the Atlantic Flyway, extending into southern Ontario and Quebec. The geese are largely non-migratory, shifting distributions only slightly in the winter, depending on the severity of the weather. During the fall and winter, the migratory and resident Canada geese have an overlapping distribution (USFWS 1997).

Population Density

Total number of Canada geese (migratory and resident populations) in North America has increased from 980,000 in 1960 to 3,734,500 in 2000 (mid-winter survey) (USFWS 2005). The resident Canada goose was thought to be extinct from the 1930s to 1960s, but is now considered overabundant in many regions. The resident Canada geese populations are growing more rapidly than migrant species. In the Atlantic Flyaway, the resident Canada geese population increases 6 to 14 percent annually (NPS 2004a).

The annual survival rate for resident Canada geese is greater than 90 percent (USFWS 2005). There are few predators that regularly take adult resident Canada geese and other forms of natural mortality are limited. The largest source of adult mortality is hunting; most residential geese are exposed to hunting 50 to 100 days per year. Resident Canada geese avoid hunting mortality through the extensive use of urban environments. Gosling survival is generally high; however, most gosling mortality occurs within the first two to three weeks by predators including gulls, crows, ravens, raptors, foxes, raccoons, opossum, and owls. Resident Canada geese living in urbanized areas are subjected to herbicides, pesticides, pollution, automobiles, illegal takes, pets, and transmission of disease from domestic waterfowl. Resident Canada geese can attain an age of 20 years (Harris 2002).

In 2004, the population of resident Canada geese at Anacostia Park was estimated to be 500 to 600 birds, along the tidal Anacostia River, most of which can be found in the park and other public areas (NPS 2004a). During the fall and winter, the population increases by approximately 30 percent due to the return of migratory geese. Weekly monitoring of the resident Canada goose population was performed at the Kingman and Kenilworth Marsh areas from 2001 to 2003; the count results are displayed in table 11. The weekly counts were preformed April through September for resident Canada geese and October through March for resident plus migratory geese. The weekly counts were based on fixed five-minute point counts and observations made while walking between points by personnel from the USGS Patuxent Wildlife Research Center (NPS 2004a). During 2004 and 2005, goose counts were conducted three times annually when only resident Canada geese were present. The population was estimated to be 600 birds during these years (Paul et al. 2004).

TABLE 11: RESIDENT CANADA GOOSE COUNTS IN KINGMAN AND KENILWORTH MARSH, 2001 TO 2003

Site and Count Period	2001	2002	2003	Annual Average
Kingman Marsh				
Resident Canada Geese, April – September	171	216	139	175
Resident Canada Geese plus Migratory Geese, October – March	230	288	261*	260
Kenilworth Marsh				
Resident Canada Geese, April – September	51	26	37	38
Resident Canada Geese plus Migratory Geese, October – March	82	31	92*	68

Source: NPS 2004a

* Based on weekly counts conducted for October and November 2003 only.

Within Anacostia Park, Canada geese generally congregate in areas that are adjacent to Anacostia Drive and in Langston Golf Course. These sites provide large mowed areas immediately adjacent to the water, with large sections of shoreline free of vegetation, the preferred habitat of Canada geese. Nesting resident Canada geese in Anacostia Park appear to nest most frequently in the Kenilworth Marsh, as well as in the Kingman Marsh and Anacostia mainstem. Currently, the NPS organizes goose counts in Anacostia Park through volunteers. Volunteers are dispersed to sites identified on a map between Bladensburg and Poplar Point, and count all the geese in the area for five minutes. The technique was developed in consultation with professionals at Patuxent Wildlife Refuge. Counts have been conducted four times per year since 2004 (a total of 17 counts thus far). The total geese are counted during each survey at the following locations: Bladensburg, Kenilworth Marsh, Kingman Marsh (including Langston Golf Course), Heritage Island Wetlands, and Anacostia Park. Each location is divided into zones to describe the counts in more detail. The mean goose count for July (resident Canada goose population) from 2004 to 2008 was 676 geese, based upon counts that ranged from 521 geese to 783 geese (NPS 2009a) as presented in table 12. Due to the migratory geese, the numbers in December roughly double. There may be an inverse correlation between geese in the Kenilworth and Kingman Marshes. When the population at Kenilworth is abundant, the count at Kingman Marsh/Langston Golf Course is lower; and when the population is abundant at Kingman Marsh/Langston Golf Course, the counts at Kenilworth Marsh are lower. This was particularly true during early July when the geese were molting feathers. The majority of the Anacostia Park population of geese has been located at the Kingman Marsh/Langston Golf Course sites where there is open water for waddling and the open golf course for browsing (NPS 2009a). This area provides habitat that is safer from predators during the bird's flightless period. In June 2010, a mean of 371 geese were counted at the Kingman Marsh/Langston Golf Course site (Bates 2010a).

TABLE 12: RESIDENT CANADA GOOSE COUNTS FROM 2004 TO 2011

Date	Bladensburg	Kenilworth	Kingman	Heritage Island	Anacostia Park, East	Day Total (Relative Abundance)
4/10/2004	86	175	184	100	42	587
7/17/2004	30	133	349	93	89	694
9/11/20004	56	32	2	83	189	362
12/9/2004	No Count Occurred					
4/13/2005	14	123	266	69	71	543
7/13/2005	83	52	337	118	1107	700
8/31/2005	8	304	31	226	176	745
12/2/2005	207	627	28	34	325	1,221
4/13/2006	55	138	187	77	77	534
7/6/2006	22	0	380	13	106	521
9/7/2006	52	178	59	89	118	496
12/7/2006	268	327	51	19	371	1,036
4/6/2007	24	110	195	51	43	423
7/10/2007	0	4	640	0	139	783
9/11/2007	57	101	6	155	68	387
12/4/2007	113	144	529	0	216	1,002
4/3/2008	28	99	201	30	43	401
7/10/2008	15	0	565	14	117	711
9/16/2008	143	107	45	62	101	458
12/9/2008	320	484	494	133	514	1945
4/7/2009	16	46	162	21	47	292
Flightless Period Counts, 2009 to 2011						
July 2009*	No Count	8	382	10	93	492
July 2009 CV	---	*0.56*	*0.42*	*1.28*	*0.15*	*0.6*
June 2010**	No Count	79	362	14	110	564
June 2010 CV	---	*0.04*	*0.19*	*0.26*	*0.2*	*0.17*
June 2011***	No Count	60	445	86	83	---
June 2011 CV	---	*0.30*	*0.17*	*0.39*	*0.46*	---
Total	**1,597**	**3,331**	**5,900**	**1,497**	**4,245**	**14,898**

Source: McKindley-Ward 2008; Bates 2010a; Milton 2012
*Average counts from nine days in July 2009 (July 6-10, 13, 17, 21-22)
**Average counts from five days in June 2010 (June 2-4, 7-8)
***Average counts from six days in June of 2011 (June 1-3, 6-8)
CV = coefficient of variation
Note: the Bladensburg counts are not located within Anacostia Park, but are presented in the table for comparison purposes and the numbers for individual areas are not as relevant as the total count for the entire Park.

The methodology for conducting goose counts has been changing since 2009 and will continue to change in the future in an attempt to reduce the coefficient of variation for the population and to concentrate on the flightless period when the majority of the Canada geese are resident geese. In July 2009, the goose counts were conducted for nine days spanning three weeks during the flightless period. The 2009 mean goose within these nine days at four sectors (Kenilworth, Kingman, Heritage Island, and Anacostia East locations) was 492 geese, with a range of 175 to 667 total geese per day for all sectors (NPS 2009a). In June 2010, the goose counts were conducted for five days spanning two weeks during the flightless period. The mean for 2010 within these five days at four sectors (Kenilworth, Kingman, Heritage Island, and Anacostia East locations) was 564 geese, with a range of 94 to 619 total geese per day for all sectors (Bates 2010a). The goose counts in 2011 were conducted during six days. The counts at Kingman for 2011 were the highest (at 445 total geese) since the count began in 2009. From 2004 through 2011, Kingman represents the location with the highest number of geese. For this plan/EIS, the 2010 mean of 564 resident Canada geese within Anacostia Park is the current number used for all sections that follow. Figures 30 through 32 present the approximate goose count locations, areas, and zones for counts at Kenilworth Marsh, Kingman Marsh, Heritage Island Wetlands, and Anacostia Park East.

Resident Canada Goose Management

Since 2004, the park and partners have oiled resident Canada goose eggs during the April nesting season along the tidal Anacostia River corridor from Bladensburg to Poplar Point. Nests are located, marked, and the eggs are coated with corn oil, which prevents gas exchange through the shell and prevents hatching (AWS 2006). Egg oiling has reduced the population of the number of resident Canada geese at Anacostia; however in the near future, this will not bring noticeable reductions in the population (AWS 2006).

At Langston Golf Course, a product was applied to the grass to deter the resident Canada geese but was expensive and ineffective in deterring geese. In addition, at one time, the golf course used a chase dog to drive the geese off the greens. This management practice was only used once.

Resident Canada Geese and the Role of Climate Change

As stated previously, freshwater tidal marshes are extremely productive and important for a wide range of bird species (Strange et al. 2008). Vegetation type, soil type, sediment inputs, and current ecological health can all affect the response to sea level rise. As a result of sea level rise, wildlife species such as Canada geese that depend on these habitats for activities such as foraging or nesting would vary in their responses to habitat changes, depending on species-specific responses to changes in inundation, salinity, vegetation structure and composition, and other habitat characteristics (Strange et al. 2008). Specifically, rising sea level can cause freshwater tidal marshes to erode at the waterward boundary, drown in place, and convert to open water (Strange et al. 2008). For example, an elevation that may support high marsh plants under current conditions may become dominated by low marsh species in 50 years as a result of rising water levels. Similarly, other areas such as lower Kingman Lake may no longer support emergent wetland vegetation because these areas could be inundated as a result of sea level rise. Tidal flats would be inundated as a result of sea level rise, and although changes in extent might be localized at first, scientists anticipate an overall reduction in forage habitat for shorebirds (Strange et al. 2008), which would most likely also reduce nesting areas for resident Canada geese. In areas where habitat is lost or degraded, the species that are dependent on marshes (birds, fish, invertebrates, and mammals) may show decreased growth, reproduction, or survival (Strange et al. 2008). In general, birds have exhibited a variety of responses to warming trends, including earlier breeding dates and range expansions (Marra et al. 2005 as cited in NPS 2009d). The science team for this project considered climate change and predicted that the Anacostia River could rise approximately 2 inches during the 15-year life of this plan. Tidal elevations, even changes as small as inches, are extremely important parameters to consider in wetland restoration and management as well as long-term planning for this project, including the management of resident Canada geese.

FIGURE 30: 2009 RESIDENT CANADA GOOSE COUNT LOCATIONS IN ANACOSTIA PARK, NORTH AREA

FIGURE 31: 2009 RESIDENT CANADA GOOSE COUNT LOCATIONS IN ANACOSTIA PARK, CENTRAL AREA

FIGURE 32: 2009 RESIDENT CANADA GOOSE COUNT LOCATIONS IN ANACOSTIA PARK, SOUTH AREA

CULTURAL RESOURCES

The consideration of cultural resources by NPS meets pertinent requirements of the NHPA and related legislation and implementing regulations.

Director's Order #28: *Cultural Resource Management* states that the NPS will protect and manage cultural resources in its custody through effective research, planning, and stewardship and in accordance with the policies and principles contained in the NPS *Management Policies 2006*. Section 106 of the NHPA, as amended, and as implemented in 36 CFR 800, requires federal agencies to consider the effects of federally funded, regulated, or licensed undertakings on cultural resources listed on or eligible for inclusion in the NRHP; moreover, the federal agency must afford the Advisory Council on Historic Preservation the opportunity to comment in the event that an undertaking would have an adverse effect on a cultural resource that is eligible for or listed in the NRHP. For the purposes of this plan/EIS, cultural resources impact topics include either recorded or potential historic archeological sites, prehistoric sites, and standing architectural structures, and historic districts. Cultural landscapes, ethnographic resources and museum collections were dismissed as impact topics. The consideration of cultural resources by NPS meets pertinent requirements of the NHPA and related legislation and implementing regulations.

For this study, efforts to identify cultural resources included a review of information provided by the park, supplemented by interviews with park staff, Washington, D.C. Historic Preservation Office, cultural resource survey data, and other published and unpublished sources. For historic structures and cultural landscapes, the principal sources reviewed were District Inventory of Historic Sites, NRHP nomination forms, and the NPS' List of Classified Structures (LCS) database. The LCS contains "information about historic and prehistoric structures in which the NPS has or plans to acquire any legal interest. Properties included in the LCS are either in or eligible for the National Register or are to be treated as cultural resources by law, policy, or decision reached through the planning process even though they do not meet all National Register requirements."

The study area considered for this plan/EIS includes the land within the current NPS jurisdiction of Anacostia Park.

HISTORICAL BACKGROUND

When Captain John Smith explored the Potomac River in 1608, he discovered a thriving American Indian village at the junction of the Potomac River and the Anacostia River. The Nanchotank (or Nacotchtank) Indians built villages along the shorelines, and it is from the word "anaquash," meaning a village trading center, that the river derives its name. European settlers did not fully begin to claim the land along the Anacostia River until the 1660s. The fertile soil was suitable for tobacco farming and settlers cleared the once forested land and developed farms.

When the site for the capital city of Washington, D.C., was chosen in 1790, the lands along the Anacostia River consisted mostly of plantations used for the cultivation of tobacco and grain. Small and large residences dotted the landscape on land patents dating from the seventeenth century (Engineering Science, Inc. 1989). In 1792, the Anacostia River, then known as the Eastern Branch (of the Potomac), was already developing as an important part of Pierre L'Enfant's plan for the new federal city. Tobias Lear, the personal secretary of George Washington, wrote in his 1793 report *Observations on the River Potomak and the Country Adjacent and the City of Washington* that:

> The eastern branch affords one of the finest harbors imaginable… The channel is generally so near the city, that a wharf extended 40 or 50 feet from the bank, with have water enough for the largest ships to come up, discharge and receive their cargoes. The

> land on each side of the branch is sufficiently high to secure shipping from any wind that blows… while vessels in the main river, if they should be caught there by ice, are liable to receive great injury, and are sometimes totally lost by it, those in branch lay in perfect security (Lear 1793).

Property owners and businessmen soon constructed wharves along the waterfront, and in 1799, the Navy Yard was built on the western shore of the Anacostia and further promoted waterfront development. Land clearing, farming, and construction activities led to the siltation of the Anacostia River early on and often inhibited transportation. Regular dredging occurred after 1875, and consequently, tidal flats along the river became exposed along with raw sewage in the mud and grasses. By the end of the nineteenth century, the flats had become a nuisance and were a health concern due to mosquitoes and pollution (Engineering Science, Inc. 1989).

As early as 1898, Congress authorized the dredging of the Anacostia River and directed that the reclaimed material placed on the flats "with the objectives of land reclamation, sanitation, and promotion of navigation and commerce" (Gutheim 1977). However, it was the McMillan Commission in 1901, led by Senator James McMillan, which set the stage for the development of Anacostia Park to provide gardens and recreational space for public use. Inspired by the *City Beautiful Movement* and L'Enfant's original Baroque Plan, the commission created a plan to guide the future development of the District towards the *City Beautiful Movement* aesthetics. In March 1901, McMillan Plan successfully passed a Senate resolution that developed plans for improvements to the District's park system. The 1902 plans discussed the development of the Anacostia Flats as a park, referred to as the "Anacostia Water Park."

The USACE began work on dredging the river and filling the flats in 1902 and the project continued until 1925. In order to sufficiently support the dredged material, a seawall was built along the shoreline (Gutheim 1977). After it was determined that the reclaimed area would be used for public purposes, Congress passed the Anacostia River Flats Act in 1914, providing for the acquisition, reclamation, and development of lands on both sides of the Anacostia River for highway and park purposes. The Commission of Fine Arts' annual report of 1914 identified the park an "important element in restoring the 'balance in development that had tended toward the northwest." The park was formally declared Anacostia Park in 1919 (Gutheim 1977).

In the summer of 1932, the park was used as a camp by World War I veterans. In the midst of the Great Depression, approximately 17,000 jobless World War I veterans gathered in the District to seek early payment of their promised war bonus. The majority of the veterans, who called themselves the *Bonus Expeditionary Forces*, set up camp in Anacostia Park, at that time still commonly called the Anacostia Flats. The marchers vowed to stay in the District until the Bill passed and were encouraged when it passed in the House of Representatives on June 15. As the number of veterans swelled to around 20,000, the Bill was ultimately defeated in the Senate. President Hoover eventually ordered the evacuation of all of the camps. On July 28, Army troops, led by General Douglas MacArthur, forced the veterans out of the camps on the western side of the river and destroyed their makeshift shelters. By the end of the day, over 100 people were injured. Hoover then sent orders to MacArthur stating MacArthur should not pursue the *Bonus Marchers* across the bridge at their main camp on the Anacostia Flats. Ignoring Hoover's orders, MacArthur crossed the bridge to the main camp in Anacostia Park, known as Camp Mark (PBS 2008). Fire erupted in the camp as the veterans retreated. Although the origin of the fire is unknown, the *Washington Post* reported, "early today the flames were burning a memorial across the sky in what may be the epitaph of the bonus army" (*Washington Post* 1932).

In 1933, the park was transferred to NPS, and additional improvements were made with the construction of golf courses, swimming areas, and playing fields. NPS facilities at that time were segregated, and Anacostia Park was no exception. While the Langston Golf Course was built in 1938 for African-

Americans, the Anacostia Field House, along with its swimming pool, was built in 1936 only for whites. The park expanded in 1938 when NPS acquired the Kenilworth Aquatic Gardens. Today the park continues as a unique multi-use park that emerged from the reclaimed riverbanks of the Anacostia.

HISTORIC STRUCTURES, DISTRICTS, AND OBJECTS

Listed and Eligible Resources

Two historic structures within the project area have been listed on the NRHP and include Kenilworth Aquatic Gardens and Langston Golf Course Historic District. In addition to these resources, two other resources have been determined as eligible for the NRHP and include the Anacostia Shoreline Pump Station and Anacostia Park itself. A brief description of these four resources is included in the paragraphs that follow.

Kenilworth Aquatic Gardens—The Kenilworth Aquatic Gardens (figure 33) began in 1882 as the hobby of W.B. Shaw, a retired Civil War veteran from Maine. Shaw purchased 37 acres of land along the eastern shore of the Anacostia River and began to grow water lilies on the marshy sections of the land. As the lilies thrived, Shaw created more ponds and began to hybridize the plants. In 1912, Shaw and his daughter Helen began to sell their lilies commercially and shipped thousands of the flowers to New York, Boston, and Chicago, as the gardens produced lilies that were not available anywhere else in the U.S. NPS acquired the gardens from Helen Shaw in 1938. Directly southwest of the gardens are the administration building built in 1912 and two original greenhouses built in 1913 that were used in the Shaw's commercial aquatic plant operations. The Kenilworth Aquatic Gardens make up the only site in the NPS whose primarily purpose is to raise and propagate aquatic plants (Dillon 1973, Section 8, 1).

FIGURE 33: KENILWORTH AQUATIC GARDENS

Kenilworth Aquatic Gardens was listed on the NRHP in 1978 and on the District's Inventory of Historic Sites in 1968. The property is historically significant as a designed landscape associated with the botanical study and development of water plants (Dillon 1973, Section 7, 1). Its contributing elements include the lily ponds, the ancient lotus pond, and the remaining original structures, which include the

administration building (Aquatic Garden Visitor Center/Office), and the north and south greenhouses. Recreational structures built after the acquisition of the gardens by NPS, including the picnic areas, restrooms, and new greenhouses, are not considered historically significant (Dillon 1973, Section 7, 1-3). Currently, the Kenilworth Aquatic Gardens is the only area of Anacostia Park that has structures included in the park's LCS. There are five structures within the gardens that are listed on the LCS database and include the exterior tanks, greenhouse 1, greenhouse 2, administration building, and ponds and dikes.

Langston Golf Course Historic District—The Langston Golf Course (known today as Langston Legacy Golf Course) opened in 1939 after a long campaign by African-American golfers to gain access to local golfing facilities. The facility, named after John Mercer Langston, the first African-American elected to office in 1855, was originally built under the Works Project Administration (WPA) program as a segregated golf facility for African-American golfers. In 1938, the *Washington Post* reported:

> Transformation of a mosquito-infested 36-acre tract of waste land in Anacostia Park adjoining Benning Road and Kingman Marsh into a golf course and recreation center for colored citizens is nearing completion by WPA workers… (*Washington Post* 1938).

Although originally planned as an 18-hole course, limited funding only allowed for an initial nine holes to be built. The course was finally expanded in 1955, when it was enlarged to 18 holes. Langston Legacy Golf Course has been the home course of the nation's first golf club for African-American men (Royal Golf Club) and women (Wake Robin Golf Club). Langston is also home of the international Pro-Am tournament, the Capitol City Open, an event that has attracted many African-American professional golfers. Today the course retains most of its original layout, both the original nine holes and the nine holes that were added in 1955; however, minor changes have been made to accommodate playing conditions. The landscape character of the golf course along the river contributes to the qualities that make the site eligible for its listing on the NHRP (Cole 1989, Section 8; Langston Junior Boys and Girls Golf Club 2009).

Langston Golf Course Historic District is historically important because of its "symbolic association with the development and desegregation of public golfing and recreational facilities in the greater District area and with the growth of golf as a popular recreational and professional sport for African-Americans" (Cole 1989, Section 8). It is also significant as the home course of the Royal Golf Club and the Wake Robin Wake Club's home course. Both clubs were the first African-American golf clubs for men and women established in the U.S. and played an important role in the development of Langston Golf Course and the desegregation of the District's golf clubs. Additionally, the Langston Golf Course Historic District is also significant for its association with Harold L. Ickes, Secretary of the Interior (1933-1941), and his efforts to open all NPS facilities to African-American citizens (Cole 1989, Section 8).

The golf course's entire landscape within the parkland setting is a contributing feature of the historic district. As a whole, the district consists of 145 acres on a man-made landscape of grassy, undulating terrain. The district's boundary includes the Anacostia River on the east and Benning Road on the south. The complex western boundary consists of 26th Street, Spingarn High School, I Street, and 22nd Street. The northern boundary includes Maryland Avenue, M Street, and the southern boundary of the National Arboretum. Non-contributing features include the 1955 clubhouse, a 1977 maintenance shed, a 1985 driving range hut, the 1954 and 1977 bridges over Kingman Marsh, and the remnant of the miniature golf course built in the 1950s (Cole 1989, Section 7). No structures within the Langston Golf Course are listed on the LCS.

Anacostia Park—NPS considers Anacostia Park to be eligible for the NRHP as an historic district because of its association with historic events including the 1932 *Bonus Army* marches and the desegregation movement; its design and architecture as a part of the McMillan Plan, for the reclamation

and construction of the seawall by the USACE; and for the construction of park facilities by WPA workers; and as its potential for yielding both prehistoric and historic archeological sites. The District State Historic Preservation Office (SHPO) has not formally concurred with this determination, but for the purpose of this plan/EIS, Anacostia Park is considered NRHP-eligible as a result of documentation and comments made by NPS and SHPO with regard to of the South Capitol Street EIS (Parsons Brinckerhoff 2008, Chapter 3). No formal historic district boundaries for the resource have been established; however, preliminary boundaries coincide with the current park boundaries.

Anacostia Shoreline Pump Station—The Anacostia Shoreline Pump Station was determined eligible for the NRHP in 2006 along with the Main Pump Station and the Poplar Point Pump Station (Parsons Brinckerhoff 2008, Chapter 3). The Anacostia Shoreline Pump Station is a small, one-story masonry structure with a hipped roof that sits on the eastern shore of the Anacostia River at poplar point (figure 34). The pump station was probably built in 1905 in conjunction with along with the Main Pump Station (O Street Station) on the west side of the river.

FIGURE 34: ANACOSTIA SHORELINE PUMP STATION

Additional Resources

Six additional structures, sites, and objects located within the Anacostia Park may be eligible for the NRHP, but have not been formally evaluated by the park. These six resources include:

- Anacostia Field House
- Anacostia River Seawall
- Seafarer's Boat Club
- Water Street Quonset Huts
- Bonus Marchers Campsite
- Stones of the Old United States Capitol Building.

If any of these could be impacted by any of the alternatives considered for proposed project, these resources should be evaluated for NRHP eligibility, so that impacts can be appropriately assessed. A description of these six resources is included in the paragraphs below.

Anacostia Field House—The Anacostia Field House is a Colonial Revival-style brick structure that was built in 1932 as a recreation center for white patrons. The outdoor pool, which is a part of building, was the scene of racial tensions in the summer of 1949 when attempts to desegregate the pool led to conflicts between white and African-American patrons. These incidents are emblematic of desegregation efforts and the Civil Rights Movement in the U.S. and within the National Park system.

Anacostia River Seawall—The seawall, which lines both sides of the Anacostia, is a result of a 50-year program implemented by the USACE in 1891 due to health and flooding issues associated with the condition of the river. As funding was made available through Congressional appropriations, the USACE dredged the river and filled the marshland that was known as the Anacostia Flats. In order to properly support the fill, a seawall of Potomac River stone was raised to an average high of four feet above mean low water. The riprap base of the wall was mostly built of salvaged stone from demolished structures including the Old Navy Yard Bridge. By the 1920s, the majority of the structure was completed along both sides of the river and around the man-made lake on the west side of the park known as Kingman Marsh (Overbeck 1985). The wall is considered historically important as an expression of the reclamation project that created Anacostia Park.

Seafarers Boat Club—The Seafarers Boat Club, currently known as the Seafarers Yacht Club, was established in 1945 by Lewis T. Green and is the oldest African-American yacht club on the East Coast. Green, a wood carver and a District public school vocational arts teacher, built boats as a hobby and petitioned the Department of the Interior for permission to access a site on the west side of the Anacostia River for a boat launch. Green organized a boat club, but his access request was rebuffed by the government. With the help of Mary McLeod Bethune and Eleanor Roosevelt, Green was finally able to gain permission from the Department of the Interior to rent the land in return for clearing the property. The club members improved the shoreline and constructed docks and a clubhouse on the site. The Seafarers Boat Club is significant as the first African-American boat club on the east coast and for its association with the desegregation of National Parks.

Water Street Quonset Huts—Two Quonset huts dating from the 1940s are located on Water Street at the base of the northbound 11th Street Bridge. These two prefabricated steel structures, which were illustrative of World War II prefabricated structures of the United States military, have been fitted with masonry facades.

Bonus Marchers Campsite—In the summer of 1932, Anacostia Park, then known as the Anacostia Flats, served as the main camp for the *Bonus Army*. Veterans and their families lived in the organized camp, which was called *Camp Mark*, in shanties and was often referred to as a large *Hooverville*. The camp was burned down while General MacArthur, against President Hoover's orders, pushed across the Anacostia River to clear out the camp. The camp and the fire were documented in a number of photographs and the images became synonymous with the *Bonus Army* and their efforts. While no physical remains of the camp are visible, the site is significant due to its historical association with the camp and the events that followed, known as the only time in American history when U.S. troops committed violence against their own veterans.

Stones of the Old United States Capitol Building—Granite slabs and sculptured stone from the exterior of the old U.S. Capitol building are located on the park grounds between Howard Road and the NPS headquarters building.

ARCHEOLOGICAL RESOURCES

For this study, efforts to identify archeological resources included a review of studies and databases maintained by the NPS and the District SHPO. There is no modern archeological overview for Anacostia Park, but a wealth of information is available in reports and investigations that have been conducted over more than a century of archeological study. Archeological sites were identified in what are now park lands as early as the 1880s, but urbanization and land-filling has made it difficult to investigate these sites in modern times.

Efforts to identify archeological resources included a review of studies and databases maintained by the NPS and the District SHPO.

As early as the late 1800s, investigations along the lower Anacostia River yielded an abundance of aboriginal (defined as being the first or earliest known of its kind present in a region) material culture. Local landowners amassed substantial collections of aboriginal artifacts, which sparked an interest in local prehistory. This growing interest resulted in the formation of the Anthropological Society of Washington in 1870. Members of this group, and other amateur archeologists, began to investigate the Anacostia area more intensively for evidence of its earliest inhabitants.

Many of the artifacts gathered by these early collectors are now housed in the National Museum of Natural History, but since most collectors kept no records, there is no data to place these objects in context. Approximately 45 sites have been identified and given site numbers along the Anacostia River, including 26 sites that are located within Anacostia Park. For many of these sites, only limited information is available, and the precise location and condition of many of the sites is unknown. A complete list of these sites, along with as much information about the site type and date is included in table 13.

S.V. Proudfit, an active member in the Anthropological Society of Washington who was among the more diligent 19th-century collectors, identified many of the sites within Anacostia Park. He was also one of the first explorers of the region to speculate about the location of the village of the Nacotchtank (Anacostan) Indians. Nacotchtank was a large trading center, ideally situated for its purpose along two natural trade routes - east-west across the mountains and north-south along the fall line. Based on Captain John Smith's 1608 map and description of the village, Proudfit postulated that several sites he identified on the east bank of the Anacostia River might be the remains of the village (Proudfit 1889). William Henry Holmes of the United States National Museum (now the National Museum of Natural History) in the late 19th and early 20th centuries was another pioneer in the study of local prehistory. Like Proudfit, Holmes speculated on the location of the village of Nacotchtank, but concluded that it could be located anywhere along the east bank of the Anacostia River, from Giesboro Point to the vicinity of the present day Benning Bridge (Holmes 1889).

Several studies during the 1930s and 1950s focused on locating Anacostin Fort, a structure documented in early land records that may have been a later location of the village of Nacotchtank. After studying archival evidence, William Marye determined that the Fort was located on the east side of the Anacostia River, upstream from the John Philip Sousa Bridge, but did not conduct any investigations to verify its location (Bromberg et al. 1989). Louis D. Scisco concluded that the Fort was located on Poplar Point, based upon the quantity of tools and pottery recovered there (Bromberg et al. 1989). In 1957, Howard MacCord also favored Poplar Point as the Fort's most likely location (Bromberg et al. 1989). MacCord also completed a study of a site along Beaverdam Creek (51NE1, also known as the Kenilworth Site). Site 51NE1 was located within Anacostia Park, but it was destroyed by the construction of the interchange of I-295 and New York Avenue (Flanagan et al. 1989).

TABLE 13: ARCHEOLOGICAL RESOURCES IN ANACOSTIA PARK

Site Number and Name	Description of Site
51NE5, GWU3	Unknown
51NE13	Unknown
51NE15	Prehistoric Woodland Period Camp/ Multi-Component
51NE10	Multi-component
51SE3	Contact Period and unknown Prehistoric Camp
51SE5	Contact Period and unknown Prehistoric Camp
51SE6	Prehistoric Contact Period/ Multi-Component
51SE7	Contact Period and unknown Prehistoric Camp
51SE8	Contact Period and unknown Prehistoric Camp
51SE9	Contact Period and unknown Prehistoric Camp
51SE10	Contact Period and unknown Prehistoric Camp
51SE11	Contact Period and unknown Prehistoric Camp
51SE12	Contact Period and unknown Prehistoric Camp
51SE13	Prehistoric Unknown
51SE15	Unknown
51SE16	Prehistoric Quarry
51SE20	Not listed/unknown
51SE22	Not listed/unknown
51SE26	Late Archaic camp, Multi-Component
51SE29, Correctional Treatment Facility	Prehistoric Unknown
51SE30	Prehistoric Unknown (lithic scatter)
51SE31	Prehistoric Woodland base camp
51SE32	Prehistoric Woodland period camp
51SE33	Prehistoric Unknown (lithic scatter)
51SE35	Prehistoric Unknown (lithic scatter)

In the late 1970s and early 1980s, the construction of the Washington Metropolitan Area Transit Authority's (METRO) Green Line necessitated several archival and archeological investigations. These studies pointed up the difficulty of archeological investigations in urbanized waterfront areas where massive filling had taken place. Archeological investigations at the site of the Anacostia METRO Station identified widespread prehistoric deposits possibly associated with the village of Nacotchtank, as well as remains of the Freedmen's Bureau settlement established after the Civil War (Louis Berger & Associates, Inc. 1986).

Engineering-Science, Inc. completed an archeological investigation in 1989 for the Barney Circle Freeway Project that also included portions of Anacostia Park (Flanagan et al. 1989). This study involved subsurface testing only in areas to be directly affected by highway construction and not in areas associated with landscaping or construction of facilities at Anacostia Park. Archeological testing revealed well-preserved remains at two sites (51SE25 and 51SE26) along the east bank of the Anacostia River, one

of which (51NE26) is inside the park boundary (Flanagan et al. 1989). Both sites were recommended as eligible for listing in the NRHP and a general recommendation was developed for future testing in archeologically sensitive areas of the park. One area that was singled out in the 1989 Barney Circle Freeway report is directly east of the eastern terminus of the John Philip Sousa Bridge (the Pennsylvania Avenue Bridge) where the site of the former Anacostin Fort may have been located (Flanagan et al. 1989).

Later in 1989, in response to the proposed planting and grading activities at Anacostia Park, Engineering-Science, Inc. completed an archeological overview to identify archeologically sensitive areas within the park (Bromberg et al. 1989). The study area included park land on both sides of the Anacostia River from the 11th Street Bridge, upstream to the Benning Bridge. This study identified a number of areas within the park that have a high potential for archeological resources. The report noted that the portion of the park northwest of I-295 (the Anacostia Freeway) between the 11th Street Bridge and the John Philip Sousa Bridge along the east side of the river, has a very high potential to yield prehistoric archeological resources in primary contexts (Bromberg et al. 1989). This conclusion was based on previous investigations and the presence of three former tributary streams that once emptied into the Anacostia River in this area. The report noted that one area in particular, located east of the tennis courts and corresponding to Site 51SE7 or 51SE8, is "known for the richness of its archeological resources since the late 19th century and has been related to the historically documented aboriginal occupation of Nacotchtank" (Bromberg et al. 1989). The 1989 overview also identified a number of areas that were considered sensitive for historic archeological sites. Specific sites included the remains of various piers, wharves, ferries, and residential structures that were historically located along the riverfront (Bromberg et al. 1989).

PARK OPERATIONS AND MANAGEMENT

This topic includes the current management and operations at the park as well as the long-term management of resources and lands at the park; park management and operations refers to the availability of park resources to adequately protect and preserve vital park resources and provide for an effective visitor experience. The National Capital Parks - East includes 13 park sites, parkways, and statutory covering more than 8,000 acres of historic, cultural, and recreational parklands from Capitol Hill to the nearby Maryland suburbs. Anacostia Park and the Kenilworth Park and Aquatic Gardens are both under the management oversight of National Capital Parks - East. The two sites have a single site manager and a combined full time staff of approximately 20 individuals. This includes 9 interpretive rangers, 10 maintenance staff, and 1 administrative technician. These sites also have various seasonal staff, interns, and volunteers that serve critical needs.

Park management and operations refers to the availability of park resources to adequately protect and preserve vital park resources and provide for an effective visitor experience.

The park rangers at Anacostia have many different duties. The rangers develop and conduct interpretation programs for the public at the aquatic gardens and other areas throughout the park. They provide environmental education to students at local schools either at the park or offsite. Rangers work at the park's roller rink, Aquatic Education Center, and aquatic gardens Visitor Center and bookshop. They work to coordinate visitor services, such as managing special use permits, special events in the park, and ball field league games. In addition, the park rangers coordinate with NPS volunteers. Some of the task park volunteers assist park rangers and staff with includes conducting trash and river cleanups throughout the park, wetland vegetation plantings, maintaining goose enclosures, planting trees, and conducting goose counts. Seasonal programs, such as the Student Conservation Association, also involve the park rangers and the public.

As part of the National Capital Parks - East, Anacostia Park and Kenilworth Park and Aquatic Gardens also have the support of other National Capital Parks - East staff including additional Grounds Maintenance, Facilities Maintenance, Natural Historic Resource staff, and others, as needed. The Langston Golf Course and the marinas within the park property are operated by outside concessionaires. The NPS does not supply these areas with park service employees.

RESOURCE MANAGEMENT

National Capital Parks - East currently has six permanent, full-time employees with duties in resource management. The resource management team is located in the park headquarters building and includes a chief resource manager, museum curator, historian, two park rangers, and biologist. The resource management team works at all parks within the National Capital Parks - East system, including Anacostia Park. At Anacostia, the resource management staff devotes much of their time to wetland and resident Canada goose management throughout the park. The staff has been monitoring the wetlands within the park for the past five years. The staff monitors plant growth, plant diversity, and the wildlife that utilize the wetland areas. Additionally, staff identifies areas with high counts of invasive plant species which are in need of treatment. The resource management staff works with the District Fish and Wildlife and the AWS to perform egg oiling during the resident Canada goose breeding season. They also conduct the quarterly goose counts within the Anacostia watershed (Syphax 2008).

MAINTENANCE

The Kenilworth Aquatic Gardens has four permanent maintenance staff. The primary tasks for maintenance staff at the gardens include the preservation of the lily ponds and the propagation of the lilies. There are five additional permanent maintenance staff that work within the remaining grounds of Anacostia Park. This staff is responsible for the daily upkeep of park grounds. Maintenance tasks include maintaining the grounds by mowing and trimming, trash removal, coordinating with the trash removal on the river (water skimmer), and sanitation (cleaning restrooms and picnic areas) (Syphax 2008). Other NPS maintenance staff is brought to the park on an as needed basis. This staff is used for plumbing, mechanical, electrical, construction, and painting jobs.

RESOURCE EDUCATION AND VISITOR PROTECTION

Resource Education

One of the chief functions of the NPS is to provide educational experiences to the visitors of the parks (NPS 2006a). The purpose of NPS interpretive and educational programs is to provide memorable educational and recreational experiences that help the public understand the meaning and relevance of park resources, and foster development of a sense of stewardship.

Anacostia Park offers a variety of educational and interpretive programs to park guests. The Kenilworth Aquatic Gardens are used for environmental education, nature study, and scientific research. Many school children and organizations from throughout the District metropolitan area gather at the gardens to learn about horticultural history, the propagation and varieties of aquatic plants, the diverse wildlife that inhabit the gardens, and the environment. Interpretive programs based on natural, horticultural, and historical aspects of the gardens, marsh, and surrounding woodlands are conducted by park rangers and by experts from various organizations.

The Urban Tree House, located in Anacostia Park, is a community-based environmental education program designed to enhance urban communities understanding of natural resources and environmental concepts. The curriculum is influenced by the surrounding aquatic environment, and emphasizes the

watershed, the interdependence of land and water, and the impact of the city on the environment. The Urban Tree House education program is available for students in kindergarten through grade 12. Topics discussed in the program include ecology, freshwater and saltwater ecosystems, wetlands, forests, biodiversity, sustainability, solid waste, land use, transportation, air and water pollution, and environmental ethics.

The Aquatic Resource and Education Center in Anacostia Park offers a variety of live exhibits of fish and other aquatic species from the Anacostia River. The Center evolved from a partnership between the NPS, USFWS, and the Government of the District; and is operated by the District Fisheries and Wildlife Division. In 2005, a $1.2 million expansion was completed to include classrooms and offices, display areas, local fish exhibits, a fisheries laboratory, and an aquaculture facility. Several education programs are offered at the Center. Visitors and students can learn about the Anacostia River through aquatic resource presentations and tours of the facility given by fisheries biologists. Students are encouraged to engage in hands-on activities ranging from fish identification to water quality testing. The Center's fish hatchery is operated to re-populate fish such as American shad, blueback herring, and hickory shad back to their historical spawning grounds.

Bridging the Watershed is an outreach program of the Alice Ferguson Foundation in partnership with NPS and area schools. The mission of the program is to provide meaningful educational experiences that connect students to their place in the natural and cultural world (BTW 2004).

High school students from around the District area visit national parks (including Anacostia Park) with their science classes to conduct field studies. Students are given the opportunity to take field measurements and observations just as a scientist would do. Bridging the Watershed offers teachers the opportunity to attend summer institutes which prepare teachers to incorporate the curriculum modules into science courses. A total of five modules are available for students and teachers, including *Assessing Exotic Invasive Species, Runoff and Sediment in the River, Trash: Make a Litter Difference, Assessing Benthic Macroinvertebrates,* and *Assessing Water Quality*. Park rangers work with the high school students to provide them with educational experiences and park interpretations. Rangers participate in special ranger workshops and the annual summer teacher/ranger institute.

Visitor Protection

The U.S. Park Police facility acts as a full service police department in Anacostia Park. There are a total of 22 officers that patrol the Anacostia area. The park police patrol areas throughout the park to help provide safe visits to all park visitors. Some of the major issues that park police take in hand include trash dumping, drug use, illegal fishing, crime, and disorderly conduct.

COOPERATION AND COORDINATION

The District and the USACE are cooperating agencies for this plan/EIS. The USACE has expressed that they would contribute funding in the future for wetlands restoration and maintenance in Anacostia Park.

On March 22, 2000, the following agencies entered into a MOU for the Anacostia Waterfront Initiative:

- General Services Administration
- The Government and District of Columbia
- Office of Management and Budget
- Naval District Washington

- Military District Washington
- Commandant 11th Wing
- Commanding Officer Marine Barracks Washington
- Department of Labor
- Department of Transportation
- National Park Service
- USACE
- USEPA
- Department of Housing and Urban Development
- District of Columbia Housing Authority
- Washington Metropolitan Area Transit Authority
- Smithsonian Institution
- National Capital Planning Commission
- District of Columbia Sports and Entertainment Commission
- National Arboretum of the USDA
- U.S. Small Business Administration.

These parties have joined together to create a new partnership that will help to attain a vision for the waterfront areas. This initiative will contribute to the revitalization of the surrounding neighborhoods, provide enhanced park areas, develop government-owned land for the benefit of the people of the District and the federal and District governments, increase access to the water, and enhance visitor participation in the activities and opportunities provided along the waterfront.

VISITOR USE AND EXPERIENCE

VISITATION

The majority of the visitors to Anacostia Park are the residents of the surrounding neighborhoods.

Visitation at Anacostia Park is tallied by five inductive loop counters at park entrance lanes at Fairlawn Avenue, Good Hope Road, Anacostia Drive South, and Howard Drive (two locations). Each traffic count is reduced by the number of non-reportable vehicles which is estimated at 400 vehicles per month (NPS 1996). A non-reportable vehicle would include vehicles from NPS employees, NPS contractors, volunteers, private tenants inside park boundaries, and from those who incidentally enter the park. The reduced traffic count is then multiplied by the persons-per-vehicle multiplier of 1.6 (NPS 1996). In addition to the traffic counters, the number of walk-in visitors, joggers, bicyclists, and bus visitors are added to the total.

The majority of the visitors to Anacostia Park are the residents of the surrounding neighborhoods. Annual visitation for the National Capital Parks - East system and Anacostia Park are displayed in table 14. Park visitation increased from 2003 through 2005, and then slightly decreased in 2006. Visitation has continued to decrease from 2007 through 2009. Visitation at Anacostia Park has accounted for

approximately 32 to 42 percent of the total visitation within the National Capitol Park-East system (NPS 2009e). As expected, visitation is higher during the warmer months and lower in the cooler months. In 2009, visitation was highest in March due to a large special event with over 60,000 people; however, visitation was high in July, August, and September with more than 40,000 visitors each month. Visitation was lowest in February when less than 23,000 people visited the park. The Kenilworth Aquatic Gardens had the highest attendance in July and August when more than 13,000 people toured the gardens. Less than 1,000 people per month visited the gardens in January, February, and December (NPS 2009e). Visitation begins to increase in both the gardens and park in April and May. Visitation to the Aquatic Resource Education Center declined in 2006 and 2007. In 2007, a total of 807 students visited the center, this was nearly half of the students in 2006 (1,958 students) (Whitworth 2008).

The athletic fields within the park are used for baseball, soccer, rugby, football, and tennis games. In 2009, over 21,000 spectators visited Anacostia Park to watch the various sporting events. Rugby and soccer are the most popular sports to watch at the park. A total of 121 soccer games were played in 2009, bringing over 8,800 spectators to the park and 310 rugby games brought over 5,200 spectators. In addition to the sporting events, 817 concerts were held at Anacostia Park in 2009 with over 10,000 attendees. Approximately 68,700 visitors attended one of the 426 special event picnics at the Anacostia Park Pavilion. Sporting events, concerts, and picnics are becoming more popular at the park each year. The number of events at Anacostia Park has increased by 56 percent since 2003.

TABLE 14: ANNUAL VISITATION IN THE NATIONAL CAPITOL PARKS-EAST AND ANACOSTIA PARK 2003–2009

Year	National Capitol Parks-East Visitation	Anacostia Park Visitation	Percent Change at Anacostia Park from Previous Year
2003	1,372,109	348,619	--
2004	1,575,276	443,810	+ 9.1 %
2005	1,390,442	565,480	+ 16.8 %
2006	1,310,320	501,080	- 11.3 %
2007	1,311,088	514,148	+ 2.6 %
2008	1,296,990	481,842	-6.3 %
2009	1,272,212	463,335	-3.8%

Source: NPS 2009e

RECREATION AND VISITOR ACTIVITIES

Anacostia Park encompasses the largest area within the District available for recreational opportunities to residents of Southeast Washington and its visitors. It provides valuable open space in an urban setting, contributing to the park system of the national capital. Numerous parks and recreational facilities are located within Anacostia and offer both passive and active recreation opportunities:

- **Kenilworth Park and Kenilworth Marsh**—This 180-acre site is located in the northeastern portion of the park. The area was once used as a landfill, but historic and recent restoration efforts have allowed this site to be used as a multi-purpose recreational area.
- **Kenilworth Aquatic Gardens**—This site is located on the east bank of the Anacostia River. The area houses 14 acres of aquatic plants and 11 acres of ponds which provide habitat to a diversity of wildlife, including insects, reptiles, and amphibians. The mud flats at the tidal marsh during low tide are feeding grounds to many wading birds. The gardens are the only unit in the NPS dedicated to the propagation of aquatic plants. The Aquatic Garden's annual Waterlily Festival in

July attracts thousands of visitors at the peak blooming season. Ranger-lead programs include a ½ mile guided tour of the ponds and gardens. A boardwalk hiking trail from the garden ponds leads visitors to the Kenilworth tidal marsh. Additionally, visitors may use the river trail that begins at the lily ponds and circles around pass the Kenilworth Marsh. In addition to viewing wildlife and the gardens, visitors have the opportunity to use the ball fields and picnic areas.

- **Langston Legacy Golf Course**—This 18-hole historic golf course is located on the west bank of the Anacostia River north of Benning Road. The golf course is open year round and green fees are $15 for weekdays and $19 on weekends. The facility includes a snack shop and pro shop.
- **Poplar Point**—This 60-acre site is located along the east side of the Anacostia River, just north of the South Capitol Street Bridge adjacent to the historic Anacostia District. The Poplar Point site was formerly used by the Architect of the Capitol and by the District's Lanham Tree Nursery. The wetlands, meadows, and scrub-shrub areas provide important habitat for a diversity of plants and wildlife. The area can be used for wildlife viewing and picnicking by park visitors.
- **Boating facilities**—Marinas and boat ramps located along the river provide public easy access to the water for boating, sailing, canoeing, and jet skiing. Three public marinas including the Anacostia Community Boathouse, Buzzard Point Marina, James Creek Marina; and a public boat ramp are located within the park. Additional private marinas include the Eastern Power Boat Club, the District Yacht Club, and Seafarers Yacht Club. The upper Anacostia is favored for canoeing and kayaking through natural areas, while the lower Anacostia is favored by sculling and rowing crews for its broad, flat water.
- **Anacostia Park Pavilion**—This 3,300 square foot area is located east of the Anacostia River and north of Pennsylvania Avenue. The pavilion includes a roller skating rink and an area to host special events.
- **Urban Tree House**—This community-based environmental education center is located next to the Anacostia Park Pavilion and is made of wood planks in the shape of the United States. The Urban Tree House provides opportunities for the District urban youth to learn about and experience nature in their own backyards.
- **Aquatic Resource and Education Center**—This aquatic education center is located next to the Anacostia Park Pavilion. The education center offers a variety of live exhibits of fish and other aquatic organisms from the local river. The center also includes a fisheries hatchery for shad and herring species. Visitors may watch a presentation or receive a tour of the facility from local fisheries biologists.
- **Playing fields and courts**—Numerous playing fields and courts are scattered throughout the park. The open fields are often used by visitors for picnicking, dog walking, and sport playing, including soccer, rugby, and football. Tennis courts are located close to the Pennsylvania Avenue entrance to the park and basketball courts are located just south of Benning Road. The District Kenilworth Park immediately adjacent to the Kenilworth Aquatic Gardens offers baseball fields, a track, tennis courts, basketball courts, and swimming pools. This area is not within the Anacostia Park boundary and is not maintained by the park.
- **Playgrounds**—Two playgrounds are located throughout the park. These areas are located next to the roller skating rink and the picnic area south of the Pennsylvania Avenue entrance. These areas offer children the chance to climb, slide, and swing through ropes, tires, slides, bridges, and tires. These areas are most popular during the summer months.
- **Picnic and other passive recreation areas**—The remaining areas of Anacostia Park are used for picnicking and other activities such as hiking, biking, and wildlife viewing. Designated picnic areas are located next to the tennis courts, the Anacostia Park Pavilion, and the main building

complex of the Kenilworth Aquatic Gardens, although picnicking is acceptable in any open area throughout the park. Many visitors often walk, jog, or bike along the roadway adjacent to the river.

- **Kingman and Heritage Islands**—These islands/marsh areas are located in the upper Anacostia River adjacent to RFK stadium. These areas are outside of the park boundary and are currently being redeveloped as educational and passive, low-impact recreation sites.
- **Fishing**—Recreational fishing opportunities are available along the east and west banks of the Anacostia River or by boat. A fishing permit from the District Fisheries and Wildlife department is required.

Many visitors enjoy looking at the geese in Anacostia Park, as they think of them as wildlife and value their contribution to the overall aesthetics of the park. However, the NPS has received numerous complaints concerning the large amounts of goose feces throughout the Langston Legacy Golf Course and playing fields (NPS 2004b). Visitors have also complained of the high volume of trash and floatable debris in the Anacostia River. According to MWCOG, approximately 20,000 tons of trash and debris enter the river annually (AWRP and MWCOG 2007). The majority of this trash problem is from people littering and performing illegal dumping.

Due to the poor water quality and degraded fish habitat, fishing is limited in the tidal Anacostia River. Because of the PCBs and other chemical contaminants that have continued to be found in certain fish species caught in the river, the DOH has placed restrictions on fish consumption from the Anacostia River. Water contact recreation such as swimming is also restricted because of the poor water quality and associated potential health risks.

SOUNDSCAPES

Natural soundscapes exist in the absence of human-caused sound. Some natural sounds are part of the biological or physical resources of Anacostia Park. Examples of such natural sounds at the park include:

- Sounds produced by birds, frogs, or insects to define territories or attract mates, and
- Sounds produced by physical processes such as wind in the trees, flowing water, or claps of thunder.

Natural soundscapes can be experienced in the undeveloped portions of the park such as the marsh areas, although there are few areas within the project area that are free of human-created noise. Areas along the Anacostia River have been left as unmowed meadow, and there are other established no mow areas to encourage ground nesting birds. Bald eagles and osprey hunt along the Anacostia River.

At Anacostia Park, human-caused sounds are most noticeable in areas such as the golf course, pavilion, ball fields, and playgrounds. Examples of human induced noise includes the use of automobiles throughout the park especially crossing over bridges, golf carts, children playing, boats along the river, commercial and military aircraft, trains along the CSX railroad, and sirens from nearby emergency vehicles.

AESTHETICS AND URBAN QUALITY

Prior to the late 17th century, the Anacostia watershed was a thriving natural ecosystem of dense forests, streams, and a river filled with wildlife. Eventually the Anacostia watershed was transformed into a highly urbanized metropolitan area. Anacostia Park was created to preserve forests and natural scenery in

and about the District. The park provides valuable open space in an otherwise urban setting and contributes to the natural beauty of the nation's capital. The parkland includes the Anacostia River, forests, wetlands, aquatic gardens, and landscaped or turfed areas. Man-made features including playing fields, boat docks, visitor centers, and recreational centers are available for the public.

The scenic value of the park is reduced by the large amounts of trash in the river and along the shoreline. The amount of trash within the watershed increases after a storm event. Trash includes metal, plastic bottles, tires, drums, paper products, Styrofoam containers, toys, and other materials. The AWS has collected approximately 600 tons of trash and over 7,500 tires from the river between 1998 and 2004 (AWRP and MWCOG 2007). In 2004, the AWS and 1,100 volunteers collected 43 tons of trash and over 200 tires during the Earth Day clean-up event. Volunteer trash cleanup opportunities are often posted on the bulletin boards throughout the park. To help guide the efforts to reduce the amount of trash entering the Anacostia River and its tributaries, the Anacostia Watershed Restoration Partnership, with funding from NOAA and led by MWCOG, has developed a strategy that focuses on six objectives to make major reductions of trash in both the Anacostia and Potomac watersheds by 2013. The six objectives include the following:

- Increase funding for trash reduction programs.
- Create and enhance regional partnerships and coordination among businesses, environmental groups, individual citizens, and government at all levels and in all jurisdictions.
- Improve people's awareness, knowledge, and behavior relating to littering and illegal dumping.
- Promote the greater introduction and use of effective trash reduction technologies and approaches.
- Improve the enactment and enforcement of laws to reduce trash.
- Increase trash monitoring-related data collection, generation, and dissemination efforts (AWRP and MWCOG 2007).

In addition to trash at the park, fecal droppings from resident Canada geese can also degrade the aesthetic quality of the park. Although fecal droppings from resident Canada geese have been mentioned as a public safety issue (MDNR 2009), this has not been demonstrated as a safety concern at Anacostia Park, but rather a public nuisance issue (Bates 2010b). The majority of the Anacostia Park population of geese has been located at the Kingman Marsh/Langston Golf Course sites where there is open water for waddling and the open golf course for browsing (NPS 2009a; Bates 2010a). This area provides habitat that is safer from predators during the bird's flightless period. In June 2010, a mean of 371 geese were counted at the Kingman Marsh/ Langston Golf Course site (Bates 2010a). Studies have shown that a well-fed, healthy adult Canada goose can produce up to 1.5 pounds of fecal matter per day (French 2001). Goose feces can reduce the aesthetic appeal of areas such as Langston Golf Course and could ultimately reduce public use (USFWS 2005). Visitor using other public areas at Anacostia Park in addition to Langston Golf Course are also affected by the geese, including visitors utilizing open playing fields. For example, it has been documented that public areas littered with accumulated goose feces have been closed due to the contamination or the threat of personal injury resulting from falls as people lose footing on the slippery material (French 2001). Specifically, Anacostia Park has received complaints from the unpleasant experience of goose fecal matter on golfer's shoes and from park visitors falling and/or rolling in goose fecal matter while playing ballgames (NPS 2010b).

Chapter 4: Environmental Consequences

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

The "Environmental Consequences" chapter analyzes both beneficial and adverse impacts that would result from implementing any of the alternatives considered in this *Final Anacostia Park Wetlands and Resident Canada Goose Management Plan/EIS*. This chapter also includes a summary of laws and policies relevant to each impact topic, definitions of impact thresholds, methods used to analyze impacts, and the analysis methods used for determining cumulative impacts. As required by the CEQ regulations implementing NEPA, a summary of the environmental consequences is provided in table 5, which can be found in "Chapter 2: Alternatives." The resource topics presented in this chapter, and the organization of the topics, correspond to the resource discussions contained in "Chapter 3: Affected Environment."

SUMMARY OF LAWS AND POLICIES

Three overarching environmental protection laws and their implementing regulations and policies guide the actions of the NPS in the management of the parks and their resources – the *Organic Act of 1916*, NEPA and its implementing regulations, and the NPS *Omnibus Management Act*. These guiding laws, regulations, and policies were described in detail in chapter 1 of this plan/EIS. Collectively, these guiding laws, regulations, and policies provide a framework and process for evaluating the impacts of the alternatives proposed in this plan/EIS.

GENERAL METHODOLOGY FOR ESTABLISHING IMPACT THRESHOLDS AND MEASURING IMPACTS BY RESOURCE

The general approach for establishing impact thresholds and measuring the effects of the alternatives on each resource category includes the following elements:

- general analysis methods as described in guiding regulations
- basic assumptions used to formulate the specific methods used in this analysis
- thresholds used to define the level of impact resulting from each alternative
- methods used to evaluate the cumulative effects of each alternative in combination with unrelated factors or actions affecting Anacostia Park resources

These elements are described in the following sections.

GENERAL ANALYSIS METHODS

The analysis of impacts follows guidelines from CEQ regulations and Director's Order #12 (NPS 2011) and its accompanying handbook (NPS 2001). Procedures presented in this plan/EIS are based on the underlying goal of supporting the restoration, conservation, and maintenance of the wetlands throughout Anacostia Park. The analysis incorporates the best available scientific literature applicable to the region and setting, the species and areas being evaluated, and the actions being considered in the alternatives. For each resource topic addressed in this chapter, the applicable analysis methods are discussed, including assumptions and impact intensity thresholds.

ASSUMPTIONS

Several guiding assumptions were made to provide context for this analysis. These assumptions are described below.

Analysis Period

Goals, objectives, and specific implementation actions needed to manage the wetlands and resident Canada geese at Anacostia Park are established for the next 15 years. Therefore, the analysis period for assessing impacts is up to 15 years. The impact analysis for each alternative is based on the principles of adaptive management, which would allow the NPS to change management actions as new information emerges from monitoring the results of management actions and ongoing research throughout the life of the plan.

Commitment of Techniques

The park has committed to implement specific techniques within each alternative, while other techniques would be used on an as-needed basis as presented in tables 1 and 2, chapter 2. The following impact analysis for all alternatives and resources, describes the impacts associated with the wetland and resident Canada goose management techniques proposed in this plan/EIS regardless of when or if the techniques are implemented.

Geographic Area Evaluated for Impacts

The geographic study area for this plan includes Anacostia Park in its entirety. The area of analysis may extend beyond the park's boundaries for some resources and for the cumulative impact assessment. The specific area of analysis for each impact topic is defined at the beginning of each topic discussion.

Duration and Type of Impacts

The following definitions are used for all impact topics unless otherwise noted:

- **Short-term Impacts**—Impacts would last up to six months following a management action.
- **Long-term Impacts**—Impacts would last longer than six months up to the life of the plan (approximately 15 years).
- **Beneficial Impacts**—A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
- **Adverse Impacts**—A change that moves the resource away from a desired condition or detracts from its appearance or condition.
- **Direct Impacts**—Impacts that would occur as a direct result of wetland and resident Canada goose management actions.
- **Indirect Impacts**—Impacts that would occur from wetland and resident Canada goose management actions and indirectly alter a resource or condition later in time or farther in distance from the action.

Future Trends

Visitor use and demand are anticipated to follow trends similar to recent years. The number of yearly visitors to Anacostia Park has averaged approximately 1.4 million visitors per year in the last 5 years (NPS 2008c). In the absence of notable anticipated changes in facilities or access, the average visitation is expected to continue and be reflected across user groups.

Impact Thresholds

Determining impact thresholds is a key component in applying *NPS Management Policies 2006* and the Director's Order #12 Handbook. These thresholds provide the reader with an idea of the intensity of a given impact on a specific topic. The impact threshold is determined primarily by comparing the impact to a relevant standard from state or federal regulations, scientific literature and research, or best professional judgment. Because definitions of intensity vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this document. The following intensity definitions are used throughout this analysis: negligible, minor, moderate, and major. Impact thresholds are discussed for adverse impacts only, the intensity of beneficial impacts is not defined.

CUMULATIVE IMPACT ANALYSIS METHOD

The CEQ regulations that implement NEPA require the assessment of cumulative impacts in the decision-making process for federal projects. 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 non-federal) or person undertakes such other actions" (40 CFR 1508.7). As stated in the CEQ handbook, "Considering Cumulative Effects" (CEQ 1997), cumulative impacts need to be analyzed in terms of the specific resource, ecosystem, and human community being affected and should focus on effects that are truly meaningful. Cumulative impacts are considered for all alternatives, including alternative A, the no action alternative.

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present and reasonably foreseeable future actions. Therefore, it is necessary to identify other ongoing or reasonably foreseeable future projects and plans at Anacostia Park and if applicable, the surrounding area.

Past Actions within and Around Anacostia Park

Anacostia Wetland Mitigation Project—NOAA, Maryland State Highway Administration (SHA), the M-NCPPC, Prince George's County, Federal Highway Administration (FHA), and the USEPA are working together to create a functional tidal wetland along the Anacostia River to provide habitat for fish and wildlife, satisfy tidal wetland mitigation requirements of the Woodrow Wilson Bridge project, and provide future educational and recreational opportunities. The mitigation project is located on M-NCPPC property near Bladensburg, Maryland. The site covers approximately 54 acres along the eastern shore of the Anacostia River, just upstream of the District border. The project began in May 2007 and is scheduled for completion in the fall of 2009 (NOAA 2007b).

Kenilworth Marsh—Kenilworth marsh is a restored freshwater tidal marsh on the Anacostia that is adjacent to the Kenilworth Aquatic Gardens. Thirty-two acres of emergent wetland were created by the USACE in 1993 in cooperation with the USEPA and NPS.

Kingman Marsh (Lake)—Kingman Marsh is a site of 2 recent large-scale restoration efforts, completed in 2000. This project was support by USEPA, USACE, NPS, and the District and Prince George's County

governments. The site restored totaled 40 acres. In 2005, the Heritage Island Ecosystem Restoration added an additional 6 acres of restored emergent wetland to the site.

Anacostia Riverwalk Trail—The Anacostia Riverwalk is a planned 16-mile multi-use trail along the east and west banks of the Anacostia River in the Washington, DC. It is a priority for the District Department of Transportation (DOT), which has taken the lead in planning and constructing the Riverwalk as a recreational amenity and transportation alternative for Washington residents. When completed, it will connect sixteen waterfront neighborhoods to the Anacostia National Park and the Anacostia River. Washington residents and visitors will be able to walk and bike on the Riverwalk to several popular destinations, including the Fish Wharf, the new baseball stadium, Poplar Point, the Navy Yard, historic Anacostia, RFK stadium, Kingman Marsh, Kenilworth Aquatic Gardens and National Arboretum. The trail connects the National Mall at the Tidal Basin to the Bladensburg Marina Park in Prince George's County, MD (DCDOT 2006b). The East Bank Trail incorporated a 2-mile section of trail that realigns and rebuilds Anacostia Drive, which was completed in 2012 (more or less). The West Bank Trail incorporated a 2.5-mile trail that connects the Benning Road Bridge in the north to the Navy Yard promenade in the south which was completed in 2007 (DCDOT 2006a).The Riverwalk and its loops provide interconnected greenway trails, pedestrian-friendly river crossings, and cycling lanes on streets connecting waterfront recreational areas with neighborhoods and cultural sites along the Anacostia River (DCOP 2009). Other phases are scheduled for completion by 2012 (DCDOT 2006b).

Anacostia Skating Pavilion—NPS replaced major features of the skating pavilion roof. Emergency repairs and stabilization secured the roof until a more permanent replacement is constructed. The skating pavilion reopened during the spring 2008.

Camp Simms—This project is located at 1500 Alabama Avenue SE and includes a $30 million mixed-use project with 100,000+ square feet of retail space with anchoring grocery store and 75 units of housing. This project was completed in spring 2008 (Poplar Point 2007).

Current Actions within and Adjacent to Anacostia Park

Woodrow Wilson Bridge Project—As part of the larger Woodrow Wilson Memorial Bridge reconstruction project, the southern terminus of I-295 is being re-built. Several new connections are being constructed to link the beltway (I-495) and MD-210 to I-295 with the new National Harbor site being built on shore of the Potomac River. The interchange is being re-built to accommodate future ramps for proposed HOV lanes to the beltway. The project is due to be completed in stages from 2008 to 2011.

Anacostia Gateway Government Center—This project is located at the intersection of Martin Luther King, Jr. Avenue and Good Hope Road SE and includes a $75 million project to serve as District Department of Transportation Headquarters Building with 320 square feet of office space and storefront functions. The project designs are currently underway. Demolition of the current facility is expected in the summer of 2009 with new construction for the center to follow in the future (Poplar Point 2007).

Riverfront on the Anacostia—The District Zoning Commission gave preliminary approval on March 20, 2008 to design a 1.1 million-square-foot, four building, mixed-use project on the site between Nationals Park, the Anacostia River, the Frederick Douglass Memorial Bridge, and the proposed Diamond Teague Park. The developers need to submit more detailed drawings of the plans for the South Capitol Street facades. Zoning approvals were received in 2008 and construction is proposed to begin in 2010 (Dupree 2008).

Anacostia Waterfront Initiative (AWI) - Includes approximately 900 acres of land characterized as susceptible to change for redevelopment along the 8-mile long Anacostia waterfront and Washington

Channel, including the Southwest, the Southeast, Poplar Point, Hill East Waterfront, RFK Stadium Area, South Capitol Street Corridor, and Anacostia Park/Arboretum Area. Portions of the project have been completed, other phases are underway, and additional phases are proposed for the future. The AWI was a partnership between the federal and District governments to revitalize the Anacostia River waterfront. The District Office of Planning produced the Framework Plan in collaboration with a steering committee of federal and District agencies and an advisory group of community leaders. The targeted land is 90 percent publicly owned and would offer increased public access to the waterfront, would build new parks, and would create mixed-use and mixed-income waterfront neighborhoods.

2004 Consent Decree - As a result of a consent decree that the USEPA signed with the District WASA in 2004 to improve water quality in the Anacostia and Potomac Rivers and Rock Creek, a 20-year Long-Term CSO Control Plan has been drafted and would have a beneficial, cumulative impact on water quality in the Anacostia River. This plan includes three underground storage tunnels, including side tunnels to reduce flooding rehabilitation of existing pumping stations, and the elimination of 14 overflow outfalls, four of which are located in the Anacostia Watershed (DCWASA 2008). When the project is fully implemented, CSO discharge would be reduced by a projected 98 percent on the Anacostia River (DCWASA 2010).

11th Street Bridge Replacement Project—A major project is currently underway to rebuild the interchange between I-295, DC 295, and the 11th Street Bridges. Due to the cancellation of both the remainder of the Southeast Freeway and the newer Barney Circle Freeway, there are no through connections between the 11th Street Bridges and DC 295, leading to severe congestion and major traffic routing problems. This project would construct the missing movements at this interchange, allowing direct freeway-grade access to and from DC 295 at the 11th Street Bridges, as well as provide a through grade-separated north-south route within DC.

Poplar Point—In 2006, Federal legislation was enacted authorizing transfer of the 110-acre Poplar Point Site to the District, but the transfer has not yet taken effect. In order for the transfer to occur, the District is required to complete a land use plan for Poplar Point that meets specified requirements and to locate replacement facilities for NPS. In 2009, the District of Columbia and NPS entered into an agreement to conduct a Remedial Investigation and Feasibility Study to clean up the Poplar Point Site. The District has also initiated the compliance process, writing a draft EIS for the future land use of the site. Once contamination at the site has been cleaned up, redevelopment plans can be implemented (Ferguson 2012).

Southeast Federal Center—This project includes a 5.5 million square foot, 44-acre site development, which would include 2,800 housing units, 1.8 million square feet of office space, 200,000—400,000 square feet of retail/cultural, new parks and a marina. This project is to be completed along the waterfront of the Anacostia River (Poplar Point 2007).

Waterfront Redevelopment—Several development projects are proposed along the Anacostia River's western edge. These projects include the southwest waterfront redevelopment that includes a mix of public plazas, boulevards, cultural venues, restaurants, shops, and residences; waterside mall; and arena stage (Poplar Point 2007).

PHYSICAL RESOURCES

This section discusses impacts to the soils in the study area.

SOILS

NPS Management Policies 2006

NPS *Management Policies 2006* require the NPS "to understand and preserve the soil resources of parks, and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil or its contamination of other resources." "Management action will be taken by superintendents to prevent or at least minimize adverse, potentially irreversible impacts on soil" (NPS 2006a). Therefore, NPS is required to protect geologic features from the unacceptable impacts of human activity while allowing natural processes to continue (NPS 2006a).

Assumptions and Methodologies

Potential impacts to soils are assessed based on the extent of disturbance to natural undisturbed soils, the potential for soil erosion resulting from disturbance, and limitations associated with the soils. Soils could be affected by erosion resulting from the loss of vegetation due to goose browsing. Impacts to soils were analyzed qualitatively.

Primary steps for assessing impacts to soils include identifying:

- potential changes in soils from the presence of resident Canada geese;
- if soil resources are in areas likely affected by wetland and resident Canada goose management practices;
- potential changes to soil productivity or erosion rates due to the implementation of management practices; and,
- disturbance potential of proposed restoration efforts.

Impact Threshold Definitions

The following thresholds were used to determine the magnitude of impacts on soil resources:

Negligible: Soils would not be impacted or the impact would be below or at the lower levels of detection. There would be no discernible effect on the rate of soil erosion or the ability of soils to support native vegetation.

Adverse: *Minor*: Impacts to soils would be detectable, but impacts would be small. There would be localized, detectable effects on the rate of soil erosion and the ability of soils to support native vegetation.

Moderate: Impacts to soils would be readily apparent and would result in a change of soil character over a relatively wide area within the park. There would be widespread and detectable effects on the rate of soil erosion and the ability of soils to support native vegetation.

Major: Impacts to soils would be readily apparent and would result in a substantial change in character over a large area in the park. The actions would have a substantial, highly noticeable influence on the rate of erosion and the ability of soils to support native vegetation.

Soils Alternatives Evaluation

Alternative A – No Action Alternative—Currently, resident Canada goose herbivory is reducing aerial coverage of wetland vegetation. This reduces wetland vegetation rootmass (which normally stabilizes the soil) and allows erosion to occur, as well as surface soil runoff to the Anacostia River. In some areas within the park, vegetative buffers along the Anacostia River are either extremely narrow or nonexistent, resulting in high soil erosion rates due to lack of vegetation. Grazing of shoreline areas that currently support vegetation by geese would continue and result in the further removal and loss of turf, terrestrial vegetation, and/or wetland vegetation (which holds soil) and would result in erosion during excessive rain events. In addition, it is expected that over the life of this plan/EIS, the riverine wetlands would continue to erode (NPS 2010d; Curtis 2010), resulting in a further loss of wetland vegetation that would also result in erosion during rain events as mentioned above (Curtis 2010). Removing sheet piling along the Anacostia River Fringe Wetlands (which would require additional NEPA compliance) would also impact soils due to erosion that would occur following this process. After removal of the sheet piling from the Anacostia River Fringe Wetlands, the substrate may be reworked as a result of frequent flows, especially on the wetland margins (NPS 2008a). The impacts to soils would be readily apparent and would result in a change of soil character over a relatively wide area within the park. There would be widespread and detectable effects on the rate of soil erosion and the ability of soils to support native vegetation. Overall, continued long-term moderate adverse impacts to soil are anticipated as a result of the no action alternative.

Cumulative Impacts—Projects and actions in and near Anacostia Park were considered for the cumulative impacts analysis. The following is a discussion of projects that have had, are currently having, or have the potential to have effects on soils at or in the vicinity of this site.

Numerous redevelopment projects are proposed in the vicinity of Anacostia Park, including components of the AWI such as Poplar Point as well as the 11th Street Bridge Replacement Project. Most construction projects excavate soils, which can adversely affect soil through increased erosion. However, these development and construction projects would require compliance with the District DOH Watershed Protection Division, Sediment and Storm Water Technical Services Branch, District WQS for Surface Water (21 DCMR Ch.11), District DOE, District Water Management Plan per the Water Pollution Control Act of 1984 (DC Law 5- 188), and Section 402 of the Clean Water Act, also referred to as National Pollutant Discharge Elimination System (NPDES) to minimize impacts to soils and offset the adverse impacts. Additionally, the District DOT and FHA have committed to applying soil amendments and providing plantings in select areas of the park where impacts from the 11th Street Bridge Replacement Project are anticipated. Both USEPA and NOAA (2009) have stated that BMPs such as low impact development (LID) techniques, wetland restoration, and stream bank stabilization serve a vital function in reducing erosion, and intercepting runoff of urban contaminants, thus preventing the reintroduction of contaminants. Other projects that include wetland restoration and streambank stabilization projects in the vicinity of the project area could reduce erosion in the Anacostia River Watershed. Overall, the projects and actions in and near Anacostia Park that were considered for the cumulative impacts analysis provide beneficial impacts to soils.

The long-term moderate adverse impacts on soils in and near Anacostia Park under alternative A were considered together with the effects of the projects mentioned above from other past, present, and

reasonably foreseeable future actions. Since the projects listed above would be beneficial to soils, this would reduce the adverse effects of alternative A, resulting in a long-term minor adverse cumulative impact on soils.

Conclusion—Alternative A would result in long-term moderate adverse impacts on soils because the impact to soils would be readily apparent and result in a change or impacts to soil, erosion, and the ability of soils to support native vegetation in a large area of the park. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term minor and adverse.

Soil Impacts Common to All Action (Management) Alternatives

Wetland management techniques that are common to all action alternatives include addressing upland runoff, removing sheet piling along Anacostia River Fringe Wetlands, and installing new rain garden areas. Resident Canada goose management techniques that are common to all action alternatives include population monitoring, installing/maintaining goose exclusion fencing, and education efforts regarding feeding wildlife and preparing technical brochures describing resident Canada goose management techniques. With the exception of installing new rain gardens and the removal of sheet piling along Anacostia River Fringe Wetlands (both which would require additional NEPA compliance), the techniques described above for all action alternatives if implemented would have a negligible impacts on soils because there would be no discernible effect on the rate of soil erosion or the ability of soils to support native vegetation. Removing sheet piling along the Anacostia River Fringe Wetlands would have a short-term, minor adverse effect on soils due to erosion that would occur following this process. After removal of the sheet piling from the Anacostia River Fringe Wetland, the substrate may be reworked as a result frequent flows, especially on the wetland margins (NPS 2008a). It was concluded by NPS (2008b) in a Hydraulic Evaluation of the Anacostia River Fringe Wetland that when the sheet pile is removed, erosion may occur but even high magnitude flows would not necessarily result in substantial or even moderate erosion of the Anacostia River Fringe Wetland. It is very likely that some portion of the Anacostia River Fringe Wetland would be reworked and eroded by the river, but it is also quite likely that a sizable portion of the wetland would remain similar to its present configuration (NPS 2008a). Installing new rain gardens may disturb soil during construction in the short-term but also decrease soil erosion rates in the long-term and help reduce the amount of impervious area in the park; however, these areas may be too small and localized in nature to create a detectable impact on soils. Potential areas for rain gardens include Kenilworth Parkside, Langston Golf Course parking areas, parking lots surrounding the Anacostia Park Pavilion, and parking areas north and south of Pennsylvania Avenue. At this time, it is largely unknown what size and how many rain gardens are proposed. Overall, the techniques that are common to all action alternatives would result in negligible impacts to soil because the impacts would be at the lower levels of detection and because of the limited and localized nature of the proposed techniques.

Alternative B –High Wetland, High Resident Canada Goose Management—Alternative B combines the most aggressive wetlands management techniques with intensive resident Canada goose management techniques (lethal control combined with other techniques). Wetland management techniques are proposed to improve the existing wetlands and create new wetlands along the Anacostia River, which would increase wetland vegetation and rootmass, thus stabilizing soils adjacent to the river. Stabilization would benefit soils through reducing actual soil loss during rain events. Vegetation techniques proposed, such as mechanical seedbank regeneration and high density planting efforts would increase the width of the existing vegetative buffer along the Anacostia River and reduce bare areas where soil erosion currently occurs which would also reduce soil loss during rain events. Improvements to soils would result from increased plantings. These techniques would have a beneficial impact on soils.

Techniques considered in resident Canada goose management are proposed to reduce goose herbivory and improve wetland vegetation. The resident Canada goose population would be intensively reduced as part of this alternative, which would result in indirect improvements to wetland vegetation as well as terrestrial vegetation. Reduced grazing of shoreline areas would decrease erosion through decreased loss of turf, terrestrial vegetation, and/or wetland vegetation, which hold soil along the shorelines of the Anacostia River through rootmass. A decrease in the amount of herbivory would increase wetland/terrestrial vegetation and rootmass, thus stabilizing soils adjacent to the river. Habitat modification techniques proposed would plant new buffers (25 to 50 feet) along shorelines throughout the park and increase the width of the existing vegetative buffer along the Anacostia River. These actions would reduce bare areas where soil erosion currently occurs.

The implementation of erosion control techniques proposed as part of alternative B along the shorelines of the Anacostia River would reduce surface soil runoff and erosion, thus benefiting soils through reducing actual soil loss during rain events. Overall, these techniques would have a beneficial impact on soils. Techniques proposed may include the installation of coir fiber logs, flow deflectors, bog mats, and/or shoreline steepness reduction, which may require land disturbance activities that would negatively affect soils. For example, soil would be affected as a result of the proposed techniques during land disturbance activities to restore hydrology such as the re-grading of sites or construction activities associated with hydrology techniques, vegetation techniques, and wetland restoration techniques. These techniques would have a short-term adverse impact on soils and would range from negligible to minor impacts, depending on the area of soil disturbed. However, soil disturbance impacts would be minimized by appropriate best management plans (BMPs) and may include erosion and sediment (E&S) plans, a revegetation plans, NPDES permits or other required documents in the District, depending on the total area of soil disturbed. The NPS is committed to meeting requirements set forth by the District DOE for soil disturbance. Many of the more intensive techniques included in wetland management for alternative B, such as the erosion control techniques, creating tidal guts, mechanical seedbank regeneration, daylighting, energy dissipation modifications, seawall breaks, constructing new boardwalks, and reducing impervious areas would also affect soils through land disturbance and would require additional NEPA analysis for future projects prior to construction or implementation of these projects (see table 1 in chapter 2).

Alternative B would have a short-term adverse impact on soils and would range from negligible to minor impacts, depending on the area of soil disturbed due to land disturbance activities. Overall, alternative B would result in beneficial impacts to soil that would offset the short-term adverse impacts as a result of improved wetlands along the Anacostia River through very high wetland management and high resident Canada goose management.

Cumulative Impacts—The beneficial impacts on soils as a result of alternative B were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to soils, there would be beneficial cumulative impacts on soils when added to the beneficial impacts from alternative B.

Conclusion—Alternative B would result in overall beneficial impacts on soils because of improvements in wetlands, reduced herbivory, and erosion control. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

Alternative C – Moderate Wetland, Moderate Resident Canada Goose Management—Alternative C includes many of the same wetland management and resident Canada goose management techniques proposed as alternative B, although in general less intensive techniques. Compared to alternative B, alternative C includes only limited removal of structures, both mechanical and passive seedbank

regeneration, and least invasive stream/stormwater outfall modifications. Alternative C would not include creating tidal guts, consider stream daylighting, seawall breaks, and planting efforts would be at a lower density than alternative B. However, overall impacts to soil for alternative C would be the same as alternative B: beneficial because the wetland management and resident Canada goose management techniques would decrease soil loss through plantings and reduced goose herbivory of vegetation. Land disturbance would still occur during construction activities, and would have a negligible impact on soils because less total area would be disturbed under alternative C compared to alternative B. Even though alternative C includes fewer wetland management techniques and a less intensive resident Canada goose population reduction compared to alternative B, this difference is not considered large enough to cause a change in the intensity of the impact (beneficial) to the soils at the park. An overall, beneficial impact for alternative C is appropriate because improvements to soils would be detectable, but these beneficial impacts would be small and localized.

Cumulative Impacts—The beneficial impacts on soils as a result of alternative C were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to soils, there would be beneficial cumulative impacts on soils when added to the beneficial impacts from alternative C.

Conclusion—Alternative C would result in overall beneficial impacts on soils because of improvements in from vegetation plantings and a reduction of herbivory. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

Alternative D – Low Wetland, Low Resident Canada Goose Management—Alternative D has limited wetland management and resident Canada goose management techniques proposed and a one-time lethal reduction. No new wetland restoration techniques are proposed to increase wetland vegetative cover and stabilize the soil. A one-time population reduction of resident Canada geese using resident Canada goose management techniques would be performed during the life of this plan/EIS for alternative D. This one-time population reduction would have a negligible impact on soils because temporarily reducing herbivory may not necessarily cause a measurable increase in soil stabilization and a reduction in erosion; reducing the population one time would not have a long-term effect on improving soils. Overall, alternative D results in long-term minor adverse impacts to soil because of the limited wetland management proposed; adverse impacts would be detectable but small and localized.

Cumulative Impacts—The long-term minor adverse impacts on soils as a result of alternative D were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to soils, there would be negligible cumulative impacts on soils when added to the long-term minor adverse impacts from alternative D. The beneficial effects of the other projects should reduce some of the adverse impacts to soils from implementation of this alternative resulting in a negligible cumulative impact on soils.

Conclusion—Alternative D would result in overall long-term minor adverse impacts on soils, erosion, and the ability of soils to support native vegetation because the effects would be detectable, but would be small and localized. The cumulative impacts of this project when considered together with other projects in proximity to the park would be negligible.

Alternative E – High Wetland, Moderate Resident Canada Goose Management, with No Lethal Control—Alternative E has the same wetland management techniques proposed as alternative B but the resident Canada goose management techniques proposed do not include lethal population reduction activities. Vegetative buffers along the shoreline would make upland areas less attractive to geese and

would reduce soil erosion through plantings. New wetland restoration techniques are proposed which would increase wetland vegetative cover. Land disturbance would still occur during construction activities, and would have a negligible impact on soils. However, since no lethal control for resident Canada geese is proposed, herbivory of vegetation by geese is expected to continue. The benefits from a full suite of wetland management techniques proposed without a resident Canada goose lethal population reduction may completely offset or take longer to realize. Because there would be no discernible effect on soils, the overall impacts to soils as a result of alternative E would be negligible.

Cumulative Impacts—The negligible impacts on soils as a result of alternative E were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to soils, there would still be beneficial cumulative impacts on soils when added to the negligible impacts from alternative E.

Conclusion—Alternative E would result in overall negligible impacts on soils, erosion, and the ability of soils to support native vegetation because soils would not be impacted, or the effects on soils would be undetectable. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

WATER RESOURCES

This section discusses the plan impacts to the water resources in the study area, including hydrology and water quality.

HYDROLOGY

Guiding Regulations and Policies

NPS *Management Policies* 2006 state that the NPS would "take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the Clean Water Act and all other applicable federal, state, and local laws and regulations" (NPS 2006a).

Assumptions and Methodologies

Potential impacts to water resources are assessed based on the extent of disturbance to hydrology. Hydrology refers to the water-related processes, such as stream and channel flow as well as overland or sheet flow. The high amount of impervious surface associated with a developed area such as the District reduces the total amount of rainfall, which infiltrates into the ground. The impacts of reduced infiltration are lowered groundwater levels and diminished base flows in perennial streams (USACE 1994). Impacts from the proposed alternatives to hydrology were assessed qualitatively.

To understand the effects of wetland and resident Canada goose management on the water resources throughout the park, park resources inventories, scientific literature and research, and published technical data were consulted to identify the information contained in this analysis.

Primary steps for assessing impacts to the water resources include identifying:

- surface waters in areas likely to be affected by the proposed management activities,
- potential changes in hydrology from current and future management activities.

The geographic study area for water resources includes areas within the park as well as adjacent areas within the Anacostia River and the greater Anacostia Watershed that could be impacted by wetland and resident Canada goose management activities.

Impact Threshold Definitions

The following thresholds were used to determine the magnitude of impacts on hydrology and water quality:

Negligible: Changes in hydrologic conditions would not be detectable and would not have an appreciable effect or the effects would be at low levels of detection.

Adverse: *Minor*: Changes in hydrologic conditions would be detectable but would not be large enough to cause substantial local changes.

Moderate: Changes in hydrologic conditions would be readily apparent and they would result in substantial, noticeable effects to hydrology on a local scale.

Major: Changes in hydrologic conditions would be detectable beyond the immediate management area and would be readily measurable across large areas of the park.

Hydrology Alternatives Evaluation

Alternative A – No Action Alternative—Currently, resident Canada goose herbivory is reducing the quality and quantity of wetland vegetation in the watershed. This reduces the potential for wetland areas to trap pollutants and filter runoff, so improvements to hydrology in the watershed would not occur. The resident Canada goose population would not be intensively reduced as part of the no action alternative. Removal of sheet piling along Anacostia River Fringe Wetlands (which would require additional NEPA compliance) would result in beneficial impacts to hydrology and in hydrologic communication between the Anacostia River Fringe Wetland and the mainstem of the river (NPS 2008a); therefore, causing a beneficial impact to hydrology through reconnection of the river with the wetland in this immediate and local area. However, these beneficial impacts would be offset by the lack of any other wetland management techniques in this alternative that could improve hydrology in the watershed. In addition, it is expected that over the life of this plan/EIS for the no action alternative, that the riverine wetland acreage within the Anacostia River in Anacostia Park would continue to erode based upon the NCR Hydrologist observations (Curtis 2010), resulting in a further loss of wetlands and aquatic habitat within the Anacostia River. This vegetation effectively protects wetland soils from eroding thus preventing further degradation of the wetlands in the river particularly during storm events (Curtis 2010).

As noted in the “Hydrology and the Role of Climate Change” section of chapter 3, changes in mean sea level rise (estimated to rise at Anacostia Park approximately 2 inches during the 15-year life of this plan), coastal flooding, drought, and the increase in extreme weather events such as intense precipitation and storm events would continue to occur under alternative A. When considering the effects of climate change on hydrology, it is possible that the base flow of the Anacostia River and associated tributaries could change as well as the depth and hydroperiod, which could influence the distribution of wetland areas (Erwin 2009). Because the floodplain is already disconnected from the Anacostia River in most areas, even a small reduction in base flow that results in a water quantity change could affect the distribution of sensitive shoreline wetlands along the Anacostia River. Wetland systems are vulnerable and particularly susceptible to changes in quantity of water supply and it is expected that climate change would have a

pronounced effect on wetlands through alterations in hydrological regimes (Erwin 2009). Increased flooding and increased flood runoff are also predicted to occur (Erwin 2009). This may cause increased erosion, especially if established wetland areas do not exist or are not created along shoreline of the Anacostia River. Landward or channelward migration of wetlands is another predicted effect of climate change. Therefore, identifying setback areas along the Anacostia River could be effective at establishing zones for natural coastal migration based on projected sea level rise. Some of the predicted impacts of sea level rise can be reduced by the removal of blockages along the River. Under alternative A, the sheet piling is proposed for removal, but this would not necessarily result in the inland migration of wetlands since the seawall would still be intact. Removing the sheet piling (which would require additional NEPA compliance) would allow an increased connection to the River, but could cause increased erosion of shoreline vegetation, especially under storm conditions, which are predicted to increase in severity and frequency as a result of climate change. Therefore, alternative A does not include techniques or actions that would counteract or reduce the potential pressures of climate change.

Continued, long-term minor adverse impacts to hydrology in the Anacostia River Watershed are anticipated as a result of the no action alternative because changes in hydrologic conditions would be detectable but would not be large enough to cause substantial local changes.

Cumulative Impacts—The 11th Street Bridge Replacement Project would result in permanent, adverse impacts to the Anacostia River, including adverse impacts resulting from the footprints of the pier extensions in the water and increased impervious surface. The placement of the extensions of the existing piers would have an impact on the existing riverbed, by replacing the existing habitat with a structure. However, the current and proposed wetland restoration projects along the Anacostia River such as the Anacostia Wetland Mitigation Project (ANA-11) should offset the adverse impacts described above and provide cumulative beneficial effects to hydrology of the Anacostia River Watershed. In addition to the NPS, the District Department of Transportation and projects associated with the AWI include implementing LID methods to treat stormwater and may include vegetated drainage swales, rain gardens, and/or treatment wetlands. A beneficial cumulative effect on hydrology should result from the combination of the projects that incorporate innovative stormwater management techniques.

The long-term minor adverse impacts on hydrology in and near Anacostia Park under alternative A were considered together with the effects of the projects mentioned above from other past, present, and reasonably foreseeable future actions. Since the projects listed above would be beneficial to hydrology, this would reduce the adverse effects of alternative A, resulting in a negligible cumulative impacts on hydrology.

Conclusion—Alternative A would result in overall long-term minor adverse impacts on hydrology because chemical or biological changes to hydrologic conditions would be detectable, but not large enough to cause local changes in hydrology. The cumulative impacts of this project when considered together with other projects in proximity to the park would be negligible.

Hydrology Impacts Common to All Action (Management) Alternatives

Wetland management techniques that are common to all action alternatives include addressing upland runoff, removing sheet piling along the Anacostia River Fringe Wetlands, and installing new rain garden areas. Resident Canada goose management techniques that are common to all action alternatives include population monitoring, installing/maintaining goose exclusion fencing, and education efforts regarding feeding wildlife and preparing technical brochures describing resident Canada goose management techniques. Considering new rain gardens and the removal of sheet piling along Anacostia River Fringe wetlands (which would both require additional NEPA compliance) would result in beneficial impacts to hydrology. Removing the sheet piling would result in hydrologic communication between the Anacostia

River Fringe Wetland and the mainstem of the river (NPS 2008a); therefore, causing a beneficial impact to hydrology through reconnection of the river with the wetland in this immediate and local area.

As noted in the "Hydrology and the Role of Climate Change" section of chapter 3, changes in mean sea level rise, increased upland runoff and invasive species colonization, changes to water level, and wetland migration are expected as a result of climate change. All action alternatives would include addressing upland runoff, including with one technique that includes filling rills to direct concentrated flow into wetlands. Upland runoff is expected to increase due to increased flooding events, and reducing upland runoff would help counteract the impacts of climate change. Tidal wetlands along the Anacostia River have water level changes of approximately 3 feet twice daily as well as occasional extreme water level changes of greater than 3 feet, which may affect vegetation establishment. Under all action alternatives, NPS could monitor the non-tidal wetlands within the park to determine if the establishment of wetland vegetation is being impacted by extreme water level changes. NPS could propose remedial actions to address the particular cause(s) of the problems. Monitoring would likely incorporate water level variations as a result of climate change. This would aid in understanding the nature of climatic changes that are likely to occur regionally in order to properly design wetland management and restoration at the park.

It has been suggested that the impacts of sea level rise can be ameliorated through the acquisition of inland buffer zones, which could provide an opportunity for habitats and wildlife to migrate inland (Erwin 2009). Although the park already owns the buffer zone along the Anacostia River, much of this zone is mowed/maintained grass immediately along the shoreline. All action alternatives would include, to some degree, planting new buffers along the shoreline and/or increasing the width of existing vegetative buffers. Although these vegetative buffers would be planted to act as barriers to the geese, planting the buffer zone with riparian vegetation would also ameliorate some of the effects of climate change for all action alternatives. As previously stated above for alternative 1, the removal of sheet piling at the Anacostia River Fringe Wetlands along the Anacostia River (which would require additional NEPA compliance) would not necessarily result in the inland migration of wetlands since the seawall would still be intact. Both adaptive management and wetland monitoring are key elements in each of the action alternatives. Monitoring is well known to be an essential element of wetland management, since it would allow detection of long-term change, specifically changes in the distribution of wetland areas at Anacostia Park that may result from climate change. Monitoring and adaptive management would provide insights to the potential consequences of climate change and help determine how future management practices should be implemented.

Other techniques such as installing new rain gardens would benefit hydrology since infiltrating stormwater into soils mimics natural drainage processes and reduces the volume of stormwater runoff that enters the Anacostia River during rain events; however, these areas may be too small and localized in nature to create a detectable impact on hydrologic conditions. Potential areas for rain gardens include Kenilworth Parkside, Langston Golf Course parking areas, parking lots surrounding the Anacostia Park Pavilion, and parking areas north and south of Pennsylvania Avenue. At this time, it is largely unknown what size and how many rain gardens are proposed. However, additional NEPA compliance would be required prior to construction of rain garden areas to adequately analyze the effects associated with the implementation of this technique (see table 1 in chapter 2). Overall, the techniques common to all action alternatives would result in negligible impacts to hydrology because the impacts would be at the lower levels of detection and because of the limited and localized nature of the proposed techniques.

Alternative B – High Wetland, High Resident Canada Goose Management—The resident Canada goose population would be intensively reduced as part of this alternative, which would result in improvements to wetland vegetation in the watershed. This alternative includes a suite of potential techniques to improve the hydrology of the watershed, including erosion control techniques,

removing/modifying structures that negatively affect the marsh, creating tidal guts, potential enforcement of no wake zones along the River, investigating the effects of extreme water level change, and considering altering water elevations. Revegetating and stabilizing areas along the river and proposed wetland restoration techniques would also benefit hydrology in the watershed. Hydrology would benefit as a result of alternative B because the riverine wetland acreage within the Anacostia River in Anacostia Park would not continue to erode and wetlands and aquatic habitat within the Anacostia River would be preserved. This vegetation effectively protects wetland soils from eroding thus preventing further degradation of the wetlands in the river particularly during storm events (Curtis 2010). As a result of climate change, increased flooding and increased flood runoff could occur, which may allow for increased erosion if wetland areas are not established along shorelines (Erwin 2009). Alternative B includes techniques to control shoreline erosion, primarily focusing on areas of the marsh at low elevations and near the surface where vegetation/mud flat and water interface. These erosion control techniques would aid in offsetting potential pressures of climate change in addition to the techniques described above that are common to all action alternatives. The combination of removing sheet piling (which would require additional NEPA compliance) and seawall breaks at the Anacostia River Fringe Wetlands along the River would allow the inland migration of wetlands (which is currently blocked) that would occur as a result of sea level rise. This action would also aid in counteracting potential pressures of climate change by allowing the inland and channelward migration of wetlands along the River. Alternative B incorporates the most techniques to offset the predicted effects to hydrology that would result from climate change.

Additional wetland management techniques such as reducing impervious areas would also benefit hydrology. The combination of techniques described above would benefit hydrology since infiltrating stormwater into soils mimics natural drainage processes and reduces the volume of stormwater runoff that enters the Anacostia River during rain events; stream and channel flow would also be improved by removing and/or modifying structures that impede flow, thus benefiting hydrology as well. Therefore, alternative B would result in beneficial impacts to hydrology that would be detectable but localized in the watershed as a result of improved wetlands along the Anacostia River through wetland management and resident Canada goose management techniques.

Cumulative Impacts—The beneficial impacts on hydrology as a result of alternative B were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to hydrology, there would be beneficial cumulative impacts on hydrology when added to the beneficial impacts from alternative B.

Conclusion—Alternative B would result in overall beneficial impacts on hydrology from wetland restoration, erosion control, and a reduction in herbivory. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

Alternative C – Moderate Wetland, Moderate Resident Canada Goose Management—Alternative C includes many of the same wetland management and resident Canada goose management techniques proposed as alternative B, although in general this alternative uses less intensive techniques. Compared to alternative B, alternative C would not include creating tidal guts and would not consider stream daylighting or seawall breaks and options for removal of structures that result in erosion and clogging the marsh would be more limited than alternative B. Overall, impacts to hydrology for alternative C would be the same as alternative B: beneficial because the wetland management and resident Canada goose management techniques would locally improve hydrology through stormwater infiltration that would reduce the volume of runoff that enters the Anacostia River during rain events and improved stream and channel flow. Similar to the discussion for alternative B above, increased flooding and increased flood runoff could occur as a result of climate change, which may allow for increased erosion if wetland areas are not established along shorelines (Erwin 2009). Alternative C includes techniques to control shoreline

erosion, primarily focusing on areas of the marsh at low elevations and near the surface where vegetation/mud flat and water interface. These erosion control techniques would aid in offsetting potential pressures of climate change in addition to the techniques described above that are common to all action alternatives. Even though alternative C includes fewer wetland management techniques and a less intensive resident Canada goose population reduction compared to alternative B, this difference is not considered large enough to cause a change in the intensity of the impact (beneficial) to the hydrology at the park. An overall, beneficial impact for alternative C is appropriate because improvements to hydrology would be detectable, but these beneficial impacts would be small and localized.

Cumulative Impacts—The beneficial impacts on hydrology as a result of alternative C were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to hydrology, there would be beneficial cumulative impacts on hydrology when added to the beneficial impacts from alternative C.

Conclusion—Alternative C would result in overall beneficial impacts on hydrology from an improvement to the soil from vegetation planting and herbivory reduction. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

Alternative D – Low Wetland, Low Resident Canada Goose Management—Alternative D has limited wetland management and resident Canada goose management techniques proposed and no initial lethal reduction activities. The one-time population reduction would not have a short-term or long-term effect on hydrology and goose herbivory of vegetation would continue. Additionally, alternative D does not include wetland management techniques such as reduction in impervious surface, or addressing upland runoff. Only the techniques described above that are common to all action alternatives would aid in offsetting potential pressures of climate change under alternative D. No erosion control techniques are proposed to improve hydrology and no new wetland restoration techniques are included as part of alternative D. Therefore, alternative D results in negligible impacts to hydrology because no changes to hydrologic conditions are expected.

Cumulative Impacts—The negligible impacts on soils as a result of alternative D were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to hydrology, there would be beneficial cumulative impacts on hydrology when added to the negligible impacts from alternative D.

Conclusion—Alternative D would result in overall negligible impacts on hydrology because chemical or biological changes to hydrologic conditions would not be detectable or the effects would be at low levels of detection. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

Alternative E – High Wetland, Moderate Resident Canada Goose Management, with No Lethal Control—Alternative E has the same wetland management techniques proposed as alternative B but the resident Canada goose management techniques proposed do not include lethal population reduction activities. New wetland restoration techniques are proposed, which would trap pollutants such as sediment through plantings and increased vegetative cover. However, no lethal control for resident Canada geese is proposed, and therefore goose herbivory of vegetation would continue. Similar to the discussion for alternative B, increased flooding and increased flood runoff could occur as a result of climate change, which may allow for increased erosion. Alternative E includes techniques to control shoreline erosion, primarily focusing on areas of the marsh at low elevations and near the surface where vegetation/mud flat and water interface. These erosion control techniques would aid in offsetting potential

pressures of climate change in addition to the techniques described above that are common to all action alternatives. The combination of removing sheet piling (which would require additional NEPA compliance) and seawall breaks at the Anacostia River Fringe Wetlands along the River would allow migration of wetlands (which is currently blocked) that would occur as a result of sea level rise. This action would also aid in counteracting potential pressures of climate change by allowing the inland and channelward migration of wetlands along the River. Alternative E, like alternative B, incorporates the most techniques to offset the predicted effects to hydrology that would result from climate change.

Alternative E would result in negligible impacts to hydrology because no changes to hydrologic conditions are expected.

Cumulative Impacts—The negligible impacts on soils as a result of alternative E were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to hydrology, there would be beneficial cumulative impacts on hydrology when added to the negligible impacts from alternative E.

Conclusion—Alternative E would result in overall negligible impacts on hydrology because chemical or biological changes to hydrologic conditions would not be detectable, or the effects would be at low levels of detection. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

WATER QUALITY

Guiding Regulations and Policies

NPS *Management Policies* 2006 state that the NPS would "take all necessary actions to maintain or restore the quality of surface waters and ground waters within the parks consistent with the Clean Water Act and all other applicable federal, state, and local laws and regulations" (NPS 2006a). The NPS has also established general goals for water quality, and in accordance with these goals, the NPS works cooperatively with the state to protect and enhance the quality of water in national park units. The Clean Water Act (33 USC 1251 et seq.) protects and restores the quality of natural waters through the establishment of nationally recommended water quality standards. Under the oversight of the USEPA, states administer provisions of the Clean Water Act by establishing water quality standards and managing water quality. According to USEPA regulations, water quality standards must:

- designate uses of the water,
- set minimum narrative or numeric criteria sufficient to protect the uses, and
- prevent degradation of water quality through antidegradation provisions.

In accordance with the Clean Water Act, the current use of the Anacostia River as defined by the District WQS is Class B Water (Secondary Contact Recreation).

Assumptions and Methodologies

Potential impacts to water resources are assessed based on the extent of disturbance to water quality. Water quality impacts were determined based on the sustainability of surface water for wildlife and human contact. Other considerations in assessing the magnitude of water quality impacts are the effect of those resources dependent on a certain quality or condition of water. In general and applicable to this document, turbidity is caused by suspended matter or impurities (including clay and silt) that interfere

with the clarity of the water; therefore, turbidity can be correlated to sediment transport and can affect water quality. Wetlands can minimize or reduce sediment transport off-site because particles can settle in the wetlands. Generally, if turbidity is decreased through reduced sediment transport, water clarity and thus water quality can be improved.

To understand the effects of wetland and resident Canada goose management on the water resources throughout the park, park resources inventories, scientific literature and research, and published technical data were consulted to identify the information contained in this analysis.

Primary steps for assessing impacts to the water resources include identifying:

- surface waters in areas likely to be affected by the proposed management activities,
- potential changes in hydrology from current and future management activities.

The geographic study area for water resources includes areas within the park as well as adjacent areas within the Anacostia River and the greater Anacostia Watershed that could be impacted by wetland and resident Canada goose management activities.

Impact Threshold Definitions

The following thresholds were used to determine the magnitude of impacts on hydrology and water quality:

Negligible: Chemical or biological changes to water quality would not be detectable and would not have an appreciable effect or the effects would be at low levels of detection.

Adverse: *Minor*: Chemical or biological changes to water quality would be detectable but would not be large enough to cause substantial local changes. Specifically, resulting changes in soil erosion rates and stormwater flows would cause localized alterations to turbidity that could affect water quality.

Moderate: Chemical or biological changes to water quality would be readily apparent and they would result in substantial, noticeable effects to water quality, ground water, and hydrology on a local scale. Specifically, resulting changes in soil erosion rates and stormwater flows would cause widespread but intermittent alterations to turbidity that would affect water quality.

Major: Chemical or biological changes to water quality would be detectable beyond the immediate management area and would be readily measurable across large areas of the park. Specifically, resulting changes in soil erosion rates and stormwater flows would cause frequent alterations to turbidity over an extensive area and would affect water quality and could result in modifications to the natural stream channel and instream flow characteristics.

Water Quality Alternatives Evaluation

Alternative A – No Action Alternative—Currently, resident Canada goose herbivory is reducing areal coverage of wetland vegetation. This reduces the potential for wetland areas to trap sediment (and associated pollutants binding to sediment), and creates bare areas in the wetlands so improvements to water quality in the Anacostia River would not occur. Additionally, no wetland management techniques

are being proposed to improve water quality and the no action alternative includes continuing only limited trash removal (trash is a pollutant causing impairment in the Anacostia River as defined by DCDE [2008]). Because no new wetland restoration techniques and no lethal population reduction strategies for the resident Canada goose are proposed as part of the no action alternative, bare areas in the wetlands (due to herbivory) and thus sediment scouring would continue to occur and affect the water quality of the Anacostia River in the vicinity of the park. Removing sheet piling along the Anacostia River Fringe wetlands (which would require additional NEPA compliance) would have a short-term, minor adverse effect on water quality due to erosion that would occur and the detectable but localized chemical changes that would follow this process. Erosion of soil into waterways can cause an increase in turbidity and result in reduced water clarity and water quality.

The USFWS (2005) has stated that degradation of water quality by either fecal contamination or erosion of sediments from areas denuded by goose grazing or trampling does occur, although this impact has not been quantified at the park. However, it has been estimated that with 500 or so geese during the summer and possibly 700 in the winter in the park, it is clear that the resident Canada geese do add to the contamination of the river, but this percentage is unknown and could be anywhere from one percent to 15 percent of the total (Bates 2010b). Specific effects to water quality as a result of fecal contamination by resident Canada geese have not been studied at Anacostia Park. It is unknown whether the water quality in the Anacostia River is measurably affected by fecal droppings from the resident Canada goose population in the park due to the large size of the Anacostia River. However, the combination of potential impacts to water quality from goose fecal contamination (which has not been proven at the park) and the increased erosion from excessive grazing, would negatively impact water quality.

Overall, continued long-term minor adverse impacts to water quality are anticipated as a result of the no action alternative. These adverse impacts to water quality would occur during storm events due to exposed and eroding banks where vegetation does not currently exist along the Anacostia River, erosion of soil into waterways that can cause an increase in turbidity, a decrease in water clarity, and reduced water quality.

Cumulative Impacts—The Anacostia River has heavy siltation, accumulated toxins in sediments, and sewage overflows, which all contribute to poor water quality in this section of the river (NPS 2004a). Specifically, the Anacostia River and Kingman Marsh continue to receive nonpoint discharges derived from adjacent, impervious areas as well as impacts from CSOs along the river. Due to the numerous redevelopment projects proposed in the vicinity of Anacostia Park, including components of the AWI such as Poplar Point as well as the 11th Street Bridge Replacement Project, these projects would have an adverse impact on water quality. Erosion of soil from construction sites into waterways can cause an increase in turbidity and reduced water quality. As stated above in the soils section, these development and construction projects would require compliance with the District DOH Watershed Protection Division, Sediment and Storm Water Technical Services Branch, District WQS for Surface Water (21 DCMR Ch.11), District DOE, DC Water Management Plan per the Water Pollution Control Act of 1984 (DC Law 5- 188), and Section 402 of the Clean Water Act, also referred to as NPDES to minimize impacts to water quality. However, the changes to water quality as a result of the current and proposed projects listed above are still small when considered in relation to the ongoing dredging program of the lower Anacostia by the USACE for contaminated sediment removal. The current and future projects discussed above would have a long-term moderate adverse impact on water quality in the Anacostia River.

Fecal matter from resident Canada geese generally influences water quality in situations where the waterbodies are characterized as stagnant or standing water (USFWS 1999; Rutgers 2004). Canada goose fecal matter can also lead to eutrophication (excessive richness of nutrients in a body of water) of small water bodies, especially those that have restricted circulation and flow-through, which in turn may

stimulate algae and weed growth (French 2001). Although the Anacostia River does have backwater conditions that could be considered stagnant during certain tidal cycles, fecal matter from geese and its impact on water quality and human health has not been studied at Anacostia Park. Fecal matter is described as a contributing factor to water quality in combination with other factors such as effects of goose herbivory. It is known and stated that resident Canada goose herbivory reduces areal coverage of wetland vegetation. This reduces the potential for wetland areas to trap sediment (and associated pollutants binding to sediment), and creates bare areas in the wetlands.

The water quality of the Anacostia River is being affected by increased erosion occurring from excessive grazing that affects water quality and causes increased sediments introduced from runoff and eroded soils in the Anacostia River as well as resident Canada geese fecal droppings. However, these impacts are small in comparison to the water quality issues in the District, including issues associated with CSOs and the effluent from Blue Plains Advanced Wastewater Treatment Plant, located less than one mile downstream from Anacostia Park. As a result of a consent decree that the USEPA signed with District WASA in 2004, CSO discharge would be reduced by a projected 98 percent in the Anacostia River when the project is fully implemented (DCWASA 2010). This would result in a beneficial, impact to water quality in the Anacostia River (DCWASA 2008).

Although many current and future projects are proposed along the Anacostia River, many of these projects aim to improve the water quality of the river, thus providing an overall beneficial cumulative impact that would offset the projects with adverse impacts listed above. Specifically, the AWI proposes to substantially improve water quality in the Anacostia River through the implementation of a combined sewer containment plan, wetland restoration, tributary stream daylighting, and environmental guidelines governing future development along the Anacostia watershed. Environmental programs associated with the Woodrow Wilson Project have included non-tidal wetland creation to provide water quality treatment for uncontrolled stormwater runoff. The required implementation of stormwater treatment methods for proposed projects such as the 11th Street Bridge Replacement Project should minimize the cumulative impacts to water quality, with potential for a net improvement. All current and proposed wetland restoration projects along the Anacostia River such as the Anacostia Wetland Mitigation Project (ANA-11), which restored a 54-acre tidal wetland should provide cumulative beneficial effects to water quality in the Anacostia River. The ANA-11 project specifically incorporated goals identified in the Anacostia Watershed Toxics Alliance 2002 Management Plan related to wetland functions of improving water quality by serving as a filter for overland run-off and attenuating sediments and nutrients. In addition to the NPS, the District DOT and projects associated with the AWI include implementing LID methods to treat stormwater and may include vegetated drainage swales, rain gardens, and/or treatment wetlands. The addition of these treatment methods, where none currently exist or to mitigate proposed development should have a beneficial impact on the quality of stormwater runoff discharging to the river. Some of the area projects may also provide opportunities for separation of some stormwater from the combined sewer, which would translate to a proportionately lower volume of discharge from CSOs to the river.

The long-term minor adverse impacts on water quality in the Anacostia River in and near Anacostia Park under alternative A were considered together with the effects of the projects mentioned above from other past, present, and reasonably foreseeable future actions. Since the projects listed above would be beneficial to water quality this would reduce the adverse effects of alternative A resulting in a negligible cumulative impact on water quality.

Conclusion—Alternative A would result in overall long-term minor adverse impacts on water quality because chemical or biological changes to the water quality would be detectable but not large enough to cause local changes in water quality. The cumulative impacts of this project when considered together with other projects in proximity to the park would be negligible.

Water Quality Impacts Common to All Action (Management) Alternatives

Wetland management techniques that are common to all action alternatives include addressing upland runoff, removing sheet piling along Anacostia River Fringe Wetlands, and installing new rain garden areas. Removing the sheet piling along the Anacostia River Fringe Wetlands and installing rain garden areas would require additional NEPA compliance. Resident Canada goose management techniques that are common to all action alternatives include population monitoring, installing/maintaining goose exclusion fencing, and education efforts regarding feeding wildlife and preparing technical brochures describing resident Canada goose management techniques. The Anacostia River has heavy siltation, accumulated toxins in sediments, and sewage overflows, which all contribute to poor water quality in this section of the river (NPS 2004a). The resident Canada goose management techniques described above for all action alternatives would have a negligible impacts on water quality because there would be no chemical or biological changes to water quality as a result of these techniques, thus supporting a negligible impact. Removing sheet piling along the Anacostia River Fringe Wetlands would have a short-term minor adverse effect on water quality due to erosion that would occur and the detectable but localized chemical changes that would follow this process. Erosion of soil into waterways can cause an increase in turbidity and result in reduced water clarity and water quality. It was concluded by NPS (2008b) in a hydraulic evaluation of the Anacostia River Fringe Wetland that when the sheet pile is removed, erosion may occur but even high magnitude flows would not necessarily result in substantial or even moderate erosion of the Anacostia River Fringe Wetland. It is very likely that some portion of the Anacostia River Fringe Wetland would be reworked and eroded by the river, but it is also quite likely that a sizable portion of the wetland would remain similar to its present configuration (NPS 2008a).

Installing new rain gardens may adversely affect water quality during construction in the short-term but also benefit water quality in the long-term by trapping pollutants (nutrients, sediment, and pathogens) carried by runoff and reducing the amount of impervious area in the park. Addressing upland runoff may also trap pollutants that would otherwise enter the Anacostia River as described above for rain gardens. However, the areas proposed for rain gardens and addressing upland runoff may be too small and localized in nature to create a detectable impact on water quality and thus a negligible impact to water quality would occur. Potential areas for rain gardens include Kenilworth Parkside, Langston Golf Course parking areas, parking lots surrounding the Anacostia Park Pavilion, and parking areas north and south of Pennsylvania Avenue. At this time, it is largely unknown what size and how many rain gardens are proposed. However, additional NEPA compliance would be required prior to construction of rain garden areas to adequately analyze the effects associated with the implementation of this element (see table 1 in chapter 2). Overall, the techniques common to all action alternatives would result in negligible impacts to water quality because the impacts would be at the lower levels of detection and because of the limited and localized nature of all the proposed techniques.

Alternative B – High Wetland, High Resident Canada Goose Management—The resident Canada goose population would be intensively reduced as part of this alternative, which would result in improvements to wetland vegetation. Erosion and sedimentation in wetlands are integral functions of the ecosystem, and can affect both vegetation and water quality, including serving as depositional environments and preventing the downstream passage of excess nutrients or harmful chemicals (Drake and Paulin 2003). Wetland management techniques are proposed to improve the existing wetlands and create new wetlands along the Anacostia River. Wetlands can serve as a trap for nutrients and sediment (and associated pollutants and pathogens binding to sediment) carried by runoff from surrounding uplands or contiguous wetlands. Wetlands have the ability to process these nutrients into other forms and trap pollutants as well as sediment by capturing and settling particles, thus decreasing turbidity, improving water clarity, and improving water quality in the Anacostia River. Wetlands also function to prevent the adverse effects associated with excess nutrients entering surface waters, such as the Anacostia River. During the time when newly planted vegetation in wetland areas is being established, a short-term minor

adverse impact to water quality would occur. Some erosion of soil into the Anacostia River would occur and would cause an increase in turbidity, a decrease in water clarity and water quality in localized areas.

Other wetland management park operations techniques (trash management, reduction of impervious areas, new rain gardens) as well as hydrology techniques (erosion control techniques, removing/modifying structures, and addressing upland runoff) would improve water quality as part of alternative B by reducing urban runoff and associated pollutants that enter the Anacostia River. Water quality would also be improved through a reduced resident Canada goose population. Reducing the population would decrease the number of fecal droppings and decrease the amount of erosion from excessive grazing, thus improving water quality through decreased pathogens and decreased sediments introduced from runoff and eroded soils. The combination of techniques included as part of alternative B may cause a discernible improvement in water quality in the vicinity of the park. Therefore, alternative B would result in beneficial impacts to water quality because improvements would be detectable but would not cause substantial local changes. Some hydrology techniques (removing or modifying structures that result in erosion and clogging of marsh and creating tidal guts) would also have a short-term, adverse impact on water quality during construction from land disturbance activities that cause erosion and would range from negligible to minor impacts, depending on the area disturbed. However, water quality impacts would be minimized by appropriate BMPs and may include E&S plans, revegetation plans, NPDES permits, or other required documents in the District, depending on the total area disturbed.

Because the 2008 list of *Impaired District Waters and Pollutants* within and adjacent to Anacostia Park includes for the first time trash as a pollutant causing impairment (as defined by DCDE [2008]), alternative B includes trash management as a technique under park operations and management. Since the main source of trash in the Anacostia River is litter and illegal dumping (AWRP and MWCOG 2007), trash management would have a beneficial impact on water quality by reducing the amount of litter and dumping that occurs in the Anacostia River.

Techniques considered in resident Canada goose management are proposed to reduce goose herbivory and improve wetland vegetation. As stated above in alternative A, specific effects to water quality as a result of fecal matter by resident Canada geese within the park has not been studied. Generally, improvements to water quality should occur as a result of alternative B due to a reduced resident Canada goose population, which should not only decrease the amount of fecal droppings but also reduce erosion and decrease sediments introduced from runoff and eroded soils that is occurring through herbivory of vegetation along the shoreline.

As a result of alternative B, improvements to water quality would be detectable, but these beneficial impacts would be small and localized. Alternative B would also have a short-term adverse impact on water quality and would range from negligible to minor, depending on the area disturbed due to land disturbance activities and during storm events while the newly planted vegetation is being established. Overall, alternative B would result in beneficial impacts to water quality as a result of improved wetlands along the Anacostia River through very high wetland management and high resident Canada goose management because improvements would be detectable but would not cause substantial local changes.

Cumulative Impacts—The beneficial impacts on water quality as a result of alternative B were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to water quality, there would be beneficial cumulative impacts on water quality when added to the beneficial impacts from alternative B.

Conclusion—Alternative B would result in overall beneficial impacts on water quality from wetland improvements, erosion control, and a reduction in herbivory. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

Alternative C – Moderate Wetland, Moderate Resident Canada Goose Management—Alternative C includes many of the same wetland management and resident Canada goose management techniques proposed as alternative B, although in general this alternative uses less intensive techniques. Compared to alternative B, alternative C includes only limited removal of structures, both mechanical and passive seedbank regeneration, and the least invasive stream/stormwater outfall modifications. Alternative C would not include creating tidal guts, consider stream daylighting, seawall breaks, and planting efforts would be at a lower density than alternative B. Overall, impacts to water quality as a result of alternative C would be the same as alternative B: beneficial because the wetland management and resident Canada goose management techniques would improve water quality by reducing urban runoff and associated pollutants, decreasing soil loss through plantings and reduced goose herbivory of vegetation, and reducing fecal matter from geese. Alternative C would also have a short-term, adverse impact on water quality and would range from negligible to minor, depending on the area disturbed due to land disturbance activities and during storm events while the newly planted vegetation is being established. Even though alternative C includes fewer wetland management techniques and a less intensive resident Canada goose population reduction compared to alternative B, this difference is not considered large enough to cause a change in the intensity of the impact (beneficial) to water quality at the park. An overall, beneficial impact for alternative C is appropriate because improvements to water quality would be detectable, but these beneficial impacts would not cause substantial local changes.

Cumulative Impacts—The beneficial impacts on water quality as a result of alternative C were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to water quality, there would be beneficial cumulative impacts to water quality when added to the beneficial impacts from alternative C.

Conclusion—Alternative C would result in overall beneficial impacts on water quality from a reduction in urban runoff, erosion control, and a reduction in herbivory. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

Alternative D – Low Wetland, Low Resident Canada Goose Management—Alternative D has limited wetland management and resident Canada goose management techniques proposed and no initial lethal reduction activities. The one-time population reduction would have a short-term effect on water quality through reduced resident Canada goose numbers and herbivory, but a long-term improvement to water quality would not occur. Additionally, alternative D does not include wetland management techniques such as reduction in impervious surface or addressing upland runoff. No erosion control techniques to improve hydrology and no new wetland restoration techniques are proposed as part of alternative D. Therefore, alternative D results in long-term minor adverse impacts to water quality.

Cumulative Impacts—The long-term minor adverse impacts on water quality as a result of alternative D were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to water quality. This should reduce some of the adverse impacts to water quality from implementation of this alternative resulting in a negligible cumulative impact on water quality.

Conclusion—Alternative D would result in overall long-term minor adverse impacts on water quality because chemical or biological changes to the water quality would be detectable but not large enough to

cause local changes in water quality. The cumulative impacts of this project when considered together with other projects in proximity to the park would be negligible.

Alternative E – High Wetland, Moderate Resident Canada Goose Management, with No Lethal Control—Alternative E has the same wetland management techniques proposed as alternative B but the resident Canada goose management techniques proposed do not include lethal population reduction activities. New wetland restoration techniques are proposed, which would trap pollutants such as sediment through plantings and increased vegetative cover. Alternative E would have a short-term minor adverse impact on water quality during storm events while the newly planted vegetation is being established. Because no lethal control for resident Canada geese is proposed, goose herbivory of vegetation would continue in the long-term. The benefits from a full suite of wetland management techniques proposed without a resident Canada goose lethal population reduction may be either completely offset or take longer to realize. Because there would be no discernible effect on water quality, the overall impacts to water quality as a result of alternative E would be negligible.

Cumulative Impacts—The negligible impacts on water quality as a result of alternative E were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to water quality, there would be beneficial cumulative impacts on water quality when added to the negligible impacts from alternative E.

Conclusion—Alternative E would result in overall negligible impacts on water quality because chemical or biological changes to water quality would not be detectable, or the effects would be at low levels of detection. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

FLOODPLAINS

NPS *Management Policies 2006* state that the park would manage for the preservation of floodplain values; minimize potentially hazardous conditions associated with flooding; and comply with the NPS Organic Act and all other federal laws and executive orders related to the management of activities in flood-prone areas (NPS 2006a). Specifically the NPS would:

- protect, preserve, and restore natural resources and functions to floodplains;
- avoid the long- and short-term environmental effects associated with the occupancy and modification of floodplains; and
- avoid direct and indirect support of floodplain development and actions that could adversely affect the natural resources and functions of floodplains or increase flood risks (NPS 2006a).

Executive Order 11988, “Floodplain Management” directs all federal agencies to avoid both long- and short-term adverse effects associated with occupancy, modification, and development within the 100-year floodplain, when possible. All federal agencies are required to avoid building in a 100-year floodplain unless no other practicable alternative Exists.

Assumptions and Methodologies

Impacts from the proposed alternatives to the 100-year floodplain were assessed qualitatively. Primary steps for assessing impacts to the 100-year floodplain include identifying:

- 100-year floodplains in areas likely to be affected by the proposed management activities.

The geographic study area for the 100-year floodplain includes areas within the park that could be impacted by wetland and resident Canada goose management activities.

Impact Threshold Definitions

The following thresholds were used to determine the magnitude of impacts on the 100-year floodplain:

Negligible: The impact on the 100-year floodplain would not be measurable. Any effects on functionality of the 100-year floodplain would be slight.

Adverse: *Minor*: Impacts would be measurable or perceptible but would be localized within a relatively small area. The overall functionality of the 100-year floodplain would not be affected.

Moderate: An action would result in a change in quantity or alteration of the 100-year floodplain and overall functionality of the floodplain. Impacts would cause a change in the 100-year floodplain; however, the impact would remain localized.

Major: An action would result in a change in the 100-year floodplain that would be substantial, highly noticeable, and permanent. Impacts would affect overall floodplain functionality in a relatively large area. Significant floodplain processes would be altered, and landscape-level changes would be expected.

Floodplains Alternatives Evaluation

Alternative A – No Action Alternative—Currently, resident Canada goose herbivory is reducing the quality and quantity of wetland vegetation in the watershed. The resident Canada goose population would not be intensively reduced as part of the no action alternative. Removing sheet piling along the Anacostia River Fringe Wetlands (which would require additional NEPA compliance) would have a short-term minor adverse effect on floodplains due to erosion that would occur within the floodplains but a beneficial impact would occur because the functionality of the floodplain would be improved by removing structures in the floodplain. However, this beneficial impact from removing sheet piling would be offset by the lack of other wetland management techniques in this alternative that are not being proposed to improve floodplains in the watershed. It is estimated that over the life of this plan/EIS, the riverine wetlands would continue to erode (NPS 2010d, Curtis 2010), resulting in a further loss of the floodplain. It is also expected that the number of resident Canada geese would continue to increase and graze within the floodplain, resulting in a decrease of vegetation that protects the soil from potential erosion (Curtis 2010). Overall, the floodplain is disconnected from the Anacostia River and from draining the historic wetlands, which causes a measurable, but localized impact within the park. Continued, long-term minor adverse impacts to floodplains along the Anacostia River Watershed are anticipated as a result of the no action alternative.

Cumulative Impacts—A large portion of Anacostia Park was created by filling the historic river channel, which created floodplain, but disconnected it from the Anacostia River and reduced floodplain functionality. Projects associated with the AWI, including Poplar Point could affect the floodplain through development along the Anacostia River. The 11th Street Bridge Replacement Project would span the floodplain except for the piers in the river and would impact up to 2.4 acres of floodplains along the Anacostia River. The impact to the floodplain from these projects may not measurably alter flood elevations but may reduce floodplain storage along the Anacostia River. Therefore, these projects would provide a cumulative negligible impact to the floodplain in and near Anacostia Park.

The long-term minor adverse impacts on the floodplain in and near Anacostia Park under alternative A were considered together with the effects of the projects mentioned above from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would have a negligible impact to floodplains, there would be long-term minor adverse cumulative impacts under the no action alternative. The negligible impacts from the projects listed above are not expected to add to the long-term minor adverse impacts of alternative A.

Conclusion—Alternative A would result in overall long-term minor adverse impacts on floodplains because the impacts would be measurable or perceptible, but would be localized and would not affect the overall functionality of the 100-year floodplain. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term minor and adverse.

Floodplain Impacts Common to All Action (Management) Alternatives

Wetland management techniques that are common to all action alternatives include addressing upland runoff, removing sheet piling along Anacostia River Fringe Wetlands, and installing new rain garden areas. Resident Canada goose management techniques that are common to all action alternatives include population monitoring, installing/maintaining goose exclusion fencing, and education efforts regarding feeding wildlife and preparing technical brochures describing resident Canada goose management techniques. With the exception of installing new rain gardens and the removal of sheet piling along Anacostia River Fringe Wetlands (both which would require additional NEPA compliance), the techniques described above for all action alternatives would have a negligible impact on floodplains because there would be no change in the functionality of the floodplain due to the limited and localized nature of all the techniques.

Removing sheet piling along the Anacostia River Fringe Wetlands would have a short-term minor adverse effect on floodplains due to erosion that would occur within the floodplains but a beneficial impact would occur because the functionality of the floodplain would be improved by removing structures in the floodplain. The planned removal of the sheet piling would result in hydrologic communication between the Anacostia River Fringe Wetland and the mainstem of the river, therefore, causing a beneficial impact to floodplains through reconnection of the river with the wetland. Installing new rain gardens may disturb portions of the floodplain during construction in the short-term but may also increase flood attenuation in the long-term and help reduce the amount of impervious area in the park; however, these areas may be too small and localized in nature to create a detectable impact on floodplains. Potential areas for rain gardens include Kenilworth Parkside, Langston Golf Course parking areas, parking lots surrounding the Anacostia Park Pavilion, and parking areas north and south of Pennsylvania Avenue. At this time, it is largely unknown what size and how many rain gardens are proposed. For projects that would require additional NEPA compliance, when it is not practicable to locate or relocate projects outside of the floodplain and not affecting the floodplain, NPS would prepare and approve a SOF for activities in a floodplain. Overall, the techniques common to all action alternatives would result in negligible impacts to floodplains due to the limited and localized nature of the proposed techniques.

Alternative B – High Wetland, High Resident Canada Goose Management—The resident Canada goose population would be intensively reduced as part of this alternative, which would result in improvements to wetland vegetation in the floodplain. This alternative includes a suite of potential techniques to improve the floodplains along the river, including erosion control techniques, removing/modifying structures that negatively affect the marsh, creating tidal guts, addressing upland runoff, potential enforcement of no wake zones along the river, investigating the effects of extreme water level change, and considering altering water elevations. Additional wetland management techniques included in park operations and management would improve the floodplains: reduction of impervious areas and installation of new rain garden areas. Some wetland restoration techniques would improve the

floodplains through reconnection with the Anacostia River and include possible daylighting of storm sewers and the removal of portions of the seawall. The flood protection levee (composed of both earthen berm and concrete) as well as the seawall along the shoreline have disconnected portions of the floodplain with the Anacostia River in the park. Reconnection of the floodplain with the Anacostia River as a result of techniques included in alternative B would restore the functionality of the floodplain. For projects that would require additional NEPA compliance, when it is not practicable to locate or relocate projects outside of the floodplain and not affecting the floodplain, NPS would prepare and approve a SOF for activities in a floodplain. Negligible impacts to the floodplains would result from alternative B due to soil disturbance and/or construction in the floodplains for wetland restoration techniques. However, alternative B would result in overall beneficial impacts to floodplains along the Anacostia River through wetland management and resident Canada goose management because floodplain function would improve in localized areas of the park. The majority of beneficial effects would be through improvements to wetlands, additional vegetative buffer plantings along the river, and the removal of impervious surface in the watershed as well as potential flood attenuation through wetland restoration techniques. Flood attenuation and/or alteration enables a wetland to reduce flood damage from prolonged periods of precipitation by storing and desynchronizing (i.e., gradually releasing at lower heights/velocities) floodwaters. A secondary benefit of flood attenuation is the economic value of flood protection through reduced property damage.

Cumulative Impacts—The beneficial impacts on the floodplain as a result of alternative B were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would have negligible impacts to floodplains, there would be beneficial cumulative impacts on floodplains when added to the beneficial impacts from alternative B.

Conclusion—Alternative B would result in overall beneficial impacts on the floodplain from the reconnection of wetlands with the river, and wetland restoration. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

Alternative C – Moderate Wetland, Moderate Resident Canada Goose Management—Alternative C includes many of the same wetland management and resident Canada goose management techniques proposed as alternative B, although in general less intensive techniques. Compared to alternative B, alternative C includes only limited removal of structures and least invasive stream/stormwater outfall modifications. No seawall breaks and no daylighting are proposed for alternative C to reconnect the floodplain with the Anacostia River. Therefore, impacts to floodplains as a result of alternative C would be negligible because floodplain function would only be slightly affected or improved and these impacts would not be measurable. For projects that would require additional NEPA compliance, when it is not practicable to locate or relocate a project outside of a floodplain and not affecting the floodplain, the NPS would prepare and approve a SOF for activities in a floodplain.

Cumulative Impacts—The negligible impacts on floodplains as a result of alternative C were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would have negligible impacts to floodplains, there would negligible cumulative impacts on floodplains when added to the negligible impacts from alternative C.

Conclusion—Alternative C would result in overall negligible impacts on the floodplain because there would be no measureable impact on the 100-year floodplain, and any impacts on the floodplain functionality would be slight. The cumulative impacts of this project when considered together with other projects in proximity to the park would be negligible.

Alternative D – Low Wetland, Low Resident Canada Goose Management—Alternative D has limited wetland management and resident Canada goose management techniques proposed and no initial lethal reduction activities. No sea wall breaks and no daylighting are proposed for alternative D to reconnect the floodplain with the Anacostia River. Therefore, due to the limited wetland management techniques, alternative D results in long-term minor adverse impacts to floodplains because localized and perceptible adverse impacts to the floodplain would occur because the floodplain would not be reconnected to the Anacostia River but the overall functionality of the floodplain would not be affected.

Cumulative Impacts—The long-term minor adverse impacts on the floodplain in and near Anacostia Park under alternative D were considered together with the effects of the projects mentioned above. Since the projects listed previously from other past, present, and reasonably foreseeable future actions would have a negligible impact to floodplains, there would be a long-term minor adverse cumulative impact on floodplains when added to the long-term minor adverse impacts from alternative D.

Conclusion—Alternative D would result in overall long-term minor adverse impacts on floodplains because the impacts would be measurable or perceptible, but would be localized and would not affect the overall functionality of the 100-year floodplain. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term minor and adverse.

Alternative E – High Wetland, Moderate Resident Canada Goose Management, with No Lethal Control—Alternative E has the same wetland management techniques proposed as alternative B but the resident Canada goose management techniques proposed do not include lethal population reduction activities. Sea wall breaks and daylighting are proposed for alternative E to reconnect the floodplain with the Anacostia River, which would help restore the functionality of the floodplain. However, the floodplain benefits from a full suite of wetland management techniques proposed without a resident Canada goose population (lethal) reduction may be either completely offset or take longer to realize. Therefore, alternative E would result in an overall range of negligible to beneficial impacts to floodplains along the Anacostia River. When it is not practicable to locate or relocate development to a site outside of the floodplain and not affecting the floodplain, NPS would prepare and approve a SOF.

Cumulative Impacts—The range of negligible to beneficial impacts on floodplains as a result of alternative E were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would have negligible impacts to floodplains, there would negligible cumulative impacts on floodplains when added to the negligible to beneficial impacts from alternative E.

Conclusion—Alternative E would result in overall negligible to beneficial impacts on the floodplain because there would be no measure impact on the 100-year floodplain, and any impacts on its functionality would be slight. Additionally, the reconnection of the wetland with the river would improve the floodplain function. The cumulative impacts of this project when considered together with other projects in proximity to the park would be negligible.

WETLANDS

This topic includes tidal and non-tidal wetland resources.

Guiding Regulations and Policies

The NPS would manage wetlands in compliance with NPS mandates and the requirements of EO 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 *Management Policies 2006* state that the park would provide leadership and take action to prevent the destruction, loss, or degradation of wetlands; preserve and enhance the natural beneficial values of wetlands; and 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. The NPS would implement a "no net loss of wetlands" policy (NPS 2006a). In addition, the park would strive to achieve a long-term goal of a net gain of wetlands through restoration of previously degraded or destroyed wetlands.

Section 4.4.4 of the NPS *Management Policies 2006* (Management of Exotic Species) states that exotic species would not be allowed to displace native species. All exotic plant and animal species that do not meet an identified park purpose would be managed. This section is applicable to this plan/EIS due to the presence of exotic plant species, including wetland plant species at the park. Specifically, Section 4.4.4.2 of the NPS *Management Policies 2006 (*Removal of Exotic Species Already Present) states that all exotic plant and animal species that are not maintained to meet an identified park purpose would be managed—up to and including eradication—if (1) control is prudent and feasible, and (2) the exotic species:

- interferes with natural processes and the perpetuation of natural features, native species or natural habitats, or
- disrupts the genetic integrity of native species, or disrupts the accurate presentation of a cultural landscape, or
- damages cultural resources, or significantly hampers the management of park or adjacent lands, or
- poses a public health hazard as advised by the U.S. Public Health Service (which includes the Centers for Disease Control and the NPS public health program), or
- creates a hazard to public safety.

Executive Order 11990, "Protection of Wetlands" directs all federal agencies to avoid both long- and short-term adverse impacts associated with the destruction or modifications of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a possible alternative. Each agency is required to provide leadership and shall take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. The purpose of Director's Order #77-1: *Wetland Protection* is to establish NPS policies, requirements, and standards for implementing EO 11990.

Section 404 of the Clean Water Act established a program to regulate the discharge of dredged or fill material into water of the United States. The Rivers and Harbors Act of 1899 defined navigable waters of the United States as "those waters that are subject to the ebb and flow of the tides." The Clean Water Act built on this definition and defined the waters of the United States to include tributaries to navigable waters and wetlands adjacent to other water of the United States. The Clean Water Act does not allow for the filling of wetlands if there is another practicable alternative that would be less damaging to aquatic resources or if significant degradation would occur. Permits for work within wetlands are issued by the USACE and state agencies. The USACE encourages agencies to avoid and/or minimize impacts to wetlands, and requires mitigation if unavoidable impacts to wetlands occur. A SOF describing wetlands and impacts according to the NPS definition is normally required for impacts to wetlands as a result of a proposed project. However, as described in Section 4.2 of Director's Order #77-1, some NPS requirements (SOF and wetland compensation) may be waived for certain excepted actions (NPS 2008b). Some of the techniques in this plan/EIS may be considered an excepted action if wetland impacts stay under certain acreage as described in Section 4.2.1h (actions designed for the purpose of restoring degraded aquatic habitats or ecological processes) because the purpose of the project is to restore

wetlands along the Anacostia River. Under this excepted action, up to 0.25 acres of new long-term adverse impacts on wetlands are allowed if directly associated with and necessary for the restoration (NPS 2008b). However, the techniques included in this plan/EIS that would require additional NEPA compliance may also require a SOF for activities proposed in wetlands. NPS would acquire all necessary permits and prepare an SOF for any associated impacts to wetlands under future work that would require additional NEPA compliance.

Assumptions and Methodologies

The evaluation of impacts to wetlands was based on a qualitative assessment of how management actions would affect wetland functions. Impacts were determined based on the functionality of the wetland to support vegetation and wildlife. In addition, the impacts were based upon the quality of the wetland, specifically, hydrology of the area, water quality, and plant species.

The geographic study area for wetlands includes all tidal and non-tidal wetland areas at Anacostia Park.

Impact Threshold Definitions

The following thresholds were used to determine the magnitude of impacts on wetlands:

Negligible: There would be no observable or measureable change to the wetlands within the park or their ability to support vegetation or wildlife. A reduction in the abundance and diversity of native wetland vegetation may occur, but any change would be so small that it would not be measurable.

Adverse: *Minor*: Impacts to wetlands and their ability to support wetland vegetation and wildlife would be detectable at the park. Impacts would be detectable only in or adjacent to wetland areas that have been mapped at the park. The overall functionality of the wetland would not be affected. A reduction in the abundance and diversity of wetland vegetation would occur and would be measurable but, would be limited and of little consequence to the functionality of the native plant communities.

Moderate: Impacts to wetlands and their ability to support wetland vegetation and wildlife would be detectable at the park. Impacts would be detectable in areas outside of wetland areas that have been mapped at the park. Some reduction in the abundance and diversity of native wetland vegetation would occur, and it would be measurable but would result in a small-scale consequence to the functionality of the native plant communities in Anacostia Park.

Major: Impacts to wetlands and their ability to support wetland vegetation and wildlife would be detectable at the park. Impacts would be detectable outside of wetland areas that have been mapped at the park. A noticeable reduction in the abundance and diversity of native wetland vegetation would occur. The change would be measurable and of widespread consequence to the functionality of the native plant communities within Anacostia Park.

Wetland Impacts Alternatives Evaluation

Alternative A – No Action Alternative—Under alternative A, no change from current management techniques and/or current conditions would occur. Park staff would continue resident Canada goose management activities at the same level as current with no lethal control, including (since 2004) maintaining current goose exclusion fencing and yearly egg oiling. In June 2010, the goose counts were conducted for five days spanning two weeks during the flightless period. The mean for 2010 within these five days at four sectors (Kenilworth, Kingman, Heritage Island, and Anacostia East locations) was 564 geese, with a range of 94 to 619 total geese per day for all sectors (Bates 2010a). The 2010 mean of 564 resident Canada geese within Anacostia Park is the current number used in this plan/EIS for all sections that follow. The 2010 goose count numbers exhibit fluctuations in the resident Canada goose population within Anacostia Park since 2004, when current resident Canada goose management techniques were first applied. Therefore, the resident Canada goose population would be expected to continue to fluctuate within the park and would expand in the future as a result of alternative A.

As described in "Chapter 3: Affected Environment", the wetlands that have been restored within Anacostia Park, are being damaged in part by resident Canada geese that are overgrazing the wetland plants; the emergent and submerged aquatic vegetation that comprise the tidal marshes and fringe wetlands cannot sustain viable seasonal growth due to the intense grazing pressures from resident Canada geese. Additional wetland restoration issues have been observed at Anacostia Park, including planting at incorrect hydrologic regimes. Removing sheet piling along the Anacostia River Fringe Wetlands (which would require additional NEPA compliance) would have a short-term minor adverse effect on wetlands due to erosion that would occur and water quality impacts that would follow this process but a beneficial impact would occur because wetlands would be improved by removing structures in the wetlands. However, these beneficial impacts would be offset because alternative A does not include initiating new wetland restoration efforts, but provides wetland management techniques that incorporate continuation of the current management of invasive plant species. In addition, it is expected that over the life of this plan/EIS, the riverine wetlands in Anacostia Park would continue to erode (NPS 2010a), resulting in a further loss of wetland vegetation that would also result in erosion during rain events as mentioned above (Curtis 2010). Alternative A would result in continued loss of wetlands, degradation and herbivory by the resident Canada goose population, the introduction of invasive plant species, and degradation of water quality due to sediments introduced from runoff and eroded soils. In addition, the overall functionality of the wetlands at Anacostia Park is being affected by many factors (including goose herbivory, water quality, and invasive species) that would not be addressed by alternative A.

The USGS Patuxent Wildlife Research Center has participated in a five-year monitoring project that measured the progress of a reconstructed marsh (Kingman Marsh) towards becoming a functioning, viable freshwater tidal wetland (USGS 2006b). Results derived over the course of the study substantiated major losses of wetland vegetative cover, species richness, and diversity at Kingman Marsh (USGS 2006b). It has been estimated that resident Canada goose damage results through their herbivory has led to Kingman Marsh being reduced to less than one third its original wetland cover along with severe reduction in palatable plant species (USGS 2007). The wetland vegetation impacts at Kingman Marsh could therefore be attributed to herbivory by resident Canada geese (Hammerschlag et al. 2001) coupled with effectively lowered sediment elevations following reconstruction (USGS 2006b). A goose exclusion study by Haramis and Kearns at the nearby Patuxent River in Maryland (2006) showed that fenced areas of marshland were able to support a lush, healthy population of wild rice (wetland vegetation), whereas in unfenced areas survival of wetland vegetation was extremely low due to grazing by resident Canada geese (Haramis and Kearns 2006). Although current goose exclusion fencing would be maintained, no new fencing is proposed.

When considering the effects of climate change on wetlands, increased flooding and increased flood runoff are also predicted to occur (Erwin 2009). This may cause increased erosion, especially if established wetland areas do not exist or are not created along shoreline of the Anacostia River. Landward or channelward migration of wetlands is another predicted effect of climate change. Therefore, identifying setback areas along the Anacostia River could be effective at establishing zones for natural coastal migration based on projected sea level rise. Some of the predicted impacts of sea level rise can be reduced by the removal of blockages along the River. Under alternative A, the sheet piling is proposed for removal, but this would not necessarily result in the inland migration of wetlands since the seawall would still be intact. Removing the sheet piling (which would require additional NEPA compliance) would allow an increased connection to the River, but could cause increased erosion of shoreline vegetation, especially under storm conditions, which are expected to increase in severity and frequency as a result of climate change. Invasive species would not be managed at a level to offset the effects of climate change on wetlands, and buffer zone plantings are not considered under alternative A. Alternative A does not include adaptive management or wetland monitoring, which are predicted to provide insights to the potential consequences of climate change and help determine how future management practices should be implemented. Therefore, alternative A does not include techniques or actions that would counteract or reduce the potential pressures of climate change. Overall, alternative A would have a long-term moderate adverse impact on wetland vegetation because the resident Canada goose population would continue herbivory of wetland vegetation that is not fenced and no measures other than egg oiling would be taken to limit or control the resident Canada goose population under this alternative. A reduction in the abundance and diversity of wetland vegetation has already occurred at Anacostia Park, which further supports a conclusion of long-term moderate adverse impact.

Cumulative Impacts—The Anacostia River was historically flanked with nearly 2,500 acres of tidal marsh. However, in the early 20th century the USACE was charged with a major “reclamation” effort designed to improve navigation by channeling and containing the river within a stone seawall. The Anacostia River was engineered into a channeled city river from a meandering river with extensive wetlands. Tidal flats and wetlands were drained and filled to help rid the city of mosquito-borne diseases and stench along the river. Public and government interests in restoring wetlands in the Anacostia River watershed grew in the 1980s when the NPS began working with others to restore nearly 100 acres of wetlands in the park. The restoration of tidal marshes was completed to improve the water quality of the Anacostia River, improve native plant and animal diversity, and provide a more natural recreation experience for park visitors along the river, as well as meet the Department of the Interior’s agreement to the Chesapeake Bay Recovery Program. The restoration, creation, and enhancement of wetlands in the Anacostia Watershed as well as within the park, have had a cumulative beneficial impact on wetlands. Many of these projects have already been completed, some are currently underway, and numerous others are scheduled for the future. These projects have been and continue to be undertaken by a diversity of government programs, agencies, groups, and community organizations.

One of the six restoration goals of the Anacostia Watershed is to increase wetland acreage, and many wetland restoration projects have already been completed or are scheduled for completion (MWCOG 2007). Past wetland restoration projects that have already been completed include the Anacostia Wetland Mitigation Project (ANA-11 created 54 acres of wetlands), Kenilworth Marsh (restored 77 acres of wetlands), Kingman Marsh (Lake) (restored a total of 86 acres of wetlands), Anacostia River Fringe Wetlands (restored 16 acres of wetlands), and Heritage Island Wetlands (restored 6 acres of wetlands). Other wetland restoration projects completed include the lower Anacostia Park Enhancements-Pope Branch Restoration, Hickey Run Restoration, and the Watts Branch Restoration. In addition to wetland efforts being initiated by the NPS, the District DOH, EHA is the lead agency implementing many wetland and watershed restoration projects throughout the Anacostia watershed. Key partners for these restoration projects include the USACE-Baltimore District, NPS, USDA-NRCS, USEPA, the USGS Patuxent

Wildlife Research Center, District DOE, and USFWS. The wetland restoration projects mentioned above have beneficial impacts to wetlands in and near Anacostia Park.

Numerous other efforts by various federal, local, and community organizations have been completed and are either currently underway or are scheduled for the restoration of the Anacostia River and its tributaries. Environmental programs associated with the Woodrow Wilson Project have included tidal wetland creation comprised of multiple native species (ANA-11 as mentioned above), restoration of tidal wetlands upon removal of landfill material, and wetland creation and enhancement of non-tidal wetlands dominated by common reed grass. Wetland Mitigation/Enhancement projects completed by SHA within the Anacostia River Watershed include Tuxedo Road (1.70 acres), Bladensburg Waterfront Park (1.30 acres), Anacostia East (23 acres), and many other small projects totaling over 30 acres (SHA 2006). Future SHA projects scheduled as a result of Intercounty Connector (ICC) Environmental Stewardship or ICC mitigation include over 20 acres of wetland mitigation/enhancement in the Anacostia River Watershed (SHA 2006). Other future wetland restoration or creation projects are proposed as a result of projects associated with the AWI. AWI projects that incorporate wetland restoration components include Poplar Point. The wetland restoration projects mentioned above have beneficial impacts to wetlands in and near Anacostia Park.

Projects that contribute to cumulative negative effects of wetlands through removal include the 11th Street Bridge Replacement Project, the Anacostia Riverwalk project, the Washington Gas hazardous waste cleanup, and the Poplar Point project. The 11th Street Bridges project has affected approximately 0.07 acre of wetlands. Anacostia Riverwalk would affect less than 0.1 acre of wetland. The Washington Gas hazardous waste cleanup would remove vegetation and soil from the 1 acre of wetland, thus destroying the wetland. Together these projects constitute a cumulative impact to 1.17 acres of wetlands. The Poplar Point development could impact up to 11 acres of wetlands, although the EIS for this project is currently in the planning stages (NPS 2008d). It is expected that any adverse impacts to wetlands as a result of the projects described in this paragraph would be offset by mitigation and that the projects in and near Anacostia Park previously described would have an overall beneficial impact to wetlands.

The long-term moderate adverse impacts on wetlands in and near Anacostia Park under alternative A were considered together with the effects of the projects mentioned above. Since the projects listed above would be beneficial to wetlands this would reduce the adverse effects of alternative A resulting in a long-term minor adverse cumulative impact on wetlands.

Conclusion—Alternative A would result in long-term moderate adverse impacts on wetlands because the impact to wetlands and their ability to support wetland vegetation and wildlife would be detectable. Some reduction in the abundance and diversity of native wetland vegetation would be measurable, but would only result in a small-scale consequence to the functionality of the native plant communities in Anacostia Park. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term minor and adverse.

Wetland Impacts Common to All Action (Management) Alternatives

Wetland management techniques that are common to all action alternatives include addressing upland runoff, removing sheet piling along Anacostia River Fringe Wetlands, and installing new rain garden areas. Resident Canada goose management techniques that are common to all action alternatives include population monitoring, installing/maintaining goose exclusion fencing, and education efforts regarding feeding wildlife and preparing technical brochures describing resident Canada goose management techniques. With the exception of considering new rain gardens (which would require additional NEPA compliance) and the removal of sheet piling along the Anacostia Fringe Wetlands, the techniques described above for all action alternatives would have a negligible impacts on wetlands because there

would be no observable or measurable change to the wetlands within the park due to the limited and localized nature of all the techniques. Installing/maintaining goose exclusion fencing is not expected to benefit wetlands when this technique is not combined with other resident Canada goose management techniques (such as other habitat modification techniques discussed below in the alternatives analysis).

Removing sheet piling along the Anacostia River Fringe wetlands would have a short-term, minor adverse effect on wetlands due to erosion that would occur and water quality impacts that would follow this process but a beneficial impact would occur because wetlands would be improved by removing structures in the wetlands. Vegetation surveys over the last five years by the USGS indicate that the wetland vegetation is well established in the Anacostia River Fringe Wetland with over 95 percent cover (Krafft et al. 2009). Reconnection of the floodplain with the Anacostia River would restore the functionality of the floodplain, restore hydrology, and benefit wetlands as well. Additionally, any adverse impacts to wetlands would be minimized and/or mitigated by appropriate BMPs and may include an E&S plan, or other required documents in the District.

Changes in mean sea level rise, invasive species colonization, changes to water level, and wetland migration are expected as a result of climate change. Climate change would increase opportunities for invasive plant species such as common reed to spread because of this species' adaptability to disturbance and efficiency to colonize (Erwin 2009). Therefore, invasive plant species control efforts would be essential, including extensive monitoring and targeted control. All action alternatives would include managing invasive plant species at the park at a level beyond the current efforts of the NCR-EPMT. This action would aid in counteracting potential pressures of climate change on wetland vegetation by removing a key stressor (invasive plant species) on these ecosystems. It has also been suggested that the impacts of sea level rise can be ameliorated through the acquisition of inland buffer zones, which could provide an opportunity for habitats and wildlife to migrate inland (Erwin 2009). Although the park already owns the buffer zone along the Anacostia River, much of this zone is mowed/maintained grass immediately along the shoreline. All action alternatives would include, to some degree, planting new buffers along the shoreline and/or increasing the width of existing vegetative buffers. Although these vegetative buffers would be planted to act as barriers to the geese, planting the buffer zone with riparian vegetation would ameliorate some of the effects of climate change for all action alternatives. As previously stated above for alternative 1, the removal of sheet piling at the Anacostia River Fringe Wetlands along the River (which would require additional NEPA compliance) would not necessarily result in the inland migration of wetlands since the seawall would still be intact. Both adaptive management and wetland monitoring are key elements in each of the action alternatives. Monitoring is well known to be an essential element of wetland management, since it would allow detection of long-term change, specifically changes in the distribution of wetland areas at Anacostia Park that may result from climate change. Monitoring and adaptive management would provide insights to the potential consequences of climate change and help determine how future management practices should be implemented.

It is expected that new rain gardens would not be designed within wetlands but may include wetland plantings in previously upland areas. However, these areas may be too small and localized in nature to create a detectable beneficial impact on wetlands or an improvement to the functionality of the wetland. Potential areas for rain gardens include Kenilworth Parkside, Langston Golf Course parking areas, parking lots surrounding the Anacostia Park Pavilion, and parking areas north and south of Pennsylvania Avenue. At this time, it is largely unknown what size and how many rain gardens are proposed. However, additional NEPA compliance would be required prior to construction of rain garden areas to adequately analyze the effects associated with the implementation of this element (see table 1 in chapter 2). For projects that would require additional NEPA compliance, when it is not practicable to locate or relocate

projects outside of a wetland and not affecting a wetland, NPS would prepare and approve a SOF for activities in a wetland. Overall, the techniques common to all action alternatives would result in a range of long-term, short-term, minor, and adverse to beneficial impacts to wetlands due to the limited and localized nature of the proposed techniques and due to potential measurable and perceptible improvements to the functionality of wetlands.

Alternative B – High Wetland, High Resident Canada Goose Management—Under alternative B the most aggressive wetlands management techniques are combined with intensive resident Canada goose population reduction techniques (lethal control combined with other techniques). This alternative considers new wetland restoration techniques as well. Under this alternative, it is estimated that approximately 40 to 60 percent of the current resident Canada goose population would be removed during the first year of the plan/EIS as the first step in meeting the initial goal of 54 resident Canada geese within the park. This goal may be adjusted through adaptive management to meet management goals based on the results of vegetation and resident Canada goose population monitoring. Resident Canada goose monitoring would occur for the life of this plan/EIS (15 years as stated in chapter 2) and adaptive management would be used to maintain the resident Canada goose population using methods described in this section on a regular basis. Techniques used to lethally reduce the population would include round-up, capture, and euthanasia, and lethal removal by shooting. The population would be monitored annually through the life of the plan. Resident Canada goose counts and vegetation monitoring would determine if the population needed to be maintained by using lethal methods. In subsequent years, the percent of the population to be removed would be dependent upon results of the vegetative monitoring, and if the resident Canada goose population goal within the park was achieved. Both lethal actions (shooting as well as round-up, capture, and euthanasia) would have the same beneficial effect on wetland vegetation within the park.

The primary impact to wetland vegetation within the park would be the result of immediate lethal actions taken to control the resident Canada goose population. It is expected that with rapidly reduced goose browsing pressure, the herbivory previously observed in wetland vegetation would start to reverse, as was found in exclosure studies conducted in the nearby Patuxent River (Haramis and Kearns 2006). Immediately reducing and controlling the growth of the resident Canada goose population would result in beneficial impacts to wetland vegetation, which could recover from current herbivory through decreased goose browsing. Decreased browsing may not only increase the areal coverage of the wetland areas but could also increase diversity through natural recruitment, if supported by current hydrology. The closer the resident Canada goose density would get to the initial goal of 54 resident Canada geese within the park, the higher the chance of achieving successful wetland restoration (NPS 2009b). This conclusion is supported by previous studies documenting goose herbivory of wetland areas within the park and comparison of open plot data with exclosure data for wetland vegetation. Observations drawn from exclosure experiments, as well as exclosed, fenced plantings at Kingman Marsh, clearly demonstrated the ability of marsh vegetation to grow at suitable sediment elevations when protected from herbivory (USGS 2006b). Similarly, a goose exclusion study by Haramis and Kearns at the nearby Patuxent River in Maryland (2006) showed that fenced areas of marshland were able to support a lush, healthy population of wild rice, whereas in unfenced areas grass survival was extremely low due to grazing by resident Canada geese (Haramis and Kearns 2006). In addition to lethal means of reducing the resident Canada goose population, alternative B also includes an intensive scare/harassment program as well as the following reproductive control techniques: increased egg oiling, egg addling, egg replacement if population increases after initial reduction, and application of goose hatch material if population increases greater than 20 percent in one year. It is assumed that these techniques would also reduce the resident Canada goose population and would improve existing and proposed wetlands within Anacostia Park.

The beneficial impact to wetland vegetation would occur immediately following resident Canada goose reduction activities, if these activities occur during the growing season of the wetland vegetation

(typically March through November along the Anacostia River). Specifically, goose round-ups have been planned to occur during the summer months, when adult geese are molting and flightless (starting June 15 in Mid-Atlantic) and before juveniles are able to fly. These population reduction activities would allow the wetland vegetation at least half a growing season to actively recover from goose herbivory activities. Resident Canada geese exert a higher degree of grazing pressure on wetlands over migratory geese, because they typically feed year round on seedlings, plants, propagules, and roots (Coluccy 2009). Therefore, a recovery period for wetland vegetation that immediately follows resident Canada goose removal, may allow the vegetation to become more resilient (through increased rootmass and propagules) to goose herbivory the following spring.

Resident Canada geese exhibit a high propensity to return to their previous nesting areas. Nest construction and egg laying begins in late March or early April, depending upon latitude, and hatching occurs from late April through mid-May (Gosser et al. 1997). They pair for life and often use the same nest site year after year. It is known that resident Canada geese stay within a 5 to 10 mile radius during non-breeding and a 0.25 to 0.5 mile radius during breeding season, which begins in the spring (NPS 2010b; Seamans et al. 2009). During spring and summer, the geese selectively graze on plants, or parts of plants, that are high in protein, such as grass shoots, seed heads, and aquatic vegetation (Gosser et al. 1997). These data suggest that, if a portion of the resident Canada goose population is removed from a certain area, a lag time may occur where no geese are in the area; this lag time may allow for a recovery period for the wetland vegetation. However, in time, it is likely that, due to the nature of urban-dwelling geese, other geese would capitalize on the newly void habitat (area where resident Canada geese were removed). Relocating or removing resident Canada geese has been described by Gosser et al. (1997) as a stop-gap effort because the site must be modified to make it less attractive to resident Canada geese, or the removed geese could be replaced with new ones. Additionally, Dr. Allan (1999) states that a cull (gathering and removing) of breeding Canada geese may simply create vacant territories for other birds to move into and repeat culls may be necessary for a number of years before the problem is finally brought under control (Allan 1999). Because this plan/EIS integrates both wetland management and resident Canada goose management techniques along with adaptive management, a suite of techniques, including population reduction through lethal control in combination with other techniques, are proposed as part of alternative B and are described in more detail in the following paragraphs.

Besides grazing pressures from resident Canada geese, other wetland restoration issues that have been observed at Anacostia Park include incorrect hydrologic regimes (too much inundation to vegetation or too little submersion of vegetation); planting methods, including species selection and existing seed bank; insects and disease; engineered marsh soils; removal of invasive plant species; and sediment quality. The NPS has identified a number of potential restoration projects within Anacostia Park that could be implemented in the future that could take into consideration these wetland restoration issues. Therefore, alternative B includes a suite of potential techniques that would enhance existing wetland areas at the park and restore or create new wetland areas.

Hydrology techniques are proposed to manage wetlands at the park, including erosion control techniques, removing/modifying structures that negatively affect the marsh, creating tidal guts, potential enforcement of no wake zones along the river, investigating the effects of extreme water level change, and considering altering water elevations. It has been demonstrated during previous studies at Kingman Marsh, that sediment processes indicated the propensity for accretion but this could be negated locally by erosion, especially where vegetation was missing, and by subsidence including sediment consolidation of both the placed material and unconsolidated pre-existing substrate (USGS 2006b). Therefore, these hydrology techniques would take into consideration site-specific conditions that may preclude either wetland restoration or wetland recovery as a result of resident Canada goose herbivory.

Wetland restoration techniques would have an overall improvement on the wetlands within the park and include possible daylighting of storm sewers, stream/stormwater outfall energy dissipation modifications, and the removal of portions of the seawall. These particular techniques would be designed to either create new wetland areas or reconnect the floodplain with the waterbodies (including the Anacostia River, Pope Branch, and Fort Dupont Creek) to potentially create additional or enhanced wetland areas. The construction of these techniques would cause a negligible effect on existing wetland areas if they are present in the study areas. However, these techniques would require additional NEPA analysis because site-specific designs would be necessary to make these improvements. For projects that would require additional NEPA compliance, when it is not practicable to locate or relocate projects outside of the wetland and not affecting the wetland, NPS would prepare and approve a SOF for activities in a wetland. For new restoration projects, planted wetland vegetation within fenced areas would benefit from this level of protection over the long term; however, such benefits would be limited to these small areas within the park where restoration is proposed. Some wetland management elements such as cultural/education that include techniques like constructing new boardwalks and trails would have a negligible effect on wetlands within the park. The construction and physical placement of piers for boardwalks could affect small wetland areas.

Under alternative B, invasive plant species would be managed at a higher level compared to alternative A, focusing on common reed and purple loosestrife beyond what the NCR-EPMT is currently managing. Non-native or invasive species such as common reed and purple loosestrife are playing increasing roles at Kingman Marsh where elevations permit, since they also are not palatable (USGS 2006b). Previously, the NPS did successfully reduce common reed using an herbicide at Kenilworth, where monitoring showed successful rebound of desirable marsh vegetation following treatments (USGS 2006b). Therefore, the removal of invasive plant species in wetland areas as part of alternative B would improve wetland vegetation at the park. Monitoring vegetation plots and maintaining fenced areas would result in negligible trampling of limited wetland vegetation as staff travel to and around the fenced areas. However, such impacts would be temporary, as these activities would only be scheduled to occur a few days per year. Therefore, the impact of these activities would be negligible.

As a result of climate change, increased flooding and increased flood runoff could occur, which may allow for increased erosion if wetland areas are not established along shorelines (Erwin 2009). Alternative B includes techniques to control shoreline erosion, primarily focusing on areas of the marsh at low elevations and near the surface where vegetation/mud flat and water interface. These erosion control techniques would aid in offsetting potential pressures of climate change in addition to the techniques previously described that are common to all action alternatives. The combination of removing sheet piling (which would require additional NEPA compliance) and seawall breaks at the Anacostia River Fringe Wetlands along the River would allow the inland migration of wetlands (which is currently blocked) that would occur as a result of sea level rise. This action would allow the inland and channelward migration of wetlands along the River. As discussed above in common to all action alternatives, invasive plant species removal is a technique included in alternative B that would remove a key stressor from climate change (invasive plant species) on wetland ecosystems. Alternative B incorporates the most techniques to offset the predicted effects to wetlands that would result from climate change.

Overall, alternative B would have a beneficial impact on wetlands at the park because abundance, diversity, and functionality of wetlands would improve and would be measurable. It is expected that the high wetland management techniques in combination with the high resident Canada goose management techniques would protect and slow the current erosion rate of the riverine wetlands in Anacostia Park, resulting in less wetland loss and erosion during rain events. Additionally, negligible impacts to the wetlands would result from elements of alternative B that propose soil disturbance and/or construction for some wetland management techniques. However, these impacts would only occur during active construction of wetland restoration projects and the beneficial impact on wetlands would far outweigh the

negligible impacts. Additionally, these impacts would be minimized and/or mitigated by appropriate BMPs and may include an E&S plan, or other required documents in the District.

Cumulative Impacts—The beneficial impacts on wetlands as a result of alternative B were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to wetlands, there would be beneficial cumulative impacts on wetlands when added to the beneficial impacts from alternative B.

Conclusion—Alternative B would result in overall beneficial impacts on wetlands from a reduction in herbivory, wetland restoration, and erosion control, which would improve wetland functionality. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

Alternative C – Moderate Wetland, Moderate Resident Canada Goose Management—Under alternative C, aggressive wetlands management options are combined with a moderate level of lethal and non-lethal resident Canada goose management techniques. Alternative C has similar wetland management techniques proposed as alternative B, but includes decreased wetland restoration techniques such as no sea wall breaks and no daylighting. Alternative C proposes a less intensive population reduction for the resident Canada goose within the park, but proposes to conduct resident Canada goose population monitoring for the life of the plan. This alternative assumes that more intensive wetland management would be required to counteract the resident Canada goose population that would remain in the area, due to the proposed moderate resident Canada goose management. Alternative C includes a suite of potential techniques that would enhance existing wetland areas at the park and restore or create new wetland areas.

For this alternative, the current resident Canada goose population would be reduced by killing 40 to 60 percent within the first year of the management plan. The technique used to reduce the population would include round-up, capture, and euthanasia, but no shooting of resident Canada geese would be included as part of alternative C (see “Chapter 2: Alternatives”). Although monitoring would be conducted yearly, lethal control of 40 to 60 percent of the resident Canada goose population would only be used up to five times throughout the life of this plan/EIS following the initial reduction, and only if the population exceeds the initial goal of 54 resident Canada geese within the park or if vegetation monitoring and adaptive management indicate a different goose population goal is appropriate.

As part of alternative C, immediately reducing and controlling the growth of the resident Canada goose population would result in beneficial impacts to wetland vegetation, which could recover from current herbivory through decreased goose browsing. Decreased browsing may not only increase the aerial coverage of the wetland areas but could also increase diversity through natural recruitment, if supported by current hydrology. The closer the resident Canada goose density would get to the initial goal of 54 resident Canada geese within the park, the higher the chance of achieving successful wetland restoration (NPS 2009b). Although alternative C only allows for the lethal reduction of the resident Canada goose population one time in the first year of the plan/EIS and a maximum of five total times throughout the plan to meet the initial population goal, a reduction of resident Canada geese in the park should still provide a beneficial impact to wetland vegetation, similar to described above for alternative B, but to a lesser scale. Even though alternative C includes fewer wetland management techniques and a less intensive resident Canada goose population reduction compared to alternative B, this difference is not considered large enough to cause a change in the intensity of the impact (beneficial) to wetlands at the park. That said, it has been demonstrated that a combination of techniques (besides just goose removal) are the most successful in controlling damage to sites by resident Canada geese, including making sites less attractive to geese in comparison to other sites (Gosser et al. 1997). Therefore, other resident Canada goose management techniques proposed as part of alternative C such as habitat modification (planting

buffers, applying goose repellents, etc.), less intensive scare/harassment techniques, and reproductive control techniques (egg oiling and applying goose hatch material) would work in combination with the population reduction techniques.

Even though alternative C would not include creating tidal guts and would not consider stream daylighting or seawall breaks and planting efforts would be at a lower density than alternative B, the remaining wetland management techniques proposed as part of alternative C are the same as those included in alternative B. Some techniques included in alternative C would require additional NEPA analysis because site-specific designs would be necessary to make these improvements. For projects that would require additional NEPA compliance, when it is not practicable to locate or relocate projects outside of the wetland and not affecting the wetland, NPS would prepare and approve a SOF for activities in a wetland. The high wetland management techniques proposed as part of this alternative in combination with moderate resident Canada goose management should provide an overall beneficial impact to wetland vegetation, similar to described above for alternative B and these techniques would protect and slow the current erosion rate of the riverine wetlands in Anacostia Park, resulting in less wetland loss and erosion during rain events. Similar to the discussion for alternative B above, increased flooding and increased flood runoff could occur as a result of climate change, which may also allow for increased erosion if wetland areas are not established along shorelines (Erwin 2009). Alternative C includes techniques to control shoreline erosion, primarily focusing on areas of the marsh at low elevations and near the surface where vegetation/mud flat and water interface. As discussed above in common to all action alternatives, invasive plant species removal is a technique included in alternative C that would remove a key stressor that would result from climate change (invasive plant species) on wetland ecosystems. The combination of these techniques would aid in offsetting potential pressures of climate change in addition to the techniques described above that are common to all action alternatives.

Additionally, negligible impacts to the wetlands would result from elements of alternative C that propose soil disturbance and/or construction for some wetland management techniques. However, these impacts would only occur during active construction of wetland restoration projects and the beneficial impact on wetlands would far outweigh the negligible impacts. Additionally, these impacts would be minimized and/or mitigated by appropriate BMPs and may include an E&S plan, or other required documents in the District.

Cumulative Impacts—The beneficial impacts on wetlands as a result of alternative C were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to wetlands, there would be beneficial cumulative impacts on wetlands when added to the beneficial impacts from alternative C.

Conclusion—Alternative C would result in overall beneficial impacts on wetlands from a reduction in herbivory and some wetland management techniques, which would improve wetland function. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

Alternative D – Low Wetland, Low Resident Canada Goose Management—Alternative D combines less aggressive wetlands management options with primarily non-lethal resident Canada goose management options. This alternative offers the lowest management effort for both wetlands and resident geese. Under wetland management techniques for alternative D, there are no erosion control techniques proposed, no planting efforts proposed, and no new wetland restoration efforts proposed. Under alternative D, there would be no initial lethal resident Canada goose population reduction activities, but the resident Canada goose population would be monitored annually. Other resident Canada goose management techniques are proposed (including planting buffers, applying goose repellents, a less

intensive scare/harassment program, and egg oiling) as part of alternative D as discussed in chapter 2. If the other resident Canada goose management techniques discussed do not keep the resident Canada goose population at the resident Canada goose population goal, a onetime population reduction using lethal controls of 40 to 60 percent of the resident Canada goose population would be performed during the life of the management plan but only if needed. The lethal control technique during the one-time population reduction would include round-up, capture, and euthanasia; no shooting of resident Canada geese would occur under alternative D. However, in time, it is likely that, due to the nature of urban-dwelling geese, other geese would capitalize on the newly void habitat. Relocating or removing resident Canada geese has been described by Gosser et al. (1997) as a stop-gap effort because the site must be modified to make it less attractive to resident Canada geese, or the removed geese would be replaced with new ones. Additionally, Dr. Allan (1999) states that a cull (gathering and removing) of breeding resident Canada geese may simply create vacant territories for other birds to move into and repeat culls may be necessary for a number of years before the problem is finally brought under control (Allan 1999). Future population reduction strategies beyond the one-time reduction are not proposed as part of alternative D.

Although alternative D only allows for the one-time lethal reduction (no shooting) of the resident Canada goose population during the lifetime of the plan/EIS, a reduction of resident Canada geese in the park would still provide a beneficial impact to wetland vegetation immediately following population reduction and to a lesser scale than as described above for alternative B. That said, it has been demonstrated that a combination of techniques (besides just goose removal) are the most successful in controlling damage to sites by resident Canada geese, including making sites less attractive to geese in comparison to other sites (Gosser et al. 1997). Therefore, other resident Canada goose management techniques proposed as part of alternative D such as habitat modification (planting buffers, applying goose repellents, etc.), less intensive scare/harassment techniques, and reproductive control techniques (egg oiling and applying goose hatch material) should work in combination with the one-time population reduction. However, wetland planting efforts and wetland restoration efforts are not proposed as part of alternative D; it is unlikely, given current conditions and previous lessons learned, that wetlands would re-establish naturally along the Anacostia River. In addition, it is expected that the low wetland management techniques in combination with the low resident Canada goose management techniques over the life of this plan/EIS would allow the riverine wetlands in Anacostia Park to continue to erode (NPS 2010d, Curtis 2010). This erosion would not occur as quickly as in alternative A but would result in a further loss of wetland vegetation and erosion during rain events (Curtis 2010). To address climate change, only the techniques described previously that are common to all action alternatives would aid in offsetting potential pressures of climate change under alternative D. Therefore, the low wetland management techniques proposed as part of this alternative in combination with low resident Canada goose management would provide an overall, beneficial impact (following goose reduction activities) but a long-term minor adverse impact to wetland vegetation because a reduction in the abundance, diversity, and functionality of wetlands at the park would occur**.**

Cumulative Impacts—The long-term minor adverse impacts on wetlands as a result of alternative D were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to wetlands, there would be negligible cumulative impacts on wetlands when added to the long-term minor adverse impacts from alternative D. The beneficial effects of the other projects should reduce some of the adverse impacts to wetlands resulting from implementation of this alternative resulting in a negligible cumulative impact on wetlands.

Conclusion—Alternative D would result in overall, beneficial impact (following goose reduction activities) but a long-term minor adverse impact. The one-time population reduction of resident Canada geese would provide an immediate benefit to wetland vegetation, but without wetland planting and restoration as a part of the plan, it is likely that in the long term there would be a reduction in the

abundance, diversity, and functionality of wetlands in the park. The cumulative impacts of this project when considered together with other projects in proximity to the park would be negligible.

Alternative E – High Wetland, Moderate Resident Canada Goose Management, with No Lethal Control—This alternative combines aggressive wetland management techniques with intensive resident Canada goose management activities; however, there is no lethal control for resident Canada geese. The benefits from a full suite of wetland management techniques proposed without a resident Canada goose population reduction may be either completely offset or take longer to realize. Under this alternative, no resident Canada geese would be removed, but the population would be monitored during the life of the plan/EIS. Although an initial goal of 54 resident Canada geese within the park was determined by the science team, this goal would likely not be met since a population reduction would not occur as part of alternative E. Some of the techniques included as part of alternative E would require additional NEPA analysis because site-specific designs would be necessary to make these improvements. For projects that would require additional NEPA compliance, when it is not practicable to locate or relocate projects outside of the wetland and not affecting the wetland, NPS would prepare and approve a SOF for activities in a wetland.

However, the full suite of wetland management techniques as proposed in alternative E would provide an improvement to wetland vegetation, even though these benefits would most likely be offset by the size of the resident Canada goose population. At a minimum, the resident Canada goose population would remain similar to existing conditions, but could possibly increase in size with time. It has been demonstrated that a combination of techniques are the most successful in controlling damage to sites by resident Canada geese, including making sites less attractive to geese in comparison to other sites (Gosser et al. 1997). Therefore, other resident Canada goose management techniques proposed as part of alternative E such as habitat modification (planting buffers, applying goose repellents, etc.), intensive scare/harassment techniques, and reproductive control techniques (egg oiling, addling, egg replacement, and applying goose hatch material) would work in combination with the other techniques.

Similar to the discussion for alternative B, increased flooding and increased flood runoff could occur as a result of climate change, which may allow for increased erosion. Alternative E includes techniques to control shoreline erosion that would aid in offsetting potential pressures of climate change in addition to the techniques previously described that are common to all action alternatives. The combination of removing sheet piling (which would require additional NEPA compliance) and seawall breaks at the Anacostia River Fringe Wetlands along the River would allow the inland migration of wetlands (which is currently blocked) that would occur as a result of sea level rise. As discussed above in common to all action alternatives, invasive plant species removal is a technique included in alternative E that would remove a key stressor that would result from climate change (invasive plant species) on wetland ecosystems. Alternative E, like alternative B, incorporates the most techniques to offset the predicted effects to hydrology that would result from climate change.

The high wetland management and moderate resident Canada goose management techniques proposed as part of this alternative would protect and reduce the erosion of the riverine wetlands in Anacostia Park, but some loss of wetland vegetation and erosion during rain events would still occur as a result of alternative E, although the loss would not be as pronounced as either alternatives A or D. Therefore, the high wetland management techniques proposed as part of this alternative in combination with moderate resident Canada goose management (but a lack of lethal control) would provide an overall long-term minor adverse impact to wetland vegetation.

Cumulative Impacts—The long-term minor adverse impacts on wetlands as a result of alternative E were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be

beneficial to wetlands, there would be negligible cumulative impacts on wetlands when added to the long-term minor adverse impacts from alternative E. The beneficial effects of the other projects should reduce some of the adverse impacts to wetlands resulting from implementation of this alternative resulting in a negligible cumulative impact on wetlands.

Conclusion—Alternative E would result in overall long-term minor adverse impacts on wetlands because impacts to wetlands and wetland vegetation and wildlife would be detectable, but the overall functionality of the wetland would not be affected. A reduction in the abundance and diversity of wetland vegetation would be measurable, but would be limited and would not have much consequence on the native plant communities and their functionality. The cumulative impacts of this project when considered together with other projects in proximity to the park would be negligible.

NATURAL RESOURCES

This section discusses the plan impacts to the natural resources in the study area, including aquatic and terrestrial resources.

AQUATIC RESOURCES

This topic includes benthic invertebrates, finfish, and shellfish.

Guiding Regulations and Policies

NPS regulations and policies, including the *Organic Act of 1916*, *Management Policies 2006*, and *Reference Manual 77:* Natural Resource Management directs the park to manage and preserve physical and biological processes, as well as individual species, features, and plant and animal communities. The NPS would ensure that the environmental costs and benefits of proposed operations, development, and resource management are fully and openly evaluated before taking actions that may impact the natural resources of the park (NPS 2006a). These policies require the NPS to manage natural resources to maintain, rehabilitate, and perpetuate the inherent integrity of water resources and aquatic systems. The NPS seeks to:

- eliminate human-induced impacts on aquatic habitats,
- limit effects and mitigate damage if impacts are unavoidable,
- maintain and restore aquatic habitats to protect their ecological and aesthetic character and dependent plant and animal communities.

Assumptions and Methodologies

The evaluation of aquatic species was based on a qualitative assessment of how management activities would impact aquatic species and their habitat. Potential impacts to aquatic resources were assessed based on the extent of disturbance to the aquatic resource habitats and the individual species.

The geographic study area for aquatic resources includes all waterbodies at Anacostia Park.

Impact Threshold Definitions

The following thresholds were used to determine the magnitude of impacts on aquatic resources:

Negligible: There would be no observable or measureable impacts on aquatic species, their habitats, or the natural processes sustaining them at the park. Impacts would be similar to natural fluctuations.

Adverse: *Minor*: Impacts to aquatic species, their habitats, or the natural processes sustaining them would be detectable at the park. Occasional responses to disturbance from management practices could be expected, but would not interfere with foraging or reproduction. Harassment, injury, or mortality of aquatic species is not expected. The overall viability of the species would not be affected.

Moderate: Impacts to aquatic species, their habitats, or the natural processes sustaining them would be detectable at the park. Frequent responses to disturbance from some individuals could be expected and may interfere with foraging or reproduction. Some impacts may occur during critical periods of reproduction or in key habitats and may result in harassment, injury, or mortality to one or more individuals. Detectable changes to the availability of functional habitat or key components of habitat would occur, however the viability of the species would not be affected.

Major: Impacts to aquatic species, their habitats, or the natural processes sustaining them would be obvious at the park. Frequent responses to disturbance by several or most individuals would be expected with impacts on foraging or reproduction. Impacts would occur during critical periods of reproduction or in key habitats and would result in direct mortality or loss of habitat that may affect the viability of the species.

Aquatic Resources Alternatives Evaluation

Alternative A – No Action Alternative—Currently, resident Canada goose herbivory is reducing the quality and quantity of wetland vegetation in the watershed and creating open areas in the marsh, susceptible to sediment scouring and no wetland restoration techniques are proposed as part of the no action alternative. In addition, it is expected that the riverine wetlands along the Anacostia River in the park would continue to erode during the life of this plan/EIS based upon park observations and personal communications, resulting in a further loss of wetlands and an already limited aquatic habitat within the Anacostia River (NPS 2010b). As a result of herbivory and wetland loss, the open, bare areas of the marsh have less potential to support benthic macroinvertebrates and therefore, would support fewer finfish species dependent upon this food source. These open, bare areas of the marsh are susceptible to sediment scouring which causes turbidity and can degrade water quality; water quality influences the presence of shellfish such as mussels. Recent surveys in the Anacostia River have indicated the presence of pollution-tolerant benthic macroinvertebrates and finfish species, indicating environmental stressors such as the lack of cover in unvegetated areas, disturbance, and likely polluted sediments (USGS 2006a). The abundance and diversity of finfish species in the river remains below its potential due to poor water quality (excess sediment and bacteria and low DO). It has been concluded that the loss of vegetation and the subsequent erosional substrate at wetlands in Anacostia Park are due to wildlife grazing (primarily resident Canada geese) which has affected the macroinvertebrate community development (USGS 2006a). Removing sheet piling along the Anacostia River Fringe Wetlands (which would require

additional NEPA compliance) would result in a short-term minor adverse impact on benthic macroinvertebrates and on finfish during construction due to erosion that would occur and water quality impacts that would follow this process. However, a beneficial impact to benthic macroinvertebrates and finfish would occur following removal of the sheet piling because a physical barrier between the bottom of the Anacostia River and the wetlands would be removed and the historic reconnection would occur. However, the resident Canada goose population would not be intensively reduced as part of the No Action Alternative. Additionally, wetland restoration techniques and improvements to water quality as a result of the no action alternative would not indirectly benefit benthic macroinvertebrates, finfish species, or shellfish. It is estimated that over the life of this plan/EIS, the riverine wetlands would continue to erode (NPS 2010d, Curtis 2010), resulting in a further loss of wetlands and aquatic habitat within the Anacostia River (Curtis 2010). Therefore, overall and continued, long-term moderate adverse impacts to aquatic resources in the park are anticipated as a result of the no action alternative Because a loss of habitat and changes to the natural processes sustaining them would be detectable at the park such as the availability of functional habitats or key components of supporting habitat.

Cumulative Impacts—The benthic communities in the Anacostia River are characterized by low diversity, low abundance, and dominance by pollution-tolerant worms, as described in the "Benthic Invertebrates" section of chapter 3. These conditions were likely caused by a combination of chronic exposure to pollutants and low dissolved oxygen levels. The Anacostia River substrate is dominated by mud and the area generally has degraded benthic communities as well as few instream structures for fish habitat. Proposed projects such as the 11th Street Bridge Replacement Project would not cumulatively affect finfish; the replacement structures would cause no greater blockages to passage of migratory fish to upper watershed spawning sites than the existing bridges. Some fish kills were reported as a result of the Woodrow Wilson Bridge project, particularly related to the explosives demolition of the earlier bridge; explosives would not be used to demolish the 11th Street Bridge (DCDOT and FHWA 2007). As mitigation, the Woodrow Wilson Project environmental programs includes the following which may benefit fish species: Removal of fish blockages to open historical anadromous fish habitat, five years of fish hatchery restocking in tributary streams where fish passage restorations are implemented, riffle grade controls, and construction of a rock chute. Barriers to fish movement throughout the Anacostia watershed are a problem for both migratory and resident fish. Unimpeded fish passage is especially important for anadromous fish, which live much of their lives in tidal waters, but must move into non-tidal rivers and streams to spawn. Within the Anacostia Watershed, the Woodrow Wilson Mitigation Project removed or modified a total of 14 fish barriers (NOAA 2007c). Tidal freshwater wetland restoration in Kenilworth Marsh and Kingman Marsh have already added critical rearing habitat for juvenile anadromous fish species (NOAA 2007c). Restored emergent tidal wetlands and off-channel habitat can provide similar habitat to natural wetlands and can increases food availability and shelter over degraded sites (NOAA 2007c). Surveys in the Anacostia River have indicated the presence of two shellfish species, the Eastern floater mussel (appendix D) and the tidewater mucket mussel. It is unlikely that any of the techniques described above for all action alternatives would have an impact on shellfish species since only limited shellfish currently inhabit substrate within Anacostia Park. Given the normal turbidity of the river, any temporary adverse impacts as a result of proposed projects such as the 11th Street Bridge Replacement Project would not cumulatively affect aquatic resources.

Overall, the numerous proposed wetland restoration and creation projects would have a beneficial effect on aquatic resources in and near Anacostia Park. The long-term moderate adverse impacts on aquatic resources in and near Anacostia Park under alternative A were considered together with the effects of the projects mentioned above from other past, present, and reasonably foreseeable future actions. Since the projects listed above would be beneficial to aquatic resources this would reduce the adverse effects of alternative A resulting in a long-term minor adverse cumulative impact on aquatic resources.

Conclusion—Alternative A would result in long-term moderate adverse impacts on aquatic species and their habitat. Impacts would be detectable in the park, and may occur in key reproduction periods and habitats resulting in harassment, injury, or mortality to individuals. Some individuals may frequently be disturbed, which could interfere with foraging and reproduction. Detectable changes to the availability of functional habitat and habitat components would occur, but would not impact species viability. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term minor and adverse.

Impacts to Aquatic Resources Common to All Action Alternatives

Wetland management techniques that are common to all action alternatives include addressing upland runoff, removing sheet piling along the Anacostia River Fringe Wetlands, and installing new rain garden areas. Removing sheet piling and installing new rain garden areas would both require additional NEPA compliance. Resident Canada goose management techniques that are common to all action alternatives include population monitoring, installing/maintaining goose exclusion fencing, and education efforts regarding feeding wildlife and preparing technical brochures describing resident Canada goose management techniques. Removing sheet piling along the Anacostia River Fringe Wetlands would result in a short-term, minor adverse impact on benthic macroinvertebrates and on finfish during construction due to erosion and water quality impacts that would follow this process. However, a beneficial impact to benthic macroinvertebrates and finfish would occur following removal of the sheet piling because a physical barrier between the bottom of the Anacostia River and the wetlands would be removed and the historic reconnection would occur. Surveys in the Anacostia River have indicated the presence of two shellfish species, the Eastern floater mussel (appendix D) and the tidewater mucket mussel. It is unlikely that any of the techniques described above for all action alternatives would have an impact on shellfish species since only limited shellfish currently inhabit substrate within Anacostia Park.

Because wetlands provide both aquatic diversity and habitat for benthic macroinvertebrates and finfish in the Anacostia River, and wetland plants serve as a food source (detritus) both directly and indirectly, improvements to wetlands would have a an overall beneficial impact on aquatic resources: A result of the management techniques detectable improvements to food sources and habitat quality would occur through improved natural processes sustaining benthic macroinvertebrates and finfish. Beneficial impacts would occur because wetlands (and therefore the benthic and finfish communities) would be improved in a limited and localized area by removing structures in the wetlands.

Alternative B – High Wetland, High Resident Canada Goose Management—The resident Canada goose population would be intensively reduced as part of this alternative, which would result in improvements to wetland vegetation. This alternative also includes a suite of potential techniques to improve wetlands in the park, including erosion control techniques to improve wetlands and creating tidal guts.

Revegetating and stabilizing areas along the river and wetland restoration techniques would improve the benthic macroinvertebrate population as well as the finfish within the park. Because wetlands provide both aquatic diversity and habitat for benthic macroinvertebrates and finfish in the Anacostia River, and wetland plants serve as a food source (detritus) both directly and indirectly, improvements to wetlands would have a beneficial impact on aquatic resources because detectable improvements to food sources and habitat quality would occur through improved natural processes sustaining benthic macroinvertebrates and finfish. Beneficial impacts would occur because wetlands (and therefore the benthic and finfish communities) would be improved in a limited and localized area by removing structures in the wetlands. Wetland vegetation improvements and creating tidal guts vegetated with wetland plants would provide additional detritus and create a more complex habitat to support benthic macroinvertebrates and finfish species**.** Additionally, because water quality influences the presence of

mussels, improvements to wetlands and water quality as a result of the management alternatives would indirectly benefit shellfish in the Anacostia River, although this change would not necessarily be perceptible or measurable. Namely, hydrology techniques that include removing or modifying structures that result in erosion and clogging of marsh and creation of tidal guts would have a similar overall beneficial impact on water quality and thus fisheries. Additionally, habitat modification as part of resident Canada goose management includes planting 25- to 50-foot buffers along the shorelines of the river throughout the park and increasing the width of existing vegetated buffers. Additional and/or enhancing buffers along the shoreline would benefit finfish species by shading the river and reducing the water temperature in surface waters located immediately adjacent to the buffer zone. The District WAP has identified four fish within Anacostia Park that are considered species of greatest conservation need and include alewife, American eel, American shad, and blueback herring. NPS makes every reasonable effort to conduct its actions consistent with relevant state laws and regulations and these species are given equal consideration for analysis in this plan/EIS compared to federally and state listed species. Impacts to the four finfish species listed by the District WAP and observed at Anacostia Park would also be beneficial because detectable improvements to food sources and habitat quality would occur as part of alternative B.

As part of alternative B, any submerged land disturbance may directly affect and displace benthic macroinvertebrates and indirectly affect finfish during construction activities. These activities would result in a short-term minor adverse impact during construction due to direct disturbance and as a result of erosion and water quality impacts that would follow this process. Although benthic invertebrates have limited mobility, most fish species are mobile and would be able to temporarily avoid submerged areas under construction. Overall impacts to aquatic resources (benthic macroinvertebrates and finfish) as a result of alternative B would be beneficial and would offset the short-term minor adverse impacts because detectable improvements to food sources and habitat quality would occur through improved natural processes sustaining benthic macroinvertebrates and finfish. It is unlikely that any of the techniques described above for alternative B would have an impact on shellfish species since only limited shellfish currently inhabit substrate within Anacostia Park.

Cumulative Impacts—The beneficial impacts on aquatic resources as a result of alternative B were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to aquatic resources, there would be beneficial cumulative impacts on aquatic resources when added to the beneficial impacts from alternative B.

Conclusion—Alternative B would result in overall beneficial impacts on aquatic resources because revegetation, stabilization, and changes to hydrology would improve habitat and food sources for aquatic species. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

Alternative C – Moderate Wetland, Moderate Resident Canada Goose Management—Alternative C includes many of the same wetland management and resident Canada goose management techniques proposed as alternative B, although in general less intensive techniques. Compared to alternative B, alternative C would include only limited removal of structures, both mechanical and passive seedbank regeneration, and least invasive stream/stormwater outfall modifications. Alternative C would not include creating tidal guts and would not consider stream daylighting or seawall breaks and planting efforts would be at a lower density than alternative B. Overall impacts to aquatic resources (benthic macroinvertebrates and finfish) as a result of alternative C would be the same as alternative B: beneficial because detectable improvements to food sources and habitat quality would occur as a result of improvements to wetlands and vegetative buffers along the shoreline. Submerged land disturbance would still occur during construction activities, and would have a short-term minor adverse impact on aquatic resources, but this impact would be offset by the overall beneficial impact of alternative C. Even though alternative C

includes fewer wetland management techniques and a less intensive resident Canada goose population reduction compared to alternative B, this difference is not considered large enough to cause a change in the intensity of the impact (beneficial) to finfish at the park. An overall, beneficial impact for alternative C is appropriate because impacts to finfish habitat and food sources would be detectable as a result of improvements to wetlands and water quality in the park. It is unlikely that any of the techniques described above for alternative C would have an impact on shellfish species since only limited shellfish currently inhabit substrate within Anacostia Park.

Cumulative Impacts—The beneficial impacts on aquatic resources as a result of alternative C were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to aquatic resources, there would be beneficial cumulative impacts on aquatic resources when added to the beneficial impacts from alternative C.

Conclusion—Alternative C would result in overall beneficial impacts on aquatic resources because wetland improvements would have detectable improvements on food sources and aquatic habitats. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

Alternative D – Low Wetland, Low Resident Canada Goose Management—Alternative D has limited wetland management and resident Canada goose management techniques proposed and no initial lethal reduction activities. No wetland planting efforts or new wetland restoration techniques are proposed to increase wetland vegetative cover. Therefore, food sources and habitat would not be improved or created for aquatic resources. Open, bare areas of the marsh would have less potential to support benthic macroinvertebrates, and therefore, would support fewer finfish species dependent upon this food source. The low wetland management techniques proposed as part of this alternative in combination with low resident Canada goose management would provide an overall, negligible impact to aquatic resources (benthic macroinvertebrates, finfish, and shellfish) because there would be no measurable change in habitat or natural processes sustaining aquatic resources; impacts would be similar to natural fluctuations**.**

Cumulative Impacts—The negligible impacts on aquatic resources as a result of alternative D were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to aquatic resources, there would be beneficial cumulative impacts on aquatic resources when added to the negligible impacts from alternative D.

Conclusion—Alternative D would result in overall negligible impacts on aquatic resources because there would be no measurable impacts on aquatic species, their habitats, or natural processes within the park that sustain aquatic species. Impacts would be similar to natural fluctuations. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

Alternative E – High Wetland, Moderate Resident Canada Goose Management, with No Lethal Control—Alternative E has the same wetland management techniques proposed as alternative B but the resident Canada goose management techniques proposed do not include lethal population reduction activities. The benefits from a full suite of wetland management techniques proposed without a resident Canada goose population reduction may be either completely offset or take longer to realize. Therefore, alternative E results in negligible impacts to aquatic resources (benthic macroinvertebrates, finfish, and shellfish) because there would be no detectable or measureable improvements to food sources and habitat quality for aquatic resources.

Cumulative Impacts—The negligible impacts on aquatic resources as a result of alternative E were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to aquatic resources, there would be beneficial cumulative impacts on aquatic resources when added to the negligible impacts from alternative E.

Conclusion—Alternative E would result in overall negligible impacts on aquatic resources because there would be no measurable impacts on aquatic species, their habitats, or natural processes within the park that sustain aquatic species. Impacts would be similar to natural fluctuations. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial.

VEGETATION AND WILDLIFE

This topic includes terrestrial vegetation and wildlife. Since the resident Canada goose is the focus of this plan/EIS, this species is presented in a separate section that follows the wildlife impacts analysis.

Vegetation

Guiding Regulations and Policies

NPS *Management Policies 2006* state that the fundamental purpose of the national park system begins with a mandate to conserve park resources and values and provide for the public enjoyment of the park's resources and values to the extent that the resources would be left unimpaired for future generations. Native vegetation is identified as a park resource (NPS 2006a). NPS *Management Policies 2006* provides general principles for the maintenance of vegetation in the park by:

- Preserving and restoring the natural abundance, diversities, dynamics, distributions, habitats, behaviors of native plant populations and communities and ecosystems in which they occur.
- Restoring native plant populations in parks when they have been extirpated by past human-caused actions.
- Minimizing human impacts on native plants, communities, and ecosystems, and the processes that sustain them.

Assumptions and Methodologies

The geographic study area for vegetation would include all upland areas throughout Anacostia Park; impacts would be measured qualitatively. It is also important to note that b*eneficial* impacts would result if the general coverage of invasive plant species decreases.

Impact Threshold Definitions

The following thresholds were used to determine impacts to vegetation:

Negligible: A reduction in the abundance and diversity of vegetation may occur, but any change would be so small that it would not be measurable. The general coverage of invasive plant species would remain the same.

Adverse: *Minor*: A reduction in the abundance and diversity of vegetation would occur (invasive plant species coverage may increase) and would be measurable but would be limited and of little consequence to the greater functionality of the plant populations in Anacostia Park.

Moderate: Some reduction in the abundance and diversity of native vegetation would occur (invasive plant species coverage may increase), and it would be measurable but would result in a small-scale consequence to the greater functionality of the plant populations in Anacostia Park.

Major: A noticeable reduction in the abundance and diversity of native vegetation would occur (invasive plant species coverage may increase). The change would be measurable and of widespread consequence to the viability of the native plant populations within Anacostia Park.

Vegetation Alternatives Evaluation

Alternative A – No Action Alternative—As detailed in the previous "Wetlands" section of this chapter, the resident Canada goose population would remain in excess of the recommended initial goal for successful wetland restoration projects and would increase over time, adversely impacting wetland vegetation as well as terrestrial vegetation. No new native plantings would occur and existing buffers would not be enhanced as a result of the no action alternative. Currently, resident Canada goose herbivory is occurring at turf feeding areas; breaks in the vegetative buffers along the shorelines of the Anacostia River are allowing geese to access these areas and other areas that support terrestrial vegetation. The limited, current management of invasive plant species would be continued with the no action alternative, which would increase the coverage of invasive plant species in the terrestrial areas over the life of this plan/EIS and would consequentially reduce native vegetation. Removal of the sheet piling (which would require additional NEPA compliance) would have a negligible impact on vegetation because the abundance and diversity of terrestrial vegetation is not expected to change. An overall reduction in the abundance and diversity of vegetation would occur (including invasive plant species increase in coverage) under alternative A that would be measurable but would not necessarily affect the overall functionality of the plant communities in Anacostia Park. Overall, continued, long-term minor adverse impacts to terrestrial vegetation are anticipated as a result of the no action alternative.

Cumulative Impacts—Due to the numerous redevelopment projects proposed in the vicinity of Anacostia Park, including components of the AWI such as Poplar Point as well as the 11th Street Bridge Replacement Project, impacts to terrestrial vegetation are anticipated. Most construction projects excavate soils, which would require existing vegetation to be removed. The greatest potential for impact to terrestrial habitats would come from the redevelopment project at Poplar Point, which is a large tract of natural habitat types within and adjacent to Anacostia Park. Other projects in the area are redevelopments of urbanized areas that contribute little to the naturalized habitat of the area. The Poplar Point project could potentially impact from 30 to 100 acres, but impacted habitat types are unknown at the time. The 11th Street Bridge Replacement Project would directly affect about 8 acres of woodland and scrub habitats. Although AWI projects and the 11th Street Bridge Replacement Project would affect terrestrial vegetation, planting vegetation and trees in the area is proposed as mitigation. The District DOT and FHA have committed to providing plantings in select areas of the park where impacts from the 11th Street Bridge Replacement Project are anticipated (DCDOT and FHWA 2007) and a goal of the AWI is to restore riparian function in the watershed in both urban and natural environments (DCOP 2009). As a result of the many redevelopment projects described above, a long-term minor adverse impact to terrestrial vegetation would occur.

In addition to this plan/EIS, which would manage invasive plant species, other projects are also reducing areal coverage of invasive plant species along the Anacostia River. The Woodrow Wilson Project's environmental programs have included wetland restoration in areas dominated by common reed grass, a top ten NCR-EPMT target species. Also, the Anacostia Wetland Mitigation Project (ANA-11) eliminated invasive non-native species. Therefore, beneficial effects are expected through reduced areal coverage of invasive plant species. However, these beneficial impacts would most likely be cancelled out by the long-term minor adverse impacts to terrestrial vegetation as described above, resulting in negligible impacts.

The long-term minor adverse impacts on terrestrial vegetation in and near Anacostia Park under alternative A were considered together with the effects of the projects mentioned above from other past, present, and reasonably foreseeable future actions. Since the projects listed above would have long-term minor adverse impacts to terrestrial vegetation, the adverse effects of alternative A added to this would result in a long-term moderate adverse cumulative impact on terrestrial vegetation.

Conclusion—Alternative A would result in overall long-term minor adverse impacts on vegetation because there would be a measurable minor but limited reduction in vegetation diversity and abundance, which would be of little consequence to the functionality of the plant communities in the park. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term moderate and adverse.

Vegetation Impacts Common to All Action (Management) Alternatives

Wetland management techniques that are common to all action alternatives include addressing upland runoff, additional NEPA compliance would be necessary for removing sheet piling along the Anacostia River Fringe Wetlands, and installing new rain garden areas. Resident Canada goose management techniques that are common to all action alternatives include population monitoring, installing/maintaining goose exclusion fencing, and education efforts regarding feeding wildlife and preparing technical brochures describing resident Canada goose management techniques. With the exception of installing new rain gardens (which would require additional NEPA compliance), the techniques described above for all action alternatives would have a negligible impact on vegetation because the abundance and diversity of terrestrial vegetation is not expected to change. Installing new rain gardens may disturb soil and associated vegetation during construction in the short-term but may include upland plantings and help reduce the amount of impervious area in the park in the long-term; however, these areas may be too small and localized in nature to create a detectable change in vegetation diversity and abundance. Potential areas for rain gardens include Kenilworth Parkside, Langston Golf Course parking areas, parking lots surrounding the Anacostia Park Pavilion, and parking areas north and south of Pennsylvania Avenue. At this time, it is largely unknown what size and how many rain gardens are proposed. However, additional NEPA compliance would be required prior to construction of rain garden areas to adequately analyze the effects associated with the implementation of this element (see table 1 in chapter 2). Overall, the techniques that are common to all action alternatives would result in negligible impacts to vegetation because the impacts would be at the lower levels of detection and because of the limited and localized nature of the proposed techniques.

Alternative B – High Wetland, High Resident Canada Goose Management—The resident Canada goose population would be intensively reduced as part of this alternative, which would benefit vegetation currently being grazed along the existing shoreline buffer as well as terrestrial vegetation located further inland, such as current turf feeding areas. Wetland management techniques such as the installation of coir fiber logs, flow deflectors, bog mats, and/or shoreline steepness reduction would help establish and benefit terrestrial vegetation.

Habitat modification techniques are also proposed as part of alternative B for resident Canada goose management that would have a beneficial impact on vegetation. These techniques include planting 25- to 50-foot buffers along the shorelines of the River throughout the park and increasing the width of existing vegetated buffers. It has been demonstrated by Gosser et al. (1997) that restricting a goose's ability to move between water and land deters geese from an area, especially during the molt. Therefore, physical barriers (such as vegetation) along the water's edge would restrict the movements of geese between the water and shore and would provide a beneficial impact on vegetative areas currently being grazed that have no shoreline buffers. Access from water to land would be restricted by planting thick shrubs or trees, along the shoreline of the Anacostia River to enhance existing buffers. Additionally, the new plantings would include species that are considered less desirable to geese and goose repellents would be applied to turf feeding areas yearly to protect the vegetation in these areas. Other vegetation techniques that are part of wetland management are proposed to improve terrestrial vegetation include managing invasive plant species (reducing areal coverage). By improving wetland vegetation with native species, there is less likelihood that invasive vegetative species would encroach and persist in these locations. Also, high-density plantings using persistent, native species with high root mats and variable height are also included as part of alternative B.

Vegetation may be temporarily affected during land disturbance activities such as the re-grading of sites or construction activities associated with hydrology techniques, vegetation techniques, and wetland restoration techniques. These techniques would have a negligible to minor, adverse impact on vegetation, depending on the area disturbed. However, vegetation disturbance impacts would be minimized as much as possible and the areas would be revegetated immediately following site preparation. Mitigation may include appropriate BMPs such as vegetation buffers, a revegetation plan, or other required documents in the District, depending on the total area disturbed. Even through some wetland management techniques may require land disturbance activities, alternative B would result in overall beneficial impacts to terrestrial vegetation as a result of wetland management and resident Canada goose management techniques because native vegetation coverage would increase and invasive vegetation coverage would decrease at the park.

Cumulative Impacts—The beneficial impacts on terrestrial vegetation as a result of alternative B were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would result in a long-term minor adverse impact on terrestrial vegetation, these adverse effects would be offset when added to the beneficial impacts from alternative B, resulting in a negligible cumulative impact to terrestrial vegetation.

Conclusion—Alternative B would result in overall beneficial impacts on vegetation due to wetland management practices, new plantings, and a reduction in herbivory, which would improve native vegetation communities. The cumulative impacts of this project when considered together with other projects in proximity to the park would be negligible.

Alternative C – Moderate Wetland, Moderate Resident Canada Goose Management—Alternative C includes many of the same wetland management and resident Canada goose management techniques proposed as alternative B, although in general less intensive techniques. Compared to alternative B, alternative C includes only limited removal of structures, both mechanical and passive seedbank regeneration, least invasive stream/stormwater outfall modifications, would not include creating tidal guts, would not consider stream daylighting or seawall breaks and planting efforts would be at a lower density than alternative B. Like alternative B, alternative C would also manage invasive vegetation species, the 25- to 50-foot buffers along the shorelines of the River throughout the park would be planted, and the width of existing vegetated buffers would be increased. A reduced resident Canada goose population would decrease the amount of grazing of shoreline areas so less turf and terrestrial vegetation

would be lost from grazing. Land disturbance would still occur during construction activities, and would have a negligible impact on vegetation. Overall impacts to vegetation as a result of alternative C would be the same as alternative B: beneficial because the wetland management and resident Canada goose management techniques would increase native vegetation coverage and would decrease invasive vegetation coverage at the park. Even though alternative C includes fewer wetland management techniques and a less intensive resident Canada goose population reduction compared to alternative B, this difference is not considered large enough to cause a change in the intensity of the impact (beneficial) to the vegetation at the park.

Cumulative Impacts—The beneficial impacts on terrestrial vegetation as a result of alternative C were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would result in a long-term minor adverse impact on terrestrial vegetation, these adverse effects would be offset when added to the beneficial impacts from alternative C, resulting in a negligible cumulative impact to terrestrial vegetation.

Conclusion—Alternative C would result in overall beneficial impacts on vegetation due to wetland management practices, invasive plant species management, and a reduction in herbivory, which would improve native vegetation communities. The cumulative impacts of this project when considered together with other projects in proximity to the park would be negligible.

Alternative D – Low Wetland, Low Resident Canada Goose Management—Alternative D has limited wetland management and resident Canada goose management techniques proposed, including no initial lethal reduction activities and a minor level of invasive plant species management (similar to current program). Alternative D includes new and increased vegetative buffers proposed along the shoreline, but the low resident Canada goose management would allow turf and terrestrial vegetation to be lost as a result of grazing. The limited, current management of invasive plant species would be continued with alternative D, which would increase the coverage of invasive plant species in the terrestrial areas over the life of this plan/EIS and would consequentially reduce native vegetation. A reduction in the abundance and diversity of vegetation would occur (including invasive plant species increase in coverage) that would be measurable but would not necessarily affect the overall functionality of the plant communities in Anacostia Park. Therefore, alternative D results in long-term minor adverse impacts to vegetation because invasive vegetation coverage at the park may increase and a reduction in the abundance and diversity of vegetation may occur due to goose herbivory.

Cumulative Impacts—The long-term minor adverse impacts on terrestrial vegetation in and near Anacostia Park under alternative D were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since these projects would have long-term minor adverse impacts to terrestrial vegetation, the added adverse effects of alternative D would result in a long-term moderate adverse cumulative impact on terrestrial vegetation.

Conclusion—Alternative D would result in overall long-term minor adverse impacts on vegetation because there would be a measurable minor but limited reduction in vegetation diversity and abundance, which would be of little consequence to the functionality of the plant communities in the park. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term moderate adverse.

Alternative E – High Wetland, Moderate Resident Canada Goose Management, with No Lethal Control—Alternative E has numerous wetland management and resident Canada goose management techniques proposed, including an invasive plant species management program and new and increased vegetative buffers, but no lethal reduction activities. Invasive plant species would be managed under

alternative D the same as under alternative B, which would decrease the coverage of invasive plant species in the terrestrial areas over the life of this plan/EIS and would consequentially increase native vegetation. However, alternative D results in overall negligible impacts to vegetation because native species coverage would be increased through buffer plantings, but may be offset by the lack of lethal reduction activities, resulting in an immeasurable change in vegetation at the park.

Cumulative Impacts—The negligible impacts on terrestrial vegetation in and near Anacostia Park under alternative E were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since these projects would have long-term minor adverse impacts to terrestrial vegetation, the negligible effects of alternative E would result in a long-term minor adverse cumulative impact on terrestrial vegetation.

Conclusion—Alternative E would result in overall negligible impacts on vegetation because a reduction in vegetation diversity and abundance may occur, but this change would not be measurable, and the cover of invasive plant species would remain the same. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term minor and adverse.

Wildlife (Not including Resident Canada Geese)

Guiding Regulations and Policies

NPS regulations and policies, including the NPS *Organic Act of 1916*, NPS *Management Policies 2006*, and NPS Reference Manual 77: *Natural Resource Management* directs the park to provide for the protection of park resources. The *Organic Act* directs national parks to conserve wildlife unimpaired for future generations and is interpreted to mean that native animal life are to be protected and perpetuated as part of the park's natural ecosystem. Parks rely on natural processes to control populations of native species to the greatest extent possible; otherwise, they are protected from harvest, harassment, or harm by human activities.

NPS *Management Policies 2006* make restoration of native species a high priority. Management goals for wildlife include maintaining components and processes of naturally evolving park ecosystems, including natural abundance, diversity, and ecological integrity of plants and animals (NPS 2006a). The NPS would seek to protect native animal populations against destruction or harm through human actions.

The *Migratory Bird Treaty Act of 1918*, as amended, prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests except as authorized under a valid permit (50 CFR 21.11). Additionally, the act authorizes and directs the Secretary of the Interior to determine if, and by what means, the take of migratory birds should be allowed and to adopt suitable regulations permitting and governing take. "Take" includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb.

Assumptions and Methodologies

The evaluation of wildlife (other than resident Canada geese) was based on a qualitative assessment of how expected changes to wetlands and the resident Canada goose population would affect the habitat of other wildlife. The park's wildlife is directly affected by the natural abundance, biodiversity, and the ecological integrity of their habitat. Wildlife groups analyzed in this section include birds; mammals; reptiles, amphibians, and invertebrates, and invasive wildlife species.

Available information on known wildlife was compiled and analyzed in relation to the proposed management actions. The geographic study area for wildlife would include all upland and wetland habitats within the park boundaries.

The District WAP has identified 15 birds, five mammals, 13 reptiles, 13 amphibians, and nine invertebrates within Anacostia Park that are considered species of greatest conservation as described in table 10 of chapter 3. NPS makes every reasonable effort to conduct its actions consistent with relevant state laws and regulations. Due to the additional wildlife included on lists produced by the District WAP, impacts to these species are analyzed in this section; these species are still given equal consideration for analysis in this plan/EIS compared to federally and state listed species.

Impact Threshold Definitions

The following thresholds were used to determine impacts to wildlife:

Negligible: There would be no observable or measurable impacts on species, their habitats, or the natural processes sustaining them. Impacts would be well within natural fluctuations.

Adverse: *Minor*: Impacts would be detectable but would not be outside the natural range of variability. Small changes to population numbers, population structure, genetic variability, and other demographic factors might occur. Occasional responses to disturbance by some individuals could be expected but without interference to factors affecting population levels. Sufficient habitat would remain functional to maintain viability of all species. Impacts would be outside critical reproduction periods for sensitive native species.

Moderate: Impacts to native species, their habitats, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Changes to population numbers, population structure, genetic variability, and other demographic factors would occur, but species would remain stable and viable. Frequent responses to disturbance by some individuals could be expected, with some negative impacts on factors affecting population levels. Sufficient habitat would remain functional to maintain the viability of all native species. Some impacts might occur during critical periods of reproduction or in key habitat.

Major: Impacts to native species, their habitats, or the natural processes sustaining them would be detectable, outside the natural range of variability, and extensive. Population numbers, population structure, genetic variability, and other demographic factors might experience large declines. Frequent responses to disturbance by some individuals would be expected, with negative impacts on factors resulting in a decrease in population levels. Loss of habitat might affect the viability of at least some native species.

Wildlife Alternatives Evaluation

Alternative A – No Action Alternative—Currently, resident Canada goose herbivory is reducing the quality and quantity of wetland habitat in the watershed, but the resident Canada goose population would not be intensively reduced as part of the no action alternative. Additionally, no wetland restoration

techniques or habitat modifications such as buffers or new plantings are proposed as part of the no action alternative. The existing habitat to support wildlife species is not diverse due to reduced or degraded wetland areas. In addition, it is expected that over the life of this plan/EIS, the riverine wetlands would continue to erode (NPS 2010d, Curtis 2010), resulting in a further loss of wetland vegetation that would also affect wildlife species utilizing this habitat. The limited, current management of invasive plant species would be continued with the no action alternative. Additionally, the loss of vegetation and the subsequent erosional substrate at wetlands within Anacostia Park due to wildlife grazing (primarily resident Canada geese) negatively affects aquatic-dependent wildlife species in the park that utilize these areas such as other waterfowl and migratory Canada geese. Removal of the sheet piling (which would require additional NEPA compliance) would have a negligible impact on wildlife species since the impact on vegetation is negligible since the abundance and diversity of terrestrial vegetation is not expected to change.

The USFWS (1999) has stated that the presence of large numbers of resident Canada geese conflict with management of the wild, migratory Atlantic Population (AP) of Canada geese. Other migratory waterfowl such as ducks can also be affected by large concentrations of resident Canada geese. Food and habitat for AP geese become food and habitat for resident Canada geese, making it more difficult to manage for migrant populations as a result of the growing resident Canada goose population, which quickly degrades and decimates these resources that are important for the health and survival of wild geese (USFWS 1999). If left unchecked and uncontrolled, the resident Canada goose population could adversely affect other wildlife species diversity and abundance (USFWS 1999). In addition, the USFWS (2005) and McCoy (2000) state that concentrated resident Canada geese populations may threaten the health of other wildlife, especially waterfowl and state that influenza A viruses and avian tuberculosis outbreaks are exacerbated by dense populations of waterfowl, including Canada geese (McCoy 2000). Resident Canada geese can also unintentionally serve as live decoys, attracting migratory geese to problem areas, thus exacerbating existing problems, or causing new ones, and can concentrate birds in small areas, potentially facilitating the spread of avian disease (USFWS 2005). Although resident Canada geese present the threat of spreading pathogens to bird and mammal populations, the correlation between the spread of avian diseases and the presence of resident Canada geese has not been demonstrated or studied at Anacostia Park.

It has been specifically observed by the State of Connecticut's Department of Environmental Protection (DEP) that resident Canada geese can serve as decoys, attracting migrant waterfowl, which can lead to crowded conditions and encourage the spread of diseases through the wild population (Connecticut DEP 2009). Although it has been specifically demonstrated by USFWS (1999), McCoy (2000), USFWS (2005), and Connecticut DEP (2009) that the resident Canada goose population could affect other wildlife, this correlation has not been measured at Anacostia Park. As suggested in USFWS (2005, IV-9), impacts of resident Canada geese on other migratory waterfowl could include resident Canada goose damage to habitat intended for wintering and migrating waterfowl. Because the resident Canada goose population would not be reduced under alternative A, the migratory Canada goose population within the Park would continue to compete with the resident Canada goose population at the park for resources such as food and habitat. As a result of the no action alternative, continued, long-term minor adverse impacts to wildlife are anticipated due to loss of vegetation in wetlands because impacts would be detectable but would not be outside the natural range of variability; small changes to population numbers, population structure, genetic variability, and other demographic factors might occur and occasional responses to disturbance by some individuals would be expected to wildlife.

Cumulative Impacts—Due to the numerous redevelopment projects proposed in the vicinity of Anacostia Park, including components of the AWI such as Poplar Point as well as the 11th Street Bridge Replacement Project, cumulative impacts to wildlife are anticipated. Most construction projects would require existing vegetation to be removed, which would reduce the existing habitat available to wildlife.

The greatest potential for impact to terrestrial habitats would come from the redevelopment project at Poplar Point, which is a large tract of natural habitat types within and adjacent to Anacostia Park. Other projects in the area are redevelopments of urbanized areas that contribute little to the naturalized habitat of the area. The Poplar Point project could potentially impact from 30 to 100 acres, but impacted habitat types are unknown at the time. The 11th Street Bridge Replacement Project would directly affect about 8 acres of woodland and scrub habitats. Although AWI projects and the 11th Street Bridge Replacement Project would affect terrestrial vegetation, planting vegetation and trees in the area is proposed as mitigation. It is unknown whether these plantings would be landscaped areas for aesthetic purposes that would provide little wildlife value or if they would include more natural terrestrial habitats to support wildlife. The District DOT and FHA have committed to providing plantings in select areas of the park where impacts from the 11th Street Bridge Replacement Project are anticipated (DCDOT and FHWA 2007) and a goal of the AWI is to restore riparian function in the watershed in both urban and natural environments (DCOP 2009). As a result of the many redevelopment projects described above, a long-term minor adverse impact to wildlife would occur.

The long-term minor adverse impacts on wildlife in and near Anacostia Park under alternative A were considered together with the effects of the projects mentioned above. Since the projects listed above would have long-term minor adverse impacts to wildlife, the adverse effects of alternative A when added to these projects would result in a long-term moderate adverse cumulative impact on wildlife.

Conclusion—Alternative A would result in overall long-term minor adverse impacts on wildlife because impacts would be detectable, but would remain within the range of natural variability, though there may be small changes to demographics and genetic variation, and some individuals may have responses to disturbance without impacting the population as a whole. Impacts would not occur during key reproduction periods and habitats for sensitive native species. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term moderate and adverse.

Wildlife Impacts Common to All Action (Management) Alternatives

Wetland management techniques that are common to all action alternatives include addressing upland runoff, removing sheet piling along the Anacostia River Fringe Wetlands, and installing new rain garden areas. Removing sheet piling and installing new rain garden areas would require additional NEPA compliance. Resident Canada goose management techniques that are common to all action alternatives include population monitoring, installing/maintaining goose exclusion fencing, and education efforts regarding feeding wildlife and preparing technical brochures describing resident Canada goose management techniques. Installing new rain gardens would disturb soil and associated vegetation during construction in the short-term but may include upland plantings to help reduce the amount of impervious area in the park in the long-term, thereby providing additional habitat to wildlife species. However, these areas may be too small and localized in nature to create a detectable change in wildlife species or populations. Potential areas for rain gardens include Kenilworth Parkside, Langston Golf Course parking areas, parking lots surrounding the Anacostia Park Pavilion, and parking areas north and south of Pennsylvania Avenue. At this time, it is largely unknown what size and how many rain gardens are proposed. As noted above, additional NEPA compliance would be required prior to construction of rain garden areas to adequately analyze the effects associated with the implementation of this element (see table 1 in chapter 2). Alternatives B, C, and E would include the use of visual deterrents. Visual deterrents may cause birds such as bald eagles or ospreys to temporarily avoid a particular area during the use of scare or harassment techniques, but these deterrents would be unlikely to have an effect on the overall bald eagle or osprey populations along the Anacostia River. Other wildlife such as aquatic birds (ducks, loons, grebes, coots, rails), wading birds (herons, bitterns, egrets), gulls/terns, and other permanent residents (osprey, kingfisher, double-crested cormorant), mammals (beaver, river otter, muskrat, mink,

raccoon), reptiles (turtles, snakes, lizards, skinks), and amphibians (toads, frogs, salamanders) may also be temporarily affected by some of the techniques that are common to all action alternatives, such as visual deterrents. However, these wildlife species are accustomed to urban sounds and disturbances and should be able to acclimate to short-term impacts. Migratory Canada geese would not be affected by scare and harassment techniques because these actions would take place when migratory flocks have left the park. The techniques that are common to all action alternatives would result in short-term minor adverse impacts to wildlife because the impacts would be detectable but would not be outside the natural range of variability; occasional responses to disturbance by some individuals would be expected but sufficient habitat would remain functional to maintain viability of all species. Following construction activities, a negligible impact would occur to wildlife as a result of impacts common to all action alternatives because there would be no measurable impacts on wildlife species, their habitats, or the natural processes sustaining them.

Alternative B – High Wetland, High Resident Canada Goose Management—The resident Canada goose population would be intensively reduced as part of this alternative, which would improve wetlands and provide benefits to wildlife species. Because wetlands provide habitat and the essentials necessary for a diversity of types and abundance of wildlife species typically associated with wetlands, improvements to wetlands would benefit wildlife species, including the numerous, urban-tolerant wildlife species that are found within the park. Wetland plants serve as a food source (seeds, roots, leaves) for many wildlife species. Similarly, wildlife species would also indirectly benefit through improved macroinvertebrate and finfish resources, which are also a major food source for aquatic-dependent wildlife species. Specifically, aquatic birds (ducks and migratory geese, loons, grebes, coots, rails), wading birds (herons, bitterns, egrets), gulls/terns, and other permanent residents (osprey, kingfisher, double-crested cormorant) that utilize wetlands and their fringe habitat would benefit from improved wetland areas as would mammals (beaver, river otter, muskrat, mink, raccoon), reptiles (turtles, snakes, lizards, skinks), amphibians (toads, frogs, salamanders) and numerous invertebrates such as butterflies and dragonflies. Additionally, beneficial impacts to the species listed by the District WAP (birds, reptiles, mammals, amphibians, and invertebrates) as species of greatest conservation need and observed at Anacostia Park (table 11) would also occur as a result of alternative B.

Habitat modification techniques are also proposed as part of this alternative for resident Canada goose management that would have a beneficial, impact on wildlife species. These techniques include planting 25- to 50-foot buffers along the shorelines of the river throughout the park and increasing the width of existing vegetated buffers. Vegetation techniques that are part of wetland management are proposed to improve terrestrial vegetation include managing invasive plant species. These plantings would benefit wildlife by providing additional and enhanced habitat along the river available for cover, nesting, and foraging. Also, high density plantings using persistent, native species with high root mats and variable height are also included as part of alternative B. Hydrology techniques that include removing or modifying structures that result in erosion and clogging of marsh and creating tidal guts would have an overall beneficial impact on wildlife by creating improved and additional habitat. Improved quality and quantity of habitat would indirectly benefit wildlife species as well as support food sources (seeds, roots, leaves, benthic macroinvertebrates, and finfish) for wildlife species.

Techniques considered as part of resident Canada goose management are proposed to reduce goose herbivory and improve wetland vegetation, thereby providing benefits to wildlife. There would be no indirect or direct adverse impacts to non-target species from egg addling/oiling/replacement, capture, or euthanasia (which would only take place in controlled environments). As stated in USFWS (2005, IV-3): “All capture and removal methods allow for positive identification of target species and there has been no impact observed on non-target, threatened, and endangered species.” There would also be no adverse impacts to wildlife species as a result of shooting resident Canada geese to reduce the population. Only

qualified federal employees that are trained, experienced, and licensed to use a firearm would be used for this action.

Under alternative B, the resident Canada goose population in the park would be reduced but the migratory population within the park and beyond park boundaries would not be reduced. Lethal control techniques as well as scare and harassment techniques would be implemented when migratory flocks of Canada geese have left the park. A beneficial impact to wetland vegetation would occur following resident Canada goose reduction activities. The population reduction activities of resident Canada geese would allow the wetland vegetation to recover from goose herbivory activities. Resident Canada geese exert a higher degree of grazing pressure on wetlands over migratory geese, because they typically feed year round on seedlings, plants, propagules, and roots (Coluccy 2009). The combination of reducing the resident Canada goose population and the effort to help restore the freshwater tidal ecosystem would allow wetlands to reach the desired condition of predominantly self-sustaining systems (containing advanced seral-stage habitat conditions) and would enhance habitat for migratory Canada geese that use the park on a seasonal basis. Therefore, this would have benefits for migratory Canada geese as well as other wildlife species which are all a natural part of this ecosystem. Therefore, migratory Canada geese would benefit from alternative B because less competition with resident Canada geese for nesting and foraging areas would occur due to the reduced population. Because the USFWS (1999) has stated that the presence of large numbers of resident Canada geese conflict with management of the wild, migratory AP of Canada geese, a reduced resident Canada goose population may have beneficial impacts on the migratory AP of Canada geese through reduced competition of habitat and food sources.

All wildlife, including the species described above, may be temporarily affected during land disturbance activities such as the re-grading of sites or construction activities including hydrology, vegetation, and wetland restoration techniques that increase noise. These techniques would have a negligible impact on wildlife at the area disturbed and during the period of activity. Disturbance impacts would be minimized as much as possible; the disturbed areas would be revegetated immediately following site preparation. However, the wildlife species that currently inhabit the park are accustomed to urban sounds and disturbances and should be able to acclimate to short-term construction impacts. Overall, alternative B would have a beneficial impact on wildlife because improvements to habitat (both terrestrial and wetlands) and food sources could positively affect population numbers/structure of wildlife species in the park.

Cumulative Impacts—The beneficial impacts on wildlife as a result of alternative B were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would result in a long-term minor adverse impact on wildlife, these adverse effects would be offset when added to the beneficial impacts from alternative B, resulting in a negligible cumulative impact to wildlife.

Conclusion—Alternative B would result in overall beneficial impacts on wildlife because improvements to habitat and food sources would positively impact population structure and numbers in the park. The cumulative impacts of this project when considered together with other projects in proximity to the park would be negligible.

Alternative C – Moderate Wetland, Moderate Resident Canada Goose Management—Alternative C includes many of the same wetland management and resident Canada goose management techniques proposed as alternative B, although in general less intensive techniques. Compared to alternative B, alternative C includes only limited removal of structures, both mechanical and passive seedbank regeneration, least invasive stream/stormwater outfall modifications, would not include creating tidal guts, would not consider stream daylighting or seawall breaks and planting efforts would be at a lower density than alternative B. Like alternative B, alternative C would also manage invasive plant species, the

25- to 50-foot buffers along the shorelines of the River throughout the park would be planted, and the width of existing vegetated buffers would be increased. Similar to alternative B, the combination of reducing the resident Canada goose population and the effort to help restore the freshwater tidal ecosystem would allow wetlands to reach the desired condition of predominantly self-sustaining systems (containing advanced seral-stage habitat conditions) and would enhance habitat for migratory Canada geese that use the park on a seasonal basis. This would have benefits for migratory Canada geese as well as other wildlife species, which are all a natural part of this ecosystem. Therefore, a reduced resident Canada goose population may have beneficial impacts on migratory Canada geese through reduced competition of habitat and food sources as well as other waterfowl. Overall impacts to wildlife for alternative C would be the same as alternative B: beneficial because improvements to habitat (both terrestrial and wetlands) and food sources could positively affect population numbers/structure of wildlife species in the park, including the species listed by the District WAP. Land disturbance would still occur during construction activities, and would have a negligible impact on wildlife at the area disturbed and during the period of activity.

Cumulative Impacts—The beneficial impacts on wildlife as a result of alternative C were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would result in a long-term minor adverse impact on wildlife, these adverse effects would be offset when added to the beneficial impacts from alternative C, resulting in a negligible cumulative impact to wildlife.

Conclusion—Alternative C would result in overall beneficial impacts on wildlife because improvements to habitat and food sources would positively impact population structure and numbers in the park, including species listed by the district WAP. The cumulative impacts of this project when considered together with other projects in proximity to the park would be negligible.

Alternative D – Low Wetland, Low Resident Canada Goose Management—Alternative D has limited wetland management and resident Canada goose management techniques proposed, including no initial lethal reduction activities and a minor level of invasive vegetation species management (similar to current program). Alternative D includes new and increased vegetative buffers, which would create/improve habitat and food sources for wildlife species, but low resident Canada goose management. Low resident Canada goose management would still allow resident Canada geese to compete for habitat and food sources with migratory Canada geese and/or other waterfowl at the park. As suggested in USFWS (2005, IV-9), impacts of resident Canada geese on other migratory waterfowl could include resident Canada goose damage to habitat intended for wintering and migrating waterfowl. Land disturbance would still occur during construction activities, and would have a negligible impact on wildlife at the area disturbed and during the period of activity. Overall, alternative D results in long-term minor adverse impacts to wildlife because food sources and habitat quality would be improved through plantings, but may be offset or reduced by the lack of lethal reduction activities, resulting in detectable impacts that would not be outside the natural range of variability; small changes to population numbers, population structure, genetic variability, and other demographic factors might occur and occasional responses to disturbance by some individuals would be expected.

Cumulative Impacts—The long-term minor adverse impacts on wildlife in and near Anacostia Park under alternative D were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed above would have long-term minor adverse impacts to wildlife, the added adverse effects of alternative D would result in a long-term moderate adverse cumulative impact on wildlife.

Conclusion—Alternative D would result in overall long-term minor adverse impacts on wildlife because impacts would be detectable, but would remain within the range of natural variability, though there may

be small changes to demographics and genetic variation, and some individuals may have responses to disturbance without impacting the population as a whole. Impacts would not occur during key reproduction periods and habitats for sensitive native species. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term moderate and adverse.

Alternative E – High Wetland, Moderate Resident Canada Goose Management, with No Lethal Control—Alternative E has the same wetland management techniques proposed as alternative B including an invasive plant species management program and high density planting efforts, but no lethal reduction activities. The lack of lethal reduction activities would still allow resident Canada geese to compete for habitat and food sources with migratory Canada geese and/or other waterfowl at the park. Overall, alternative E results in negligible impacts to wildlife because food sources and habitat quality would be improved through plantings, but may be offset by the lack of lethal reduction activities, resulting in an immeasurable change to population numbers or structure of wildlife in the park. Land disturbance would still occur during construction activities, and would have a negligible impact on wildlife at the area disturbed and during the period of activity.

Cumulative Impacts—The negligible impacts on wildlife in and near Anacostia Park under alternative E were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed above would have long-term minor adverse impacts to wildlife, the negligible effects of alternative E would result in a long-term minor adverse cumulative impact on wildlife.

Conclusion—Alternative E would result in overall negligible impacts on wildlife because there would be no measureable impacts on species, their habitats, or natural processes that sustain them and any impacts would be within the limits of natural fluctuation. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term minor and adverse.

Resident Canada Geese

Guiding Regulations and Policies

According to NPS *Management Policies 2006,* whenever a park removes native plants or animals, manages plant or animal populations to reduce their size, or allows others to remove plants or animals for an authorized purpose, the NPS would seek to ensure that such removals would not cause unacceptable impacts on native resources, natural processes, or other park resources. If the NPS identifies a possible need for reducing the size of a park plant or animal population, the park would use scientifically valid resource information obtained through consultation with technical expert literature review, inventory, monitoring, or research to evaluate the identified need for population management. There are specific sections in NPS *Management Policies 2006* that are applicable and supportive of the management of resident Canada geese, as described in the paragraphs that follow.

The *Migratory Bird Treaty Act of 1918* implements various treaties and conventions between the United States and other countries for the protection of migratory birds. Under the activities prohibited, unless permitted by regulations, to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention…for the protection of migratory birds…or any part, nest, or egg of any such bird (16 USC 703).

As stated previously in chapter 1, Canada geese are federally protected by the MBTA (16 USC 703-711). Regulations governing the issuance of permits to take, capture, kill, possess, and transport migratory birds are authorized by the MBTA, promulgated in Title 50 CFR parts 13 and 21, and issued by the USFWS. As promulgated in 1999, subpart C of part 21, Specific Permit Provisions, section 21.26 is the Special Canada Goose Permit, issued only to State wildlife agencies, authorizing certain resident Canada goose management and control activities. Section 21.27 pertains to special-purpose permits, which allow for the taking of migratory birds with compelling justification. In subpart D of part 21, section 21.41 pertains to general depredation permits and section 21.42 authorizes the Director of the USFWS to issue depredation orders to permit the killing of migratory game birds. The USFWS adopted special federal regulations (called "depredation orders" and "control orders") in 2006 authorizing take of Canada geese without a federal permit in certain situations and is described in detail in Title 50, CFR, Part 21, Subpart D (50 CFR 21D: Control of Depredating Birds). Therefore, the take of resident Canada geese by NPS in this plan/EIS would require obtaining a permit from USFWS.

Assumptions and Methodologies

The evaluation of resident Canada geese was based on an assessment of how expected management actions would affect the Anacostia Park resident Canada goose population at the park, currently estimated at 564 geese in 2010 (NPS 2009b; Bates 2010a). Available information on the population size, habitat preference, and life history were compiled and analyzed in relation to the management actions. Egg oiling is occurring at the park, which represents the existing conditions; it is unknown whether this action is reducing the resident Canada goose population within Anacostia Park. The geographic study area for the resident Canada goose includes Anacostia Park and the area beyond park boundaries used by the resident Canada geese population.

Impact Threshold Definitions

The following thresholds were used to determine impacts to the resident Canada goose population:

Negligible: There would be no observable or measurable impacts to the population of resident Canada geese within the park or to the Statewide Maryland resident Canada goose population. Any changes to the resident Canada goose population would be similar to current conditions.

Adverse: *Minor*: Impacts to the population of resident Canada geese within the park would be detectable, but impacts to the Maryland, DC, or Atlantic Flyway resident Canada goose population would not occur.

Moderate: Impacts to the population of resident Canada geese within the park would be detectable, and these impacts would be perceptible at the Maryland and DC resident Canada goose population level, but not at the Atlantic Flyway resident Canada goose population levels.

Major: Impacts to the population of resident Canada geese would occur, and these impacts would be perceptible at both the population level within the park and would be perceptible at the Maryland, DC, and Atlantic Flyway resident Canada goose population levels.

Resident Canada Goose Alternatives Evaluation

Alternative A – No Action Alternative—Under alternative A, no change from current management techniques and/or current conditions would occur. Park staff would continue resident Canada goose management activities at the same level as current, including (since 2004) maintaining current goose exclusion fencing and yearly egg oiling. Lethal population reduction strategies and scare/harassment techniques are not included as part of alternative A. The removal of sheet piling (which would require additional NEPA compliance) would have a negligible impact on resident Canada geese because there would be no observable or measurable changes to the population of resident Canada geese within the park or beyond park boundaries as a result of this action.

The Atlantic Flyway Council's Canada Goose Committee estimates that if 95 percent of the eggs in the local population are found and destroyed each year, it would result in only a 25 percent reduction [of the local population] in the next 10 years, which would not relieve the overgrazing pressure on the wetland communities at Anacostia Park (AWS 2006). Ground-based resident Canada goose count surveys have been conducted since 2004 within Anacostia Park (includes Kenilworth, Kingman, Heritage Island, and Anacostia Park East locations). Survey data from the month of June or July have been presented in this document because most, if not all geese, are resident Canada geese during these months and because geese are flightless during this molting period (NPS 2009b). Within Anacostia Park, the mean resident Canada goose population was 664 in 2004, 617 in 2005, 499 in 2006, 783 in 2007, 696 in 2008, 492 in 2009, and 564 in 2010 (NPS 2009b; Bates 2010a).

Resident Canada goose count surveys have been conducted at the park (including Bladensburg, Kenilworth, Kingman, Heritage Island, and Anacostia Park East) since 2004. Based on the June 2010 five-day goose count conducted in the park, the average resident Canada goose population within park boundaries is approximately 564 geese (Bates 2010a). The wildlife population level is the number of individuals that the land or habitat can support without degradation to the population health, individual bird health, or the environment over an extended period of time (Decker and Purdy 1988). The goose count population data were reviewed by the science team and it was determined that wetlands within Anacostia Park are being [statistically] significantly impacted when the resident Canada goose population exceeds 30.5 geese per wetland square mile and 1 goose per 15 acres of grassland habitat (NPS 2010a; NPS 2009b; Kearns personal communication 18 June 2009). Therefore, the resident Canada goose population goal for taking action to protect vegetation within Anacostia Park is 54 resident Canada geese within the park. The current population estimate of resident Canada geese within the park (564 geese from 2010 data) demonstrate that the population is well over the recommended size (54 geese) to allow for successful wetland restoration [and conservation] in Anacostia Park (NPS 2009b). With little control on the resident Canada goose population in Anacostia Park as proposed in alternative A, the population would continue to fluctuate and vary depending on other conditions; however, an increased population above the recommended size could continue.

In general, when populations are greater than the recommended size, adverse effects to the population itself can occur as a result of crowded conditions, including reduced food sources, reduced or less than desirable available habitat, the spread of disease, and the reduced opportunity for other wildlife to occupy the same space. However, the health of the resident Canada goose population at the park is not yet in jeopardy based upon current size numbers and as suggested in USFWS (2005). It is expected that the reproductive control techniques continued as part of alternative A (yearly egg oiling) would not limit growth enough to reach the initial resident Canada goose goal (54 geese) within the life of this plan/EIS.

The biological carrying capacity is the land or habitat's limit for supporting healthy populations of wildlife without degradation to the animal's health or environment over an extended period of time (from USFWS 2005 as cited in Decker and Purdy 1988). As is presented in the FEIS for Resident Canada

Goose Management (USFWS 2005), based on known population growth curves, it was estimated that it was likely that almost all areas were well below their carrying capacity for Canada geese. Therefore, the health of the resident Canada goose population at the park is not yet in jeopardy based upon current size numbers. At some point in the future, the size of the Anacostia Park population of resident Canada geese may ultimately be limited by available food, water, sanctuary, or other resource needs. As noted in the "Resident Canada Geese and the Role of Climate Change" section of chapter 3, changes in mean sea level rise are expected as a result of climate change. As a result of sea level rise, the wildlife species that depend on these habitats for activities such as foraging or nesting would vary in their responses to habitat changes, depending on species-specific responses to changes in inundation, salinity, vegetation structure and composition, and other habitat characteristics (Strange et al. 2008). For example, tidal flats and other shoreline areas would be inundated as a result of sea level rise which would most likely reduce foraging and nesting areas for resident Canada geese. It is also possible that Canada geese would respond to the warming trends through earlier breeding dates and range expansions (Marra et al. 2005 as cited in NPS 2009d). If the Anacostia Park population of resident Canada geese is limited by resources such as foraging areas, nesting areas, food, water, etc., it is possible that a density-dependent (self) regulation of the population would occur and it is possible that the geese would so deplete their food and nesting resources that a population decline would begin. It is expected that more competition of nesting and foraging resources would adversely affect resident Canada geese, although it is unknown when and to what extent this would affect the population of resident Canada geese at Anacostia Park. As stated by USFWS (2005) in the *Final EIS for Canada Goose Management*, the timing, likelihood, and scale of a population decline of this nature is unpredictable. Alternative A would not include adaptive management or wetland monitoring, both of which are predicted to provide insights to the potential consequences of climate change and help determine how future management practices should be implemented. Therefore, alternative A does not include techniques or actions that would counteract or reduce the potential pressures of climate change. It is likely that the effects of climate change to resident Canada geese would be exacerbated by Alternative A. Climate change could reduce nesting areas and forage areas and cause the expected density-dependent (self) regulation of the population to occur more quickly than without the predicted effects of climate change.

It has been demonstrated that the health of resident Canada goose populations can be further complicated through the feeding of geese by the public (Connecticut DEP 2009). The Connecticut DEP (2009) states that geese fed nutritionally deficient food, such as bread, may be more susceptible to disease. Resident Canada goose management techniques continued as part of alternative A do not include installing *No Feeding* signage or enforcing the feeding wildlife CFR (through fines for violations). Therefore, the public would continue to feed resident Canada geese at Anacostia Park.

Therefore, it is expected that alternative A would continue to result in overall negligible impacts to the population of resident Canada geese in Anacostia Park because current resident Canada goose management practices (yearly egg oiling) are not limiting the growth of the goose population.

Cumulative Impacts—In 1989, the Maryland State resident Canada goose population was estimated at 25,000 (USFWS 1999). From 1990 to 2005, the population in Maryland increased from 17,000 to 83,000 and in Virginia it increased from 35,000 to 156,000 (AWS 2006). The resident Canada goose population in Maryland from spring population estimates (2001 through 2003 averages) was 69,467 geese. The USFWS (2005) states that Maryland's population objective for resident Canada geese is 30,000. Therefore, the current resident Canada goose population in Maryland is over 600 percent greater than the population objective (USFWS 2005). The Atlantic Flyway Council recommended that a 60 percent reduction in resident Canada geese be undertaken to decrease the population, assuming a moderate recruitment [20 to 30 percent of the current adult population] of goslings and new adults (Atlantic Flyway Council 1999). The District is located within the Atlantic Flyway, and the Atlantic Flyway Council as well as the USFWS, MDNR, and the District's WAP have all recommended reducing the resident Canada

goose population. Because the resident Canada goose population would not be reduced in Anacostia Park as a result of alternative A, the NPS would not be following directives proposed by the agencies listed above, as well as meeting a conservation action of the District's WAP (establish a goose management plan).

Hunting for migratory Canada geese was closed across the Atlantic flyway after populations plummeted in the early 1990s; the decline was then accompanied by a dramatic increase in the number of resident Canada geese in Maryland. As a result, hunting seasons for resident Canada geese were reopened in Maryland in 1999 and resident Canada goose hunting regulations set forth by the Maryland DNR Wildlife and Heritage Service were then liberalized in 2002 (and have continued ever since) to reduce the resident population (MDNR 2009). The Maryland DNR liberalization expanded the Late Resident Canada Goose Hunt Zone in Maryland (including portions of Prince George's County), including extending the season length, and increasing the bag limit of geese in response to continued growth of the resident population of Canada geese (MDNR 2009). MDNR states that the objective of the zone expansion and liberalization of bag limits is to provide greater opportunities to harvest overabundant resident Canada geese and to reduce nuisance, depredation, public safety, and health problems caused by these birds (MDNR 2009). During the 2006 September season, hunters bagged an estimated 12,700 resident Canada geese, which was a slight increase over the 10,400 taken in 2005 (USFWS 2007). Previously, growth within the Atlantic Flyway of the residential Canada goose population occurred despite an average annual sport harvest of approximately 240,000 resident birds (1997 through 1999), the reported take of over 60,000 eggs (1995 through 1999), and the reported permit take of 7,840 adult geese (1995 through 1999) (USFWS 2005). In addition to hunting, other regional organizations are currently conducting or have conducted resident Canada goose management activities in the vicinity of Anacostia Park, including the USDA APHIS Wildlife Services and the Maryland-National Capital Park and Planning Commission, as discussed in chapter 2.

As a result of the objectives for reducing the resident Canada goose population as stated in the USFWS's *Final EIS for Canada Geese* (2005) and recommendations by the Atlantic Flyway Council (1999), resident Canada geese are being harvested or managed in Maryland, the District, and other mid-Atlantic states in the Atlantic Flyway. The USFWS has stated it is possible that lethal and non-lethal activities defined in the *Final EIS for Canada Geese* would be expected to significantly decrease the number of injurious resident Canada geese in specific localized areas, especially airports and military airfields, agricultural areas, urban/suburban areas subjected to nest and egg removal, and public health threat areas; expanded hunting opportunities inside the existing hunting frameworks and additional take outside the sport hunting frameworks would help decrease populations on a more regional and statewide scale, compared to site-specific management activities (USFWS 2005). Therefore, a long-term major adverse impact to the resident Canada geese population is already occurring as a result of other activities as specified by USFWS (2005).

The negligible impacts to the resident Canada geese population under alternative A were considered together with the effects of the projects mentioned above from other past, present, and reasonably foreseeable future actions. Since the projects listed above would have long-term major adverse impacts to the resident Canada geese population, there would be long-term, major adverse cumulative impacts on the resident Canada geese population when added to the negligible impacts from alternative A.

Conclusion—Alternative A would continue to result in overall negligible impacts to the population of resident Canada geese in Anacostia Park because current resident Canada goose management practices (yearly egg oiling) are not limiting the growth of the goose population The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term major and adverse.

Resident Canada Goose Impacts Common to All Action (Management) Alternatives

Wetland management techniques that are common to all action alternatives include addressing upland runoff, removing sheet piling along the Anacostia River Fringe Wetlands, and installing new rain garden areas. Removing sheet piling and installing new rain garden areas would require additional NEPA compliance. Resident Canada goose management techniques that are common to all action alternatives include population monitoring, installing/maintaining goose exclusion fencing, and education efforts regarding feeding wildlife and preparing technical brochures describing resident Canada goose management techniques. The techniques described above that are common to all action alternatives would have a negligible impact on resident Canada geese because there would be no observable or measurable changes to the population of resident Canada geese within the park or beyond park boundaries as a result of these techniques. Generally, it is the combination of numerous wetland and resident Canada goose management techniques (discussed as action alternatives below) that would be expected to create a change to the population of resident Canada geese within the park or beyond park boundaries. Tidal flats and other shoreline areas would be inundated as a result of sea level rise which would most likely reduce foraging and nesting areas for resident Canada geese. It is also possible that resident Canada geese would respond to the warming trends like other birds through earlier breeding dates and range expansions (Marra et al. 2005 as cited in NPS 2009d). If the Anacostia Park population of resident Canada geese is limited by resources such as foraging areas, nesting areas, food, water, etc., it is possible that a density-dependent (self) regulation of the population would occur, but this would be unlikely under the action alternatives, which all propose resident Canada goose management techniques to reduce the population. Also, both adaptive management and wetland monitoring are key elements in all of the action alternatives. Monitoring is well known to be an essential element of wetland management, since it would allow detection of long-term change, specifically changes in the distribution of wetland areas, nesting areas, and foraging areas at Anacostia Park that may result from climate change. Monitoring and adaptive management would provide insights to the potential consequences of climate change and help determine how future management practices should be implemented.

Alternative B – High Wetland, High Resident Canada Goose Management—Under alternative B the most aggressive wetlands management techniques are combined with intensive resident Canada goose population reduction techniques (lethal control combined with other techniques). As stated above in alternative A, the resident Canada goose population goal within Anacostia Park is 54 resident Canada geese. Current population estimates of resident Canada geese within the park demonstrate that the population of 564 resident geese is well over the recommended size (54 geese) that would allow for successful wetland restoration (and conservation) in Anacostia Park.

Under this alternative, the number of resident Canada geese to be removed by lethal control would be based upon the prior season's spring goose count results the year this plan/EIS is implemented. The initial resident Canada goose population goal of 54 resident Canada geese may be adjusted based upon results of monitoring and adaptive management strategies. The following actions are included under alternative B regarding resident Canada goose management:

- Lethal control would begin at 40 to 60 percent removal of the resident Canada goose population in the park (based on the annual spring count) and this removal range would continue until the resident Canada goose population goal of 54 is reached or vegetation monitoring and adaptive management indicate a different resident Canada goose population goal is appropriate.
- If after 5 years of removing 40 to 60 percent of the resident Canada goose population does not result in sustainable vegetation, the lethal control would increase up to a 90 percent removal of the resident Canada goose population in the park.

- If after 2 years of removing 40 to 60 percent of the resident Canada goose population, the influx of resident Canada geese in the park causes the population level to remain within 50 percent of the population prior to implementing this plan/EIS, the lethal control would increase by up to 10 percent each year to a maximum of 90 percent.

In addition to lethal control, other options may also be used to achieve plan goals as described in more detail in the paragraphs that follow.

Under this alternative, it is estimated that 40 to 60 percent of the resident Canada goose population would be removed from Anacostia Park during the first year of the plan/EIS as the first phase towards meeting the initial goal of 54 resident Canada geese. Resident Canada goose monitoring would occur for the life of this plan/EIS (15 years as stated in chapter 1) and the resident Canada goose population would be maintained using methods described in this section on a regular basis for the life of this plan/EIS. As a result, a discrete number of resident Canada geese would be removed in subsequent years as determined by monitoring results. As stated previously, the goal of 54 resident Canada geese may be adjusted to meet management goals based on the results of vegetation and resident Canada goose population monitoring, as described in more detail in the "Adaptive Management" section of chapter 2. Techniques used to reduce the population would include round-up, capture, and euthanasia as well as lethal removal by shooting as described in more detail in chapter 2. It is important to note that although at a percentage of the resident Canada goose population would be removed from the park as a result of this plan/EIS, some Canada geese would remain in the park, including both resident and migratory geese. Although many of the impacts resulting from geese are detrimental, the birds themselves are not undesirable, and in fact, are recognized as providing a large number of public benefits, as discussed in more detail in the "Visitor Experience" and "Aesthetics" sections of this chapter. A beneficial impact to resident Canada geese would not be realized by reducing the population size as proposed in alternative B because the health of the resident Canada goose population at the park is not yet in jeopardy based upon current size numbers and as suggested in USFWS (2005).Alternative B would have a long-term major adverse effect on the resident Canada goose population within the park because the population would be reduced and maintained at a lower level than current numbers throughout the life of the plan/EIS. Resident counts and vegetation monitoring would determine if the population needs to be reduced through lethal methods after the initial resident Canada goose removal conducted during the first year of the plan/EIS. In subsequent years, the percent of the population to be removed would be dependent upon results of the vegetative monitoring, and if the initial density goal of 54 geese per square mile within the park was achieved. Resident Canada geese would be removed through round-up, capture, and euthanasia or by shooting as part of alternative B. Using the current population estimate of 592 geese as an example, it is possible that the goal of 54 resident Canada geese within Anacostia Park could be met after 3 years (following three separate 60 percent removals of a population of 592 geese). As stated previously, relocating or removing resident Canada geese has been described by Gosser et al. (1997) as a stop-gap effort because the site must be modified to make it less attractive to resident Canada geese, or the removed geese would be replaced with new geese. This plan/EIS integrates wetland management techniques along with resident Canada goose management techniques and integrates adaptive management as well. Habitat modification techniques are proposed as part of alternative B to make the sites less attractive to resident Canada geese, including planting buffers, applying goose repellents, installing and maintaining exclusion fencing, and making new plantings less desirable to geese through plant species selection. These techniques could be employed in conjunction with population reduction techniques. Additional resident Canada goose management techniques that are proposed as part of alternative B include installing *No Feeding* signage and enforcing the feeding wildlife CFR (through fines for violations). As a result of climate change, tidal flats would be inundated from sea level rise, which may reduce both foraging and nesting areas for resident Canada geese. Alternative B includes numerous techniques to manage the existing wetland areas and the resident Canada goose population at the Park. These techniques would aid in offsetting potential pressures of climate change by reducing the resident Canada goose population and potentially avoiding

the density-dependent (self) regulation of the population that may occur without population control. It is expected that less competition of nesting and foraging resources would benefit the resident Canada geese at Anacostia Park. As discussed above in common to all actions, Alternative B incorporates the most techniques to offset the predicted effects to resident Canada geese that would result from climate change.

Subadult and failed-nesting adult Canada geese can undergo a phenomenon known as molt migration (Luukkonen et al. 2008). Molt migrations are summer movements of Canada geese from their nesting grounds to locations where they molt their flight feathers (Dieter and Anderson 2009). Damage by Canada geese can be especially high during the molting period, when geese have a higher energy demand because of feather production (Dieter and Anderson 2009). Some state and federal agencies have used egg addling or nest destruction to cause nest failure of giant Canada geese (Smith et al. 1999). These management techniques may induce a molt migration, meaning the geese would molt at some other location, which may just move the resident Canada goose issues from one area to another (Dieter and Anderson 2009). Although molt migration is known to occur after a failed nest, it has been estimated that far fewer (less than 27%) females with failed nests in urban parks migrated compared to greater than 65% of females with failed nests in other land uses migrated (Luukkonen et al. 2008). There are several possible factors that could be contributing to low migration incidence in urban parks. Urban parks such as Anacostia Park typically have large expanses of fertilized and mowed grass near water, which is ideal brood habitat. Also, geese are generally protected in parks and are sometimes fed by park visitors. The combination of space, protection, and abundant food resources support high goose densities, may reduce molt migration tendencies in subadult and adult geese (Luukkonen et al. 2008).

Although it is known that resident Canada geese stay within a 5 to 10 mile radius during non-breeding and 0.25 to 0.5 mile radius during breeding season (NPS 2010b), as the population within Anacostia Park is reduced, other resident geese from adjoining lands and waters may be expected to fill the vacant habitat made available over time, although a lag time may occur. However, the local resident Canada goose population would remain at or near the initial goal because under alternative B, NPS proposes to conduct lethal management on a regular basis in combination with other resident Canada goose management and wetland management techniques. In addition to lethal means of reducing the resident Canada goose population, alternative B could also include an intensive scare/harassment program as well as the following reproductive control techniques: increased egg oiling, egg addling, and egg replacement (if population increases after initial reduction); apply goose hatch material (if population increases greater than 20 percent in one year). The local Anacostia Park residential Canada goose population would remain low, but stable in number if lethal management were conducted on a regular basis as proposed as part of alternative B. The resident Canada goose population beyond park boundaries or regionally may also be affected by alternative B. As stated above, alternative B would have a long-term major adverse effect on the resident Canada goose population within the park because the population would be reduced and maintained at a lower level than current numbers throughout the life of this plan/EIS. Even though a long-term major adverse effect would occur to the population of resident Canada geese in the park, an overall, long-term moderate adverse impact on the resident Canada geese population would occur regionally because impacts to the population of resident Canada geese within the park would be detectable, and these impacts would be perceptible at the Maryland or DC resident Canada goose population level, but not at the Atlantic Flyway resident Canada goose population levels. Detectable reductions of resident Canada geese within Anacostia Park would occur over the life of this plan/EIS.

Cumulative Impacts—The same past, present, and future actions described under alternative A would also occur under alternative B. As stated above for alternative A, the current resident Canada goose population in Maryland is over 600 percent greater than the population objective described by the USFWS (2005). The USFWS has recognized that since Canada goose populations have demonstrated the ability to sustain annual harvest rates in excess of 20 percent (USFWS 1999), it is expected that alternative B, which includes proposed lethal reduction activities, would have little to no cumulative

impact on the Statewide population of resident Canada geese for Maryland. Additionally, in 1999, before the Final EIS for Canada Geese was even drafted, the Atlantic Flyway Council recommended that a 60 percent reduction in resident Canada geese be undertaken to decrease the population, assuming a moderate recruitment (20 to 30 percent of the current adult population) of goslings and new adults (Atlantic Flyway Council 1999). The District is located within the Atlantic Flyway, and the Atlantic Flyway Council as well as the USFWS, MDNR, and the District's WAP have all recommended reducing the resident Canada goose population. If the resident Canada goose population is reduced in Anacostia Park, the NPS would be following directives proposed by the agencies listed above, as well as meeting a conservation action of the District's WAP (establish a goose management plan).

Population objectives for resident Canada geese have been described by both the Atlantic Flyway Council (1999) and the USFWS Final EIS for Canada Geese (2005). Resident Canada geese are not only a nuisance within Anacostia Park but in all the Mid-Atlantic states as well as regionally in the Atlantic Flyway. There are large numbers of resident Canada geese in each Flyway, and accordingly cooperative Flyway management plans have been developed to address these populations (USFWS 2005). Each plan presents an overall goal and associated objectives/strategies; a commonality among the goals is the need to balance the positive aspects of resident Canada geese with the conflicts they can cause (USFWS 2005). Based upon resident Canada goose population estimates and population objectives by Flyway, the USFWS (2005, I-20) suggests a 54 percent reduction in the Atlantic Flyway, a 73 percent reduction in the Mississippi Flyway, a 70 to 85 percent reduction in the Central Flyway, and a 25 to 42 percent reduction in the Pacific Flyway. In summary, USFWS (2005) recommends a 25 to 85 percent reduction of resident Canada geese. Additionally, in 1999, before the *Final EIS for Canada Geese* was drafted, the Atlantic Flyway Council recommended that a 60 percent reduction in resident Canada geese be undertaken to decrease the population, assuming a moderate recruitment (20 to 30 percent of the current adult population) of goslings and new adults (Atlantic Flyway Council 1999).

As stated above in alternative A, hunting for resident Canada geese occurs in Maryland to harvest overabundant resident Canada geese and to reduce nuisance, depredation, public safety, and health problems caused by these birds (MDNR 2009). During the 2006 September season, hunters bagged an estimated 12,700 resident Canada geese, which was a slight increase over the 10,400 taken in 2005 (USFWS 2007). Previously, growth within the Atlantic Flyway of the residential Canada goose population occurred despite an average annual sport harvest of approximately 240,000 resident birds (1997 through 1999), the reported take of over 60,000 eggs (1995 through 1999), and the reported permit take of 7,840 adult geese (1995 through 1999) (USFWS 2005). Also stated in alternative A, other regional organizations are currently conducting or have conducted Canada goose management activities in the vicinity of Anacostia Park, including the USDA APHIS Wildlife Services and the Maryland-National Capital Park and Planning Commission.

As a result of the objectives for reducing the resident Canada goose population as stated in the USFWS *Final EIS for Canada Geese* (2005) and recommendations by the Atlantic Flyway Council (1999), resident Canada geese are being harvested or managed in Maryland, the District, and other Mid-Atlantic states in the Atlantic Flyway. The USFWS has stated it is possible that lethal and non-lethal activities defined in the Final EIS for Canada Geese would be expected to significantly decrease the number of injurious resident Canada geese in specific localized areas and that expanded hunting opportunities would help decrease populations on a more regional and statewide scale, compared to site-specific management activities (USFWS 2005). Therefore, a long-term, major adverse impact to the resident Canada geese population is already occurring as a result of other activities as specified by USFWS (2005), the MDNR, and the Atlantic Flyway Council (1999).

The long-term, moderate to major, adverse impacts to the resident Canada geese population under alternative B were considered together with the effects of the projects and actions mentioned above from

other past, present, and reasonably foreseeable future actions. Since the projects listed above would have long-term major adverse impacts to the resident Canada geese population, there would be long-term major adverse cumulative impacts on resident Canada geese when added to the long-term moderate to major adverse impacts from alternative B. However, the maximum of 40 to 60 percent of the resident Canada geese proposed for removal in the first year of this plan in Anacostia Park (and removing a discrete number determined through monitoring in subsequent years) is small compared to the tens of thousands of geese removed by hunters in Maryland every year.

Conclusion—Even though a long-term major adverse effect would occur to the Anacostia Park population of resident Canada geese under alternative B, an overall long-term moderate adverse impact on resident Canada geese would occur regionally because impacts to the population of resident Canada geese within the park would be detectable, and these impacts would be perceptible at the Maryland or DC resident Canada goose population level, but not at the Atlantic Flyway resident Canada goose population levels. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term major and adverse.

Alternative C – Moderate Wetland, Moderate Resident Canada Goose Management—Alternative C has similar resident Canada goose management techniques proposed as alternative B, with a few exceptions. Alternative C proposes population reduction for the resident Canada goose within the park, through removal of 40 to 60 percent of the resident Canada goose population within the first year of the plan/EIS as the first phase towards meeting the initial goal of 54 resident Canada geese. Resident Canada goose monitoring would occur for the life of this plan/EIS (15 years as stated in chapter 1). Although monitoring may be conducted yearly, lethal control of 40 to 60 percent of the resident Canada goose population would only be used up to five times throughout the life of this plan/EIS following the initial reduction, and only if the population exceeds the initial goal of 54 resident Canada geese within the park or if vegetation monitoring and adaptive management indicate a different resident Canada goose population goal is appropriate. Therefore, a discrete number of resident Canada geese may be removed up to five times in subsequent years as determined by monitoring results. Similar to alternative B, the goal of 54 resident Canada geese may be adjusted through adaptive management to meet management goals based on the results of vegetation and resident Canada goose population monitoring. For this alternative, the current resident Canada goose population may be reduced through round-up, capture, and euthanasia, but no shooting of resident Canada geese would be included as part of alternative C (see chapter 2). Using the current population estimate of 592 geese as an example, it is possible that the goal of 54 resident Canada geese within Anacostia Park could be met after 3 years (following three separate 60 percent removals of a population of 592 geese). It is important to note that although at a percentage of the resident Canada goose population would be removed from the park as a result of this plan/EIS, some Canada geese would remain in the park, including both resident and migratory geese.

Alternative C would have a long-term moderate adverse impact on the resident Canada goose population within the park because the population would be reduced at a lower level than current numbers up to five times throughout the life of this 15-year plan/EIS. Alternative C allows for the lethal reduction of the resident Canada goose population one time in the first year of the plan/EIS and a maximum of five times throughout the plan to meet the initial population goal. It has been demonstrated that a cull (gathering and removing) of breeding Canada geese may simply create vacant territories for other birds to move into and repeat culls may be necessary for a number of years before the problem is finally brought under control (Allan 1999). It is possible that the resident Canada goose population may readjust following the maximum five-time population reduction. That said, it has been demonstrated that a combination of techniques (besides just goose removal) are the most successful in controlling damage to sites by resident Canada geese, including making sites less attractive to geese in comparison to other sites (Gosser et al. 1997). Therefore, other resident Canada goose management techniques proposed as part of alternative C such as habitat modification (planting buffers, applying goose repellents, etc.), less intensive

scare/harassment techniques, and reproductive control techniques (egg oiling and applying goose hatch material) would work in combination with the population reduction techniques. As stated above for alternative B, it is important to note that a beneficial impact to resident Canada geese would not be realized by reducing the population size as proposed in alternative C because the health of the resident Canada goose population at the park is not yet in jeopardy based upon current size numbers and as suggested in USFWS (2005). Similar to the discussion for alternative B above, tidal flats would be inundated as a result of sea level rise, which may reduce both foraging and nesting areas for resident Canada geese. Alternative C includes numerous techniques to manage the existing wetland areas and the resident Canada goose population at the Park. These techniques would aid in offsetting potential pressures of climate change by reducing the resident Canada goose population and potentially avoiding the density-dependent (self) regulation of the population that may occur without population control. It is expected that less competition of nesting and foraging resources would benefit the resident Canada geese at Anacostia Park. The combination of these techniques would aid in offsetting potential pressures of climate change in addition to the techniques described above that are common to all action alternatives. Alternative C, like alternative B, incorporates the most techniques to offset the predicted effects to resident Canada geese that would result from climate change.

As a result of alternative C, the local Anacostia Park residential Canada goose population would remain low, but could fluctuate in number if lethal management was conducted a maximum of five times as proposed as part of this alternative. The resident Canada goose population beyond park boundaries or regionally may also be affected by alternative C. As stated above, alternative C would have a long-term moderate adverse impact on the resident Canada goose population within the park because the population would be reduced and maintained at a lower level than current numbers up to five times throughout the life of this plan/EIS. Even though a long-term moderate adverse effect would occur to the Anacostia Park population of resident Canada geese, an overall long-term minor adverse impact on the resident Canada geese population would occur regionally because impacts to the population of resident Canada geese within the park would be detectable, but these impacts would not be perceptible at the Maryland, DC, or at the Atlantic Flyway resident Canada goose population levels during the life of this plan/EIS. In contrast, detectable reductions of resident Canada geese within Anacostia Park would occur over the life of this plan/EIS.

Cumulative Impacts—The same past, present, and future actions described under alternative A would also occur under alternative C. Cumulative impacts to resident Canada geese under alternative C would be very similar to those described above for alternative B, because both alternatives B and C propose lethal controls for the population reduction of the resident Canada geese within Anacostia Park. As a result of the objectives for reducing the resident Canada goose population as stated in the USFWS's *Final EIS for Canada Geese* (2005) and recommendations by the Atlantic Flyway Council (1999), resident Canada geese are being harvested in Maryland and other Mid-Atlantic states in the Atlantic Flyway. The USFWS has stated it is possible that lethal and non-lethal activities defined in the Final EIS for Canada Geese would be expected to significantly decrease the number of injurious resident Canada geese in specific localized areas and that expanded hunting opportunities would help decrease populations on a more regional and statewide scale, compared to site-specific management activities (USFWS 2005).

Therefore, a long-term major adverse impact to resident Canada geese is already occurring as a result of other activities as specified by USFWS (2005), the MDNR, and the Atlantic Flyway Council (1999). The overall long-term minor adverse impacts to resident Canada geese under alternative C were considered together with the effects of the projects mentioned above. Since the projects listed above would have long-term major adverse impacts to resident Canada geese, there would still be long-term major adverse cumulative impacts on resident Canada geese when added to the long-term minor to moderate adverse impacts from alternative C. However, the maximum of 40 to 60 percent of the resident Canada geese proposed for removal in the first year of this plan in Anacostia Park (and removing a discrete number

determined through monitoring in subsequent years) is small compared to the tens of thousands removed by hunters in Maryland every year.

Conclusion—Alternative C would have a long-term moderate adverse effect on the resident Canada goose population within the park because the population would be reduced and maintained at a lower level than current numbers up to five times throughout the life of this plan/EIS. Even though a long-term moderate adverse effect would occur to the Anacostia Park population of resident Canada geese, an overall, long-term minor adverse impact on the resident Canada geese population would occur regionally as a result of alternative C because impacts to the population of resident Canada geese within the park would be detectable, but these impacts would not be perceptible at the Maryland, DC, or at the Atlantic Flyway resident Canada goose population levels during the life of this plan/EIS. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term major and adverse.

Alternative D – Low Wetland, Low Resident Canada Goose Management—Alternative D proposes a primarily non-lethal, low resident Canada goose management option. Under alternative D, there would be no initial lethal resident Canada goose population reduction activities, but the resident Canada goose population would be monitored annually. Other resident Canada goose management techniques are proposed (including planting buffers, applying goose repellents, a less intensive scare/harassment program, and egg oiling) as part of alternative D as discussed in "Chapter 2: Alternatives". If these techniques do not keep the resident Canada goose population at the initial goal of 54 resident Canada geese within the park, a one-time population reduction using resident Canada goose management techniques of 40 to 60 percent of the resident Canada goose population would be performed during the life of this plan/EIS. This lethal population reduction would include round-up, capture, and euthanasia; no shooting of resident Canada geese would occur under alternative D. The population would be monitored annually throughout the life of the plan but the population would not be reduced in subsequent years even if the population exceeds the initial goal of 54 resident Canada geese within the park.

Alternative D would have a short-term major adverse effect on the resident Canada goose population within the park because a one-time, lethal population reduction would occur, but would not be maintained over the long-term. It is possible that, due to the nature of urban-dwelling geese, other geese would capitalize on the newly void habitat. It has been demonstrated that a cull (gathering and removing) of breeding Canada geese may simply create vacant territories for other birds to move into and repeat culls may be necessary for a number of years before the problem is finally brought under control (Allan 1999). Future population reduction strategies beyond the one-time reduction are not proposed as part of alternative D. Studies have shown that a combination of techniques (besides just goose removal) are the most successful in controlling damage to sites by resident Canada geese (Gosser et al. 1997). Therefore, other resident Canada goose management techniques proposed as part of alternative D such as habitat modification (planting buffers, applying goose repellents, etc.), less intensive scare/harassment techniques, and reproductive control techniques (egg oiling and applying goose hatch material) may work in combination with the one-time population reduction, although these techniques are similar to current actions which have not had an overall reduction on the resident Canada goose population in Anacostia Park. Although an initial goal of 54 resident Canada geese within the park was determined by the science team, it is not likely that this goal would be met after 15 years due to the one-time, lethal population reduction proposed as part of alternative D and even considering the other resident Canada goose management techniques proposed under alternative D**.** As stated above for alternatives B and C, it is important to note that a beneficial impact to resident Canada geese would not be realized by reducing the population size as proposed in alternative D because the health of the resident Canada goose population at the park is not yet in jeopardy based upon current size numbers and as suggested in USFWS (2005). Only the techniques described previously that are common to all action alternatives would aid in offsetting potential pressures of climate change under alternative D, which includes low wetland and low resident

Canada goose management. As a result, these techniques are not expected to offset potential pressures of climate change because a population reduction of resident Canada geese would occur only one time under alternative D in combination with limited foraging and nesting areas that are expected from climate change. As a result of alternative D, the local Anacostia Park residential Canada goose population could fluctuate or increase in size if lethal management was only conducted a maximum of one time as part of this alternative. The resident Canada goose population beyond park boundaries or regionally would not be affected by alternative D. As stated above, alternative D would have a short-term major adverse effect on the resident Canada goose population within the park because the population would be reduced one time at a lower level than current numbers. Even though a short-term major adverse effect would occur to the Anacostia Park population of resident Canada geese, an overall, negligible impact on the resident Canada geese population would occur in the park and regionally if the population readjusts following the maximum one-time population reduction because over the life of this plan/EIS because there would be no observable or measurable impacts to the population of resident Canada geese within the park or to the Maryland, DC, or Atlantic Flyway resident Canada goose populations; any changes to the resident Canada goose population would be similar to current conditions.

Cumulative Impacts—The same past, present, and future actions described under alternative A would also occur under alternative D. As a result of the objectives for reducing the resident Canada goose population as stated in the USFWS's *Final EIS for Canada Geese* (2005) and recommendations by the Atlantic Flyway Council (1999), resident Canada geese are being harvested in Maryland and other mid-Atlantic states in the Atlantic Flyway. The USFWS has stated it is possible that lethal and non-lethal activities defined in the Final EIS for Canada Geese would be expected to significantly decrease the number of injurious resident Canada geese in specific localized areas and that expanded hunting opportunities would help decrease populations on a more regional and statewide scale, compared to site-specific management activities (USFWS 2005). Therefore, a long-term, major adverse impact to resident Canada geese is already occurring as a result of other activities as specified by USFWS (2005), the MDNR, and the Atlantic Flyway Council (1999).

Under alternative D, although a short-term major adverse impact would occur to the Anacostia Park population of resident Canada geese, an overall, negligible impact on the resident Canada geese population would occur in the park and regionally if the population readjusts following the maximum one-time population reduction because over the life of this plan/EIS there would be no observable or measurable impacts to the population of resident Canada geese within the park or to the Maryland, DC, or Atlantic Flyway resident Canada goose populations; any changes to the resident Canada goose population would be similar to current conditions. The overall negligible impacts to the resident Canada geese population under alternative D were considered together with the effects of the projects mentioned above from other past, present, and reasonably foreseeable future actions. Since the projects listed above would have long-term major adverse impacts to resident Canada geese, there would still be long-term major adverse cumulative impacts on the resident Canada geese population when added to the negligible impacts from alternative D. However, the maximum of 40 to 60 percent of the geese proposed for a one-time removal in this plan in Anacostia Park is small compared to the tens of thousands removed by hunters in Maryland every year.

Conclusion—Alternative D would have a short-term major adverse impact on the resident Canada goose population within the park because the population would be reduced one time at a lower level than current numbers by lethal reduction. Even though a short-term major adverse effect would occur to the Anacostia Park population of resident Canada geese, an overall negligible impact on the resident Canada geese population would occur in the park and regionally as a result of alternative D if the population readjusts following the maximum one-time population reduction. Over the 15-year life of this plan/EIS there would likely be no observable or measurable impacts to the population of resident Canada geese within the park or to the Maryland, DC, or Atlantic Flyway resident Canada goose populations as a result of alternative

D; any changes to the resident Canada goose population would be similar to current conditions. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term major and adverse.

Alternative E – High Wetland, Moderate Resident Canada Goose Management, with No Lethal Control—This alternative includes intensive resident Canada goose management activities, but no lethal control for resident Canada geese. Under this alternative, no resident Canada geese would be removed from the park, but the population would be monitored during the life of the plan/EIS. Although an initial goal of 54 resident Canada geese within the park was determined by the science team, it is not likely that this goal would be met since a population reduction would not occur as part of alternative E. Similar to the discussion for alternative B, tidal flats would be inundated as a result of sea level rise, which may reduce both foraging and nesting areas for resident Canada geese. Alternative E includes numerous techniques to manage the existing wetland areas and the resident Canada goose population at the Park, but no lethal control. As a result, these techniques are not expected to offset potential pressures of climate change because a population reduction of resident Canada geese would not occur in combination with limited foraging and nesting areas that are expected from climate change.

Alternative E would have a negligible effect on the resident Canada goose population within the park because no lethal population reduction strategies would not occur; the Maryland, DC, or Atlantic Flyway populations of resident Canada geese would not be affected by alternative E. Other resident Canada goose management techniques are proposed as part of alternative E and include habitat modification (planting buffers, applying goose repellents, etc.), intensive scare/harassment techniques, and reproductive control techniques (egg oiling, addling, egg replacement, and applying goose hatch material). These techniques are similar to current actions, which have not had an overall reduction on the resident Canada goose population in Anacostia Park and thus substantiate a negligible impact.

Cumulative Impacts—The same past, present, and future actions described under alternative A would also occur under alternative E. As a result of the objectives for reducing the resident Canada goose population as stated in the USFWS's Final EIS for Canada Geese (2005) and recommendations by the Atlantic Flyway Council (1999), resident Canada geese are being harvested in Maryland and other mid-Atlantic states in the Atlantic Flyway. The USFWS has stated it is possible that lethal and non-lethal activities defined in the *Final EIS for Canada Geese* would be expected to significantly decrease the number of injurious resident Canada geese in specific localized areas and that expanded hunting opportunities would help decrease populations on a more regional and statewide scale, compared to site-specific management activities (USFWS 2005). Therefore, a long-term, major adverse impact to the resident Canada geese population is already occurring as a result of other activities as specified by USFWS (2005), the MDNR, and the Atlantic Flyway Council (1999).

The overall, negligible impacts to the resident Canada geese population under alternative E were considered together with the effects of the projects mentioned above from other past, present, and reasonably foreseeable future actions. Since the projects listed above would have long-term major adverse impacts to resident Canada geese, there would still be long-term, major adverse cumulative impacts on resident Canada geese when added to the negligible impacts from alternative E. Other resident Canada goose management techniques are proposed as part of alternative E and are similar to current actions, which have not had an overall reduction on the resident Canada goose population in Anacostia Park and any geese managed under these techniques would be small compared to the tens of thousands removed by hunters in Maryland every year.

Conclusion—Alternative E would have a negligible impact on the resident Canada goose population within the park because no lethal population reduction strategies would occur; the Maryland, DC, or Atlantic Flyway populations of resident Canada geese would not be affected by alternative E. Other

resident Canada goose management techniques are proposed as part of alternative E. These techniques are similar to current actions, which have not had an overall reduction on the resident Canada goose population in Anacostia Park and thus substantiate a negligible impact as a result of alternative E. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term, major, and adverse.

CULTURAL RESOURCES

GUIDING REGULATIONS AND POLICIES

The NPS is charged with the protection and management of cultural resources in its custody. This is furthered through the implementation of *Director's Order #28: Cultural Resources Management Guidelines* (NPS 1998), NPS *Management Policies* 2006 (NPS 2006a), and the 2008 *Servicewide Programmatic Agreement with the Advisory Council and the National Conference of State Historic Preservation Officers*. These documents charge NPS managers with avoiding, or minimizing to the greatest degree practicable, adverse impacts on park resources and values. Although the NPS has the discretion to allow certain impacts in parks, that discretion is limited by the statutory requirement that park resources and values remain unimpaired, unless a specific law directly provides otherwise.

Federal actions that have the potential to affect cultural resources are subject to a variety of laws and regulations. Generally, Section 106 of the NHPA requires all federal agencies to consider the effects of their actions on cultural resources listed and/or determined eligible for listing in the NRHP. Such resources are termed "historic properties." Agreement on mitigation of adverse effects to historic properties is reached through consultation with the SHPO; Tribal Historic Preservation Officer, if applicable; and, as required, the Advisory Council on Historic Preservation (Advisory Council). In addition, the NHPA requires that federal agencies take actions to minimize harm to historic properties that would be adversely affected by a federal undertaking. Among other things, Section 110 of the NHPA also charges federal agencies with the responsibility for establishing preservation programs for the identification, evaluation, and nomination of historic properties to the NRHP.

Other important laws and regulations designed to protect cultural resources are:

- Native American Graves Protection and Repatriation Act, 1990
- American Indian Religious Freedom Act, 1978
- National Environmental Policy Act, 1969
- Archeological Resources Protection Act, 1979
- Executive Order 11593, Protection and Enhancement of the Cultural Environment," 1971

METHODOLOGIES AND ASSUMPTIONS

The NPS categorizes cultural resources by the following categories: archeological resources, cultural landscapes, historic districts and structures, museum objects, and ethnographic resources. As noted in the "Issues and Impact Topics" section of the "Purpose and Need" chapter, only impacts to historic districts and structures and archeological resources are of potential concern for this plan. There would be no impacts to cultural landscapes, ethnographic resources, or museum objects, so these topics were dismissed from consideration. The analyses of effects on cultural resources that are presented in this section respond to the requirements of both NEPA and Section 106 of the NHPA in a general and programmatic documentation. Where NEPA analysis is suggested or required for site-specific management or

techniques carried out under the guidance of this document, future analyses, including detailed Section 106 compliance would "tier to" or reference this plan/EIS. Site-specific NEPA analysis, when required, would focus on issues, alternatives, and environmental effects unique to the study area.

In accordance with the Advisory Council's regulations implementing Section 106 (36 CFR Part 800, *Protection of Historic Properties*), impacts on cultural resources were identified and evaluated by (1) determining the Area of Potential Effects (APE); (2) identifying cultural resources present in the APE that are either listed in or eligible to be listed in the NRHP (i.e., historic properties); (3) applying the criteria of adverse effect to affected historic properties; and (4) considering ways to avoid, minimize, or mitigate adverse effects.

Under the implementing regulations for Section 106, a determination of either *adverse effect* or *no adverse effect* must also be made for affected historic properties. An adverse effect occurs whenever an impact alters, directly or indirectly, any characteristic of a cultural resource that qualifies it for inclusion in the NRHP (for example, diminishing the integrity of the resource's location, design, setting, materials, workmanship, feeling, or association). Adverse effects also include reasonably foreseeable effects caused by the proposal that would occur later in time, be farther removed in distance, or be cumulative (36 CFR 800.5). A determination of *no adverse effect* means there is either no effect or that the effect would not diminish, in any way, the characteristics of the cultural resource that qualify it for inclusion in the NRHP.

CEQ regulations and the NPS Director's Order #12: *Conservation Planning, Environmental Impact Analysis and Decision-Making* Handbook (NPS 2001) also call for a discussion of the appropriateness of mitigation, as well as an analysis of how effective the mitigation would be in reducing the intensity of a potential impact, e.g. reducing the intensity of an impact from major to moderate or minor. Any resultant reduction in intensity of impact due to mitigation, however, is an estimate of the effectiveness of mitigation under NEPA only. Cultural resources are non-renewable resources and adverse effects generally consume, diminish, or destroy the original historic materials or form, resulting in a loss in the integrity of the resource that can never be recovered. Therefore, although actions determined to have an adverse effect under Section 106 may be mitigated, the effect remains adverse.

The NPS guidance for evaluating impacts (Director's Order #12 Handbook) (NPS 2001) requires that impact assessment be scientific, accurate, and quantified to the extent possible. For cultural resources, it is seldom possible to measure impacts in quantifiable terms; therefore, impact thresholds must rely heavily on the professional judgment of resource experts.

Broadly defined, the study area coincides with the entire length of Anacostia Park, which encompasses 1,300 acres along 5 miles of the Anacostia River shoreline (see figure 1). For purposes of analysis of impacts to cultural resources, the geographic study area is limited to approximately 100 acres of restored tidal wetlands within Anacostia Park including Kenilworth Marsh, Kingman Marsh, and Anacostia River Fringe Wetlands (see figure 4).

HISTORIC STRUCTURES AND DISTRICTS

The proposed activities have the potential to impact four NRHP-listed or NRHP-eligible properties and six properties that may be NRHP-eligible but have not been formally evaluated. These properties include:

- Kenilworth Aquatic Gardens (NRHP-listed)
- Langston Golf Course Historic District (NRHP-listed)
- Anacostia Park (NRHP-eligible)

- Anacostia Shoreline Pump Station (NRHP-eligible)
- Anacostia Field House (potentially NRHP-eligible)
- Anacostia River Seawall (potentially NRHP-eligible)
- Seafarer's Boat Club (potentially NRHP-eligible)
- Water Street Quonset Huts (potentially NRHP-eligible)
- Bonus Marchers Campsite (potentially NRHP-eligible)
- Stones of the Old United States Capitol Building (potentially NRHP-eligible)

Impact Threshold Definitions

For an historic district or structure to be listed on the NRHP, it must possess significance (the meaning or value ascribed to the historic district or structure) and have integrity of those features necessary to convey its significance. For purposes of analyzing potential impacts to historic districts and structures, the thresholds of change for the intensity of an impact are defined as follows:

Beneficial: No levels of intensity for beneficial impacts are defined. Beneficial impacts can occur under the following scenarios: when character-defining features of the historic district or structure would be stabilized/preserved in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (NPS 1995), to maintain its existing integrity; when the historic district or structure would be rehabilitated in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* to make possible a compatible use of the property while preserving its character defining features; or when historic district or structure would be restored in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* to accurately depict its form, features, and character as it appeared during its period of significance. For purposes of Section 106, a beneficial effect is equivalent to *no adverse effect*.

Negligible: The impact is at the lowest level of detection with neither adverse nor beneficial consequences. For purposes of Section 106, the determination of effect would be *no adverse effect*.

Adverse: *Minor*: Alteration of a pattern(s) or feature(s) of a historic district or structure listed on or eligible for the NRHP would not diminish the integrity of a character-defining feature(s) or the overall integrity of the historic property. For purposes of Section 106, the determination of effect would be *no adverse effect.*

Moderate: The impact would alter a character-defining feature(s) of a historic district or structure and diminish the integrity of that feature(s) of the historic property. For purposes of Section 106, the determination of effect would be *adverse effect*.

Major: The impact would alter a character-defining feature(s) of the historic district or structure and severely diminish the integrity of that feature(s) and the overall integrity of the historic property. For purposes of Section 106, the determination of effect would be *adverse effect*.

Duration: Short-term impacts would last for the duration of construction activities associated with the proposed alternative; long-term impacts would last beyond the construction activities.

Historic District and Structures Alternatives Evaluation

Alternative A – No Action Alternative—The no action alternative would continue the existing practices for wetland management and resident Canada goose management at their current levels. The removal of sheet piling (which would require additional NEPA compliance) would have no impact on historic structures and districts. There would be no additional changes to improve the hydrological conditions or to restore wetlands under alternative A. Control of invasive plant species would continue. Resident Canada goose management strategies, which include egg oiling, population monitoring, fencing, and wetland vegetation planting, would not change. None of these activities has had any effect on historic structures and districts, nor is it expected that continued practices would result in any impacts to historic structures and districts. Therefore, alternative A would have no impacts (corresponds to *no adverse effect* for Section 106) on historic structures and districts.

Cumulative Impacts—Among the various other projects considered for assessment of potential cumulative impacts to historic districts and structures, the following previously completed and present projects within Anacostia Park have had no impacts to historic districts and structures: Kenilworth Marsh, Kingman Marsh, Anacostia Riverwalk Trail, and Anacostia Skating Pavilion.

However, some future projects would affect the historic districts and structures in the study area and include the 11th Street Bridges Project and the Poplar Point Redevelopment, and the Poplar Point Restoration Project. The NEPA compliance for the Poplar Point Redevelopment and the Poplar Point Restoration projects is not yet available, but the EIS for the 11th Street Bridges Project determined that the project would result in an *adverse effect* to Anacostia Park since 1.5 acres of open recreation area would be lost. While the project would not impact the seawalls themselves, it would impact land close to the seawalls on both sides of the Anacostia River. Thus, a finding of *adverse effect* was recommended. It was determined that the 11th Street Bridges Project would have *no adverse effect* on the Bonus Marchers Campsite. Given the magnitude of these three projects within Anacostia Park, especially the 11th Street Bridges Project, adverse impacts to historic districts and structures are expected to Anacostia Park, the Anacostia Seawalls, the Anacostia Shoreline Pump Station, and the Water Street Quonset Huts, are located within the study area. Therefore, the impact from these cumulative projects would be a long-term moderate, adverse impact (*adverse effects*) to historic districts and structures and would be dependent upon the extent of the resources' loss of integrity.

The effect determinations to historic districts and structures under alternative A were considered together with the effects of the projects mentioned above from other past, present, and reasonably foreseeable future actions. Since the cumulative projects listed above would have long-term moderate adverse impacts (*adverse effects*) to historic districts and structures, there would be long-term moderate adverse cumulative impacts on historic districts and structures (corresponds to *adverse effect* for Section 106) when added to the impacts from alternative A, which are *no adverse effect.*

Conclusion—None of the current resident Canada goose and wetland management practices that would be continued under alternative A would have any impact on historic structures and districts. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term moderate and adverse (corresponds to *adverse effect* for Section 106).

Historic District and Structures Impacts Common to All Action (Management) Alternatives

Wetland management techniques that are common to all action alternatives include addressing upland runoff, removing sheet piling along the Anacostia River Fringe Wetlands, and installing new rain garden areas. Removing sheet piling and installing new rain garden areas would require additional NEPA compliance. Resident Canada goose management techniques that are common to all action alternatives include population monitoring, installing/maintaining goose exclusion fencing, and education efforts regarding feeding wildlife and preparing technical brochures describing resident Canada goose management techniques. These techniques would not noticeably alter the setting of Kenilworth Gardens, Langston Golf Course, or Anacostia Park and would not diminish the character-defining features or the overall integrity of these historic resources. Thus, these actions would have negligible impacts on historic districts and structures, equivalent to *no adverse effect* under Section 106.

Alternative B – High Wetland, High Resident Canada Goose Management—Alternative B represents the highest level of effort to control the resident Canada goose populations through various resident Canada goose management and wetland management techniques. A number of these techniques under alternative B would occur adjacent to National Register-listed or eligible historic structures or districts or within the boundaries of historic districts. Wetland management techniques include the management of invasive plant species, the buffering of the shoreline, and high density planting. While these techniques would somewhat alter the setting in the vicinity of Kenilworth Gardens, and in Langston Golf Course and Anacostia Park, these actions would not diminish the character-defining features or the overall integrity of these historic resources. Therefore, these activities would have negligible impacts on historic structures and districts. Future resident Canada goose management techniques under alternative B could include shoreline buffers throughout Anacostia Park, installation of goose exclusion fencing, soft armoring around the perimeter of restored wetlands, and an increased width of vegetative buffers. These actions would occur adjacent to Kenilworth Gardens and within the boundaries of Langston Golf Course and Anacostia Park, including the potentially eligible resources within Anacostia Park. While these actions would alter aspects of the setting, they would not diminish the integrity of character-defining features or compromise the overall integrity of these historic resources. Thus, these actions would have negligible impacts on historic districts and structures. Seawall breaks and daylighting, future wetland management techniques considered under alternative B, could have a long-term moderate adverse impact on the Anacostia River Seawall, which is potentially eligible for the NRHP. For purposes of Section 106, the impact would be *no adverse effect* or *adverse effect*, depending on the loss of integrity to any of the resources' character-defining features. Future NEPA compliance would be necessary to assess possible impacts to the Anacostia River Seawall in the event that NPS implements the seawall breaks and daylighting associated with the alternative. Assuming that the loss of integrity to the seawall was found to be of such magnitude that resulted in a finding of adverse effect under Section 106, NPS would consult with the District of Columbia State Historic Preservation Office and the Advisory Council to develop mitigation measures that would be stipulated in a formal Memorandum of Agreement. Adverse effects under Section 106 would be mitigated by context sensitive design or other measures developed during future Section 106 consultation.

Cumulative Impacts—The assumed finding of *adverse effect* that would result from the loss of integrity to the Anacostia River Seawall under alternative B was considered together with the effects of the projects mentioned in alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would have long-term moderate adverse impacts (*adverse effect*) to historic districts and structures, there would be a long-term, moderate adverse cumulative impacts (*adverse effect*) on historic districts and structures when added to the negligible to moderate, adverse impacts from alternative B.

Conclusion—Alternative B would result in overall negligible to moderate adverse impacts on historical structures and districts. Wetland and resident Canada goose management techniques would be at the lowest level of detection with neither adverse nor beneficial consequences. These actions would not diminish the character-defining features or the overall integrity of these historic resources they would potentially impact, and thus would have negligible impacts. Depending on the implementation of seawall breaks and daylighting, activities that would be assessed in future NEPA and Section 106 compliance, moderate impacts could occur to the Anacostia River Seawall, a resource that is potentially eligible for the NRHP. Seawall breaks and daylighting, future wetland management techniques would alter a character-defining feature of the Anacostia River Seawall, and may diminish the integrity of the seawall, resulting in long-term moderate adverse impact, equivalent to an *adverse effect* under Section 106. The cumulative impacts of this project when considered together with other projects in proximity the park would be long-term moderate and adverse, corresponding to an *adverse effect* for Section 106. Since the cumulative projects listed previously would have long-term moderate adverse impacts (*adverse effects*) to historic districts and structures, there would be long-term moderate adverse cumulative impacts on historic districts and structures (corresponds to *adverse effect* for Section 106) when added to the negligible to long-term moderate adverse impacts from alternative B.

Alternative C – Moderate Wetland, Moderate Resident Canada Goose Management—Alternative C has similar wetland management techniques proposed as alternative B and a moderate level of resident Canada goose management techniques. A number of these techniques under alternative C would occur adjacent to historic structures or districts or within the boundaries of historic districts. Wetland management techniques include the management of invasive vegetation species, the buffering of the shoreline, and low density planting. While these techniques would somewhat alter the setting in the vicinity of Kenilworth Gardens, around within Langston Golf Course and Anacostia Park, these actions would not diminish the character-defining features or the overall integrity of these historic resources. Therefore, these activities would have negligible impacts on historic structures and districts, equivalent to a *no adverse effect* finding under Section 106. Future resident Canada goose management techniques under alternative C include shoreline buffers at Kingman Marsh and Anacostia River Fringe Wetlands, soft armoring around the perimeter of restored wetlands, and an increased width of vegetative buffers while future wetland management techniques include new rain garden areas. These actions would occur adjacent to Kenilworth Gardens and within the boundaries of Langston Golf Course and Anacostia Park and would slightly alter aspects of the setting. The impacts to historic districts and structures under alternative C would be negligible (*no adverse effect*) as none of the proposed activities would result in any loss of integrity to any of the historic districts and structures.

Cumulative Impacts—The negligible (corresponds to *no adverse effect* for Section 106) impact to historic districts and structures under alternative C was considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the cumulative projects listed previously would have long-term moderate adverse impacts (*adverse effects*) to historic districts and structures, there would be long-term, moderate adverse cumulative impacts on historic districts and structures (corresponds to *adverse effect* for Section 106) when added to the no effect impacts from alternative C.

Conclusion—Alternative C would result in overall negligible impacts (corresponds to *no adverse effect* for Section 106) on historical structures and districts. Wetland and resident Canada goose management techniques would be at the lowest level of detection with neither adverse nor beneficial consequences. These actions would not diminish the character-defining features or the overall integrity of these historic resources. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term moderate and adverse (corresponds to *adverse effect* for Section 106).

Alternative D – Low Wetland, Low Resident Canada Goose Management—Alternative D has limited wetland management and resident Canada goose management techniques that would impact historic districts and structures. Wetland management techniques adjacent to or within the boundaries of historic districts or structures are limited to the passive seedbank regeneration adjacent to Kenilworth Gardens. This action would not diminish the character-defining features or the overall integrity of the historic resource and would have negligible impacts (*no adverse effect*) on Kenilworth Gardens, as it would take place outside the boundaries of the historic district. Future resident Canada goose management techniques under alternative D include the planting of vegetative buffers along the shorelines at Kingman Marsh and Anacostia Rive Fringe Wetlands excluding Langston Golf Course, and the increasing of the width of vegetative buffers. Future wetland management techniques under alternative D include the modification of structures that result in erosion and clogging of marsh, the addressing of upland runoff, invasive plant species management, and passive seedbank regeneration. As in the previous alternatives, these actions would take place adjacent to Kenilworth Gardens and adjacent to or within the boundaries of Langston Golf Course, Anacostia Park, including the potentially eligible resources within Anacostia Park. Since these activities would not diminish the character-defining features of the overall integrity of these historic resources, these actions would have negligible impacts (corresponds to *no adverse effect* for Section 106) on historic districts and structures.

Cumulative Impacts—The *no adverse effect* determination to historic districts and structures under alternative D were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the cumulative projects mentioned previously would have long-term moderate adverse impacts (*adverse effects*) to historic districts and structures, there would be long-term moderate adverse cumulative impacts on historic districts and structures (corresponds to *adverse effect* for Section 106) when added to the no effect impacts from alternative D.

Conclusion—Alternative D would result in overall negligible, adverse impacts on historical structures and districts (*no adverse effect*). Wetland and resident Canada goose management techniques would be at the lowest level of detection with neither adverse nor beneficial consequences. These actions would not diminish the character-defining features or the overall integrity of these historic resources they would potentially impact, and thus would have negligible impacts. The cumulative impacts of this project when considered together with other projects in proximity the park would be long-term moderate and adverse, equivalent to *adverse effects* under Section 106.

Alternative E – High Wetland, Moderate Resident Canada Goose Management, with No Lethal Control—In terms of activities that could potentially impact historic districts and structures, alternative E is identical to alternative B. While resident Canada goose management techniques are proposed to take place in vicinity to Kenilworth Gardens and within Langston Golf Course and Anacostia Park, these actions would somewhat alter the setting, but would not compromise the integrity of the resources. Therefore, these actions would have negligible impacts on these resources (corresponds to *no adverse effect* under Section 106).

Future resident Canada goose management techniques under alternative E, which includes shoreline buffers, goose exclusion fencing, soft armoring around the perimeter of restored wetlands, and an increased width of vegetative buffers, would take place adjacent to/within the boundaries of Kenilworth Gardens, Langston Golf Course, Anacostia Park, and the potentially eligible resources within Anacostia Park. While these actions would change aspects of the setting, they would not compromise the overall integrity of these historic resources. Thus, these actions would have direct negligible impacts on these historic districts and structures, equivalent to *no adverse effect* under Section 106. Seawall breaks and daylighting, a future wetland management technique planned under alternative B, could have a long-term moderate adverse impact the Anacostia River Seawall, which is potentially eligible for the NRHP. As

discussed above under alternative B, it is assumed that the loss of integrity to the Anacostia River Seawall would result in an *adverse effect* under Section 106. Future NEPA compliance and Section 106 consultation would be necessary to assess possible impacts to the Anacostia River Seawall in the event that NPS implements the seawall breaks and daylighting associated with the alternative. Section 106 consultation would involve the District of Columbia SHPO and the Advisory Council to develop a Memorandum of Agreement that would provide for appropriate mitigation measures. Adverse effects under Section 106 would be mitigated by context sensitive design or other measures developed during Section 106 consultation. Overall, alternative E would result in overall negligible to long-term moderate adverse impacts (corresponds to *no adverse effect* or *adverse effect* for Section 106) on historical structures and districts.

Cumulative Impacts—The assumed finding of *adverse effect* that would result from the loss of integrity to the Anacostia River Seawall under alternative E was considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the cumulative projects mentioned previously would have long-term moderate adverse impacts (*adverse effect*) to historic districts and structures, there would be long-term moderate adverse cumulative impacts (*adverse effect*) on historic districts and structures (corresponds to *no adverse effect* for Section 106) when added to the negligible to long-term moderate adverse impacts (corresponds to *no adverse effect* or *adverse effect* for Section 106) from alternative E.

Conclusion—Alternative E would result in overall negligible to moderate, adverse impacts on historical structures and districts. Resident Canada goose management techniques would be at the lowest level of detection with neither adverse nor beneficial consequences. These actions would not diminish the character-defining features or the overall integrity of these historic resources they would potentially impact, and thus would have negligible impacts. Depending on the implementation of seawall breaks and daylighting, activities that would be assessed in future NEPA and Section 106 compliance, moderate impacts could occur to the Anacostia River Seawall, a resource that is potentially eligible for the NRHP. Seawall breaks and daylighting, future wetland management techniques would alter a character-defining feature of the Anacostia River Seawall, and may diminish the integrity of the seawall, resulting in long-term moderate adverse impact and an *adverse effect* under Section 106. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term moderate and adverse (corresponds to *adverse effect* for Section 106).

ARCHEOLOGICAL RESOURCES

Assumptions and Methodologies

As archeological resources exist essentially in subsurface contexts, potential impacts to archeological resources are assessed according to the extent to which the proposed alternatives would involve ground-disturbing activities such as excavation or grading. Analysis of possible impacts to archeological resources was based on a review of previous archeological studies, consideration of the proposed design concepts, and other information provided by the NPS.

Impacts to archeological resources occur when the proposed alternative results in whole or partial destruction of the resource, which is termed a loss of integrity in the context of Section 106. Impact thresholds for archeological resources consider both the extent to which the proposed alternative results in a loss of integrity and the degree to which these losses can be compensated by mitigating activities, such as preservation or archeological data recovery. The process begins with assessment of a resource according to its eligibility for the NRHP, as only sites considered significant enough for listing on the NRHP are protected by federal regulations.

Under federal guidelines, resources are eligible for the NRHP if they possess integrity and they meet one or more of the criteria of eligibility for inclusion in the NRHP. Most archeological resources found eligible for the NRHP are significant under criterion D because they have the potential to provide important information about the history or prehistory. However, in some circumstances, archeological resources might be found significant because (i) they are associated with events that have made a significant contribution to the broad patterns of our history (NRHP criterion A), or (ii) because they are associated with the lives of persons significant in our past (NRHP criterion B), or (iii) because they the distinctive characteristics of a type, period, or method of construction (NRHP criterion C).

Impact Threshold Definitions

For purposes of analyzing impacts to archeological resources, thresholds of change for the intensity of an impact are based on the foreseeable loss of integrity. All of these discussions consider only the direct impacts of construction, because operation of the facilities should have no ground disturbance activities and no additional effect on archeological resources under any of the alternatives under consideration. All impacts are considered long-term (e.g., lasting longer than the period of construction).

Beneficial: A resource would be preserved or stabilized in its pre-existing condition or actively stabilized/preserved in accordance with the *Secretary of the Interior's Standards for the Treatment of Historic Properties* to accurately depict its form, features, and character as it appeared during its period of significance. For purposes of Section 106, the determination of effect would be *no adverse effect.*

Negligible: Impact is at the lowest levels of detection with neither adverse nor beneficial consequences. The determination of effect for Section 106 would be *no adverse effect.*

Adverse: *Minor*: Disturbance of a site(s) results in little, if any, loss of integrity. For purposes of Section 106, the determination of effect would be *no adverse effect.*

Moderate: Disturbance of a site(s) results in loss of integrity to the extent that there is a partial loss of the character-defining features and information potential that form the basis of the site's NRHP eligibility. Mitigation is accomplished by a combination of archeological data recovery and in place preservation. The determination of effect for Section 106 would be *adverse effect.*

Major: Disturbance of a site(s) results in loss of integrity to the extent that it is no longer eligible for the NRHP. Its character-defining features and information potential are lost to the extent that archeological data recovery is the primary form of mitigation. The determination of effect for Section 106 would be *adverse effect.*

Duration: All impacts to archeological resources are considered long-term.

Archeological Resources Alternatives Evaluation

Alternative A – No Action Alternative—The no action alternative would continue the existing practices for wetland management and resident Canada goose management at their current levels. The removal of sheet piling (which would require additional NEPA compliance) would have no impact on archeological resources. There would be no other changes to improve the hydrological conditions or to restore wetlands. Control of invasive plant species would continue through manual removal of invasive species and

application of herbicides and other biological control agencies. The existing trails would be maintained at their current levels. None of these activities is having any impact on archeological resources, nor is it expected that continued practices would result in any impacts to archeological resources. Therefore, alternative A would have no impact on archeological resources, equivalent to *no adverse effect* under Section 106.

Cumulative Impacts—Among the various other projects considered for assessment of potential cumulative impacts to archeological resources, the following previously completed and present projects within Anacostia Park have had no impacts to archeological resources: Kenilworth Marsh, Kingman Marsh, Anacostia Riverwalk Trail, and Anacostia Skating Pavilion.

Some future projects that could have impacts on archeological resources in the study area include the 11th Street Bridges Project and the Poplar Point Redevelopment, and the Poplar Point Restoration Project. The NEPA compliance for the Poplar Point Redevelopment and the Poplar Point Restoration projects is not yet available, but the EIS for the 11th Street Bridges Project determined that the study area had a very high potential for archeological resources but the impact analysis stated that "Until archaeological surveys and testing have occurred, it is not possible to determine if resources that may be found during construction would have enough integrity to be eligible for the NRHP," implying that construction would proceed without further efforts to identify archeological resources. However, given the magnitude of these three projects within Anacostia Park, especially the 11th Street Bridges Project, adverse impacts to archeological resources could reasonably be expected as a result of these projects. Therefore, the impact from these projects would be a long-term moderate adverse impact (*adverse effects*) to archeological resources but would be dependent upon the character of the specific archeological resources involved and the extent of loss to the resources. Since the cumulative projects mentioned above would have long-term moderate adverse impacts (*adverse effect*) to archeological resources, there would be long-term moderate adverse cumulative impacts (*adverse effect*) to archeological resources (corresponds to *no adverse effect* for Section 106) when added to the lack of impacts (corresponds to *no adverse effect* for Section 106) from alternative A.

Conclusion—None of the current resident Canada goose and wetland management practices that would be continued under alternative A would have any impact on archeological resources. Since the cumulative projects mentioned above would have long-term moderate adverse impacts (*adverse effect*) to archeological resources, there would be long-term moderate adverse cumulative impacts (*adverse effect*) to archeological resources (corresponds to *no adverse effect* for Section 106) when added to the lack of impacts (corresponds to *no adverse effect* for Section 106) from alternative A.

Archeological Impacts Common to All Action (Management) Alternatives

Wetland management techniques that are common to all action alternatives include addressing upland runoff, removing sheet piling along the Anacostia River Fringe Wetlands, and considering new rain garden areas. Resident Canada goose management techniques that are common to all action alternatives include population monitoring, installing/maintaining goose exclusion fencing, and education efforts regarding feeding wildlife and preparing technical brochures describing resident Canada goose management techniques. As archeological resources are present in subsurface contexts, impacts to archeological resources could occur only in situations that involve ground-disturbing activities, including cultural/educational techniques such as installation of signage and wetland management techniques such as removal of sheet piling along the Anacostia River Fringe Wetlands. Therefore, these techniques that would require ground-disturbing activities could result in direct, negligible to minor, adverse impacts to archeological resources. Future NEPA and Section 106 compliance would be necessary to fully evaluate impacts of creating new rain gardens and removing the sheet piling. In consultation with the District of Columbia SHPO, NPS would undertake future archeological studies to identify NRHP-eligible resources

within the APE associated with the planned actions. In the event that these studies identify NRHP-eligible resources that would be subject to adverse effects, NPS would develop mitigation measures in accordance with Section 106 of the NHPA, which would require future consultation with the District of Columbia SHPO and the Advisory Council.

Alternative B – High Wetland, High Resident Canada Goose Management—Alternative B represents the highest level of effort to control the resident Canada goose populations through various resident Canada goose management and wetland management techniques. Some of these techniques would require ground-disturbing activities that could result in direct, long-term minor to moderate adverse impacts to archeological resources. The installation of erosion control measures and mechanical seedbank regeneration would occur near Site 51NE17, and the planting of native species/shoreline buffers would occur near Site 51NE30. Other activities planned under alternative B that could impact other, as yet undiscovered archeological resources include the stream daylighting of Pope Branch and Fort DuPont Creek, as well as seawall breaks, signage, boardwalks and trails. Additional documentation of archeological resources and NEPA compliance would be necessary to assess possible impacts to archeological resources as a result of daylighting, conducting seawall breaks, and creating new boardwalks and trails. Section 106 compliance would involve continued consultation with the District of Columbia SHPO regarding the evaluation of possible NRHP-eligible archeological resources because horizontal and vertical LODs for several ground-disturbing activities have not been determined. In a letter dated January 4, 2013, the SHPO has agreed on a conditional *no adverse effect* on historic resources with the following conditions: 1) continued Section 106 consultation on the proposed ground disturbing activities' effects on archeological resources; 2) archeological identification survey, and /or geoarcheological survey if warranted; 3) mitigation of adverse effects if such cannot be avoided; and 4) reporting of archeological investigations following NPS and District guidelines. Depending on the loss of integrity to NRHP-eligible archeological resources, alternative B would result in minor to moderate, adverse impacts to archeological resources. Assuming at least a moderate adverse impact to NRHP-eligible archeological resources, NPS would develop mitigation measures in consultation with the District of Columbia SHPO and the Advisory Council, as required by Section 106 of the NHPA.

Cumulative Impacts—The assumed *adverse effect* determination for archeological resources under alternative B was considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed above would have long-term moderate adverse impacts (*adverse effect*) to archeological resources, there would be cumulative long-term moderate adverse cumulative impacts (*adverse effect*) on archeological resources from alternative B.

Conclusion—Alternative B would result in overall long-term minor to moderate adverse impacts on archeological resources. Some of the techniques used in wetland and resident Canada goose management would require ground-disturbing activities that could disturb archeological sites, and cause little loss of site integrity (minor) to loss of integrity to the extent where there is loss of character-defining features of the site that is the basis of the NRHP eligibility (moderate). In the event that these studies identify NRHP-eligible resources that would be subject to *adverse effects*, NPS would develop mitigation measures in accordance with Section 106 of the NHPA, as outlined above. The cumulative impacts of this project when considered together with other projects in proximity the park would be long-term moderate and adverse (corresponds to *adverse effect* for Section 106).

Alternative C – Moderate Wetland, Moderate Resident Canada Goose Management—Alternative C has similar wetland management techniques proposed as alternative B and a moderate level of resident Canada goose management techniques. Some of the techniques would require ground-disturbing activities that could result in direct long-term minor adverse impacts (*no adverse effect*) to archeological resources. Additional documentation of archeological resources and NEPA and Section 106 compliance would be

necessary to assess possible impacts to archeological resources. Future archeological identification and evaluation studies would be completed as outlined in the "Archeological Impacts Common to All Action Alternatives" above, and, in the event that these studies identify NRHP-eligible resources that would be subject to adverse effects, NPS would develop mitigation measures in consultation with the District of Columbia SHPO and the Advisory Council.

Cumulative Impacts—The *no adverse effect* determination to archeological resources under alternative C was considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the cumulative projects mentioned previously would have long-term moderate adverse impacts (*adverse effect*) to archeological resources, there would be long-term, moderate adverse cumulative impacts (corresponds to *adverse effect* for Section 106) to archeological resources when added to the long-term minor adverse impacts (corresponds to *no adverse effect* for Section 106) from alternative C.

Conclusion—While some of the techniques used in wetland and resident Canada goose management under alternative C would require ground-disturbing activities could result in long-term, adverse impacts on archeological resources, it is expected that the loss of integrity to any archeological resources, if present, would be minor (*no adverse effect* under Section 106). Future studies would be necessary to determine whether any NRHP-eligible archeological resources are present in the areas where ground disturbing activities would occur under this alternative. The cumulative impacts of alternative C on archeological resources, when considered together with other past, present and future projects in proximity of the park would be long-term moderate and adverse (*adverse effect* for Section 106).

Alternative D – Low Wetland, Low Resident Canada Goose Management—Alternative D has limited wetland management and resident Canada goose management techniques and as such has relatively few ground-disturbing activities that could have an impact on archeological resources. Resident Canada goose management techniques that involve ground disturbance are limited to the planting of vegetative buffers, while the only ground-disturbing techniques of wetland management are the construction of new rain gardens, and the removal or modification of structures that cause erosion or clogging of the marsh. Alternative D would require very few ground-disturbing activities, so the likelihood of impacts to archeological resources is probably negligible (*no adverse effect* under Section 106).

Cumulative Impacts—The *no adverse effect* determination to archeological resources under alternative D were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the cumulative projects mentioned previously would have long-term moderate adverse impacts (*adverse effect*) to archeological resources, there would be long-term moderate adverse cumulative impacts (corresponds to *adverse effect* for Section 106) to archeological resources when added to the negligible impacts (corresponds to *no adverse effect* for Section 106) from alternative D.

Conclusion—Alternative D would require very few ground-disturbing activities, so the likelihood of impacts to archeological resources is probably negligible (*no adverse effect* under Section 106). The cumulative impacts of this project when considered together with other projects in proximity the park would be long-term moderate and adverse (*adverse effect* for Section 106).

Alternative E – High Wetland, Moderate Resident Canada Goose Management, with No Lethal Control—In terms of ground-disturbing activities that could potentially impact archeological resources, alternative E is identical to alternative B: some of the wetland management techniques and resident Canada goose management techniques could result in direct, long-term minor to moderate adverse impacts to archeological resources, equivalent to an *adverse effect* determination under Section 106. The installation of erosion control measures and mechanical seedbank regeneration would occur near Site

51NE17, and the planting of native species/shoreline buffers would occur near Site 51NE30. Other activities planned under alternative B that could impact other, as yet undiscovered archeological resources include the stream daylighting of Pope Branch and Fort DuPont Creek, as well as seawall breaks, signage, boardwalks and trails. As outlined under alternative B, additional NEPA and Section 106 compliance studies would be necessary to assess possible impacts to archeological resources as a result of daylighting, conducting seawall breaks, and creating new boardwalks and trails. In the event that that these future studies identify NRHP-eligible archeological resources that would be subject to an *adverse effect* under Section 106, NPS would develop and implement mitigation measures in consultation with the District of Columbia SHPO and the Advisory Council, as required by Section 106 of the NHPA.

Cumulative Impacts—The potential *adverse effect* determination for archeological resources under alternative E was considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects mentioned previously would have long-term moderate adverse impacts (*adverse effect*) to archeological resources, cumulative impacts would be long-term moderate and adverse (*adverse effect*) on archeological resources when added to the long-term minor to moderate impacts (*adverse effect* for Section 106) from alternative E.

Conclusion—Alternative E could result in overall long-term minor to moderate adverse impacts on archeological resources. Some of the techniques used in wetland and resident Canada goose management would require ground-disturbing activities that could disturb archeological sites to the extent that would result in a moderate loss of resource integrity, equivalent to a finding of *adverse effect* under Section 106. Otherwise, potential losses to the integrity of archeological sites would range from negligible to minor, which is equivalent to *no adverse effect* under Section 106. Future NEPA and Section 106 compliance studies would be necessary to fully evaluate potential impacts to NRHP-eligible resources. In the event that these studies identify NRHP-eligible resources that would be subject to adverse effects, NPS would develop mitigation measures in accordance with Section 106 of the NHPA. The cumulative impacts of this project when considered together with other projects in proximity the park would be long-term moderate and adverse (*adverse effect* for Section 106).

PARK MANAGEMENT AND OPERATIONS

This section discusses the plan impacts to park management and operations, including resource management, maintenance, education, and visitor protection.

GUIDING REGULATIONS AND POLICIES

Park management and operations refers to the current staff available to adequately protect and preserve Anacostia Park resources and provide for an effective visitor experience. This topic also includes the operating budget necessary to conduct Anacostia Park operations.

ASSUMPTIONS AND METHODOLOGIES

The discussion of impacts to park operations focuses on the amount of staff available to perform wetland and resident Canada goose management practices, the amount of staff to ensure visitor and resident safety, and the ability of park staff to protect and preserve resources given current funding and staffing levels. The study area includes Anacostia Park.

Actions included in the alternatives could change the park's existing staff requirements. The evaluation considers whether or not additional workload would be added or contracted services would be required in order to accomplish a larger workload on an ongoing basis. This includes changes that may occur within all divisions of the park, including:

- **Natural Resource Management**—The natural resource management staff has limited tasks related to resident Canada goose management, including yearly egg oiling and population counts along with park volunteers and invasive plant species removal.
- **Maintenance**—Maintenance requirements related to wetlands and resident Canada goose management include maintaining goose exclusion fencing, removing trash, and maintaining trails within the park.
- **Resource Education and Visitor Protection**—Staff involved in this division include coordinating and conducting park programs to educate visitors.

General impacts of the alternatives on the park's annual operating budget and funding sources are evaluated for each alternative, which considers the financial requirements for each alternative and the availability of existing or new funding sources to meet additional operating and capital costs.

Impact Threshold Definitions

Reduced staffing needs and financial balances between operating costs and revenue sources or financial imbalances where revenue sources exceed operating costs would be considered beneficial impacts. The need for higher staffing levels that are not covered by increased revenues and financial imbalances where operating costs exceed revenue sources would be considered adverse impacts. The following thresholds were used to determine impacts to park operations:

Negligible: Park operations would not be impacted.

Adverse: *Minor*: Park operations would be impacted, and the effect would be detectable, but current levels of funding and staff would be adequate and other park operations would not be reduced.

Moderate: Park operations would be impacted, the effect would be readily apparent, and increased staff and funding would be needed or other park operations would have to be reduced and/or priorities changed.

Major: Park operations would be impacted, the effect would be readily apparent, increased staff, and funding would be needed or other park programs would have to be eliminated.

Park Operations and Maintenance Alternatives Evaluation

Alternative A – No Action Alternative—Under the no action alternative, park operations would remain unchanged. At Anacostia Park, the natural resources staff devotes much of their time to wetland and resident Canada goose management throughout the park, including monitoring the wetlands within the park, maintaining the goose exclusion fencing, conducting the quarterly goose counts within the Anacostia watershed (Syphax 2008), conducting the yearly egg oiling, invasive plant species management, limited trash removal, and limited park ranger education. The majority of these actions are currently undertaken by volunteers or are covered in existing labor costs as and estimated at approximately $30,000 per year or a total of $450,000 over the life of the plan/EIS (15 years), although this cost is contingent upon the availability of volunteers, funding, and materials similar to current conditions. Over the next 15 years, maintenance requirements would increase under this alternative if the resident Canada goose population within the park exhibits an overall increase. Additionally, the removal of sheet piling (which would require additional NEPA compliance) would require increased staff and

resources necessary to complete this activity. Overall, alternative A would result in long-term minor adverse impacts to park operations and maintenance.

Cumulative Impacts—Many actions, plans, and programs place demands on park staff and budget, and contribute to adverse cumulative effects on park management and operations. These include the demand on staff time and resources from normal daily operational duties, as well as managing special use permits, special events in the park, and seasonal programs, such as the Student Conservation Association. Management and handling of land acquisitions, permits, vandalism, trash and river cleanups throughout the park, construction in the park, and development and oversight of visitor use opportunities such as recreational use of the river and interpretation programs all require staff time and money. The natural resources staff has additional demands at Anacostia Park, which included devoting much of their time to wetland and resident Canada goose management throughout the park. The resource management staff supports the egg oiling performed during the resident Canada goose breeding season and the quarterly goose counts within the Anacostia watershed as well as conducting wetland vegetation plantings, maintaining goose enclosures, and planting trees. These tasks would likely continue at current levels and these demands are expected to continue into the future with continued and possible increased visitation and future planning needs related to general resident Canada goose and wetland management and implementation of current and future activities.

Currently, the visitors experience is being enhanced in the North Field Area of Anacostia Park with a new bike/walk trail connecting the park trails with existing trails in DC and the AWI has proposed to enhance environmental education on the river's watershed and includes a proposal for a new environmental learning center on the southern portion of Kingman Island (DCOP 2009). Although the southern part of Kingman Island and Heritage Island are outside of the park boundary, these areas are currently being redeveloped as educational and passive, low-impact recreation sites and could place demands on park management and operations at Anacostia Park if these actions increase visitor use once the projects are completed. These actions that place demands on park management and operations would have a long-term, minor adverse impact.

Actions directly related to alternative A would have long-term minor adverse impacts on park management and operations. Therefore, the long-term minor adverse impacts of all other actions that place demands on park management and operations, along with the No Action Alternative, would result in long-term moderate adverse cumulative impacts to park operations and management.

Conclusion—Alternative A would result in overall long-term minor adverse impacts on park operations because park operations would be impacted and the effect would be detectable, but the current resources would be adequate and other operations would not be reduced. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term, moderate, and adverse.

Park Operations and Maintenance Impacts Common to All Action (Management) Alternatives

Wetland management techniques that are common to all action alternatives include addressing upland runoff, removing sheet piling along the Anacostia River Fringe Wetlands, and installing new rain garden areas. Removing sheet piling and installing new rain garden areas would require additional NEPA compliance. Resident Canada goose management techniques that are common to all action alternatives include population monitoring, installing/maintaining goose exclusion fencing, and education efforts regarding feeding wildlife and preparing technical brochures describing resident Canada goose management techniques. All techniques described above would require additional staff and resources at the park. Regardless of the alternative adopted, there would be a need for public education as well as for

public safety. Increased educational opportunities as a result of the majority of the management alternatives would benefit the surrounding community by providing visitors with a greater knowledge of wetlands and the resident Canada goose. Increased staff and resources for education would be required to educate the public and to install *No Feeding* signage and enforcing the feeding wildlife CFR (through fines for violations). The increased staff and resources necessary to implement the techniques associated with all action alternatives would be required to ensure a safe and beneficial experience for park visitors and would have a long-term minor to moderate adverse impact on park operations and maintenance.

Alternative B – High Wetland, High Resident Canada Goose Management—The resident Canada goose population would be intensively reduced as part of this alternative, which would reduce the population by 40 to 60 percent in the first year of the plan/EIS. Under alternative B the most aggressive wetlands management techniques are combined with intensive resident Canada goose population reduction techniques (lethal control combined with other techniques). This alternative considers new wetland restoration techniques as well. Techniques used to reduce the population could include round-up, capture, and euthanasia; and lethal removal by shooting. Alternative B includes a suite of potential techniques that would enhance existing wetland areas at the park and restore or create new wetland areas. The suite of techniques proposed as part of alternative B to improve wetlands within the park would require additional park operations resources, including maintenance, natural resource management, resident Canada goose monitoring, and visitor education. Also, many of the proposed wetland management techniques (creating tidal guts, daylighting, altering water elevations, outfall dissipation modifications, seawall breaks, reducing impervious areas, and new rain gardens) would require additional NEPA analysis for implementation and thus additional staff and resources because site-specific designs would be necessary to make these improvements.

Techniques proposed as part of alternative B to reduce the resident Canada goose population would require qualified federal employees trained in safety and firearms use as well as additional resources such as vehicles and crates for round-up and capture of the geese. In addition to techniques proposed for reducing the population, scare/harassment programs and reproductive control techniques (increased egg oiling, egg addling, and egg replacement, applying goose hatch material), which would require additional trained staff and resources. Residents in the adjacent communities could participate in the proposed volunteer opportunities such as planting new vegetation, maintaining fencing and studying water quality in the wetlands. Alternative B would require public education and ensuring public safety if this alternative were implemented. Therefore, increased staff and resources for education would be required to educate the public and to install *No Feeding* signage and enforcing the feeding wildlife CFR (through fines for violations). Also, increased educational opportunities would benefit the surrounding community by providing visitors with a greater knowledge of wetlands and the resident Canada goose. Finally, invasive vegetative species would continue to be managed as part as alternative B, and potentially at a higher level beyond what the NCR-EPMT is currently managing, which would require additional staff and resources.

Under alternative B, vegetation monitoring and invasive plant species management would cost approximately $386,370 annually (plus $30, 125 for equipment in the first year only) and resident Canada goose monitoring would cost approximately $10,000 annually, if quarterly surveys were conducted. Other costs are associated with the implementation of the wetland and resident Canada goose management techniques even though the exact year of implementation is unknown at this time. The total cost for the implementation of alternative B is approximately $16,356,943, which assumes all proposed wetland and resident Canada goose management techniques would be implemented during the life of the plan/EIS; this cost does not include maintenance or repair (if applicable) and only includes cost for year 1 of lethal control, reproductive control and scare/harassment techniques because adaptive management would determine if the technique would be required and to what extent in subsequent years. The increased staff and resources necessary to implement alternative B would be required to ensure a safe and beneficial

experience for park visitors and would have a long-term moderate adverse impact on park operations and maintenance.

Cumulative Impacts—Actions directly related to alternative B would have long-term moderate adverse impacts on park management and operations. Therefore, the long-term minor adverse impacts of all other actions that place demands on park management and operations, along with alternative B, would result in long-term, moderate adverse cumulative impacts to park operations and management.

Conclusion—Alternative B would result in overall long-term moderate adverse impacts on park operations because park operations would be impacted with a readily apparent effect, and additional staff and funding would be needed, our other resources would have to be reduced. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term moderate and adverse.

Alternative C – Moderate Wetland, Moderate Resident Canada Goose Management—Alternative C has similar resident Canada goose management techniques proposed as alternative B, but proposes a less intensive population reduction for the resident Canada goose within the park (removal of 40 to 60 percent of the population within the first year of the plan/EIS). For alternative C, the current resident Canada goose population would be reduced through round-up, capture, and euthanasia, but no shooting of resident Canada geese would be included as part of alternative C. Therefore, techniques proposed as part of alternative C to reduce the resident Canada goose population would require qualified federal employees trained in safety (but not firearms use) as well as additional resources such as vehicles and crates for round-up and capture of the geese. The suite of techniques proposed as part of alternative C to improve wetlands within the park includes decreased wetland restoration techniques, but would still require additional park operations resources, including maintenance, natural resource management, resident Canada goose monitoring, visitor education, and ensuring public safety. Also, some of the proposed wetland management techniques (reduce impervious areas and install new rain gardens) would require additional NEPA analysis for implementation and thus additional staff and resources because site-specific designs would be necessary to make these improvements. Also, increased educational opportunities and increased management of invasive plant species are included as part of alternative C. Resident Canada goose management techniques that would require additional staff and resources are proposed as part of alternative C, habitat modification, a scare/harassment program, and reproductive control techniques. Under alternative C, vegetation monitoring and invasive plant species management would cost approximately $386,370 annually (plus $30, 125 for equipment in the first year only) and resident Canada goose monitoring would cost approximately $10,000 annually, if quarterly surveys are conducted; these costs are the same as alternative B. Other costs are associated with the implementation of the wetland and resident Canada goose management techniques even though the exact year of implementation is unknown at this time. The total cost for the implementation of alternative C is approximately $10,442,157, which assumes all proposed wetland and resident Canada goose management techniques would be implemented during the life of the plan/EIS; this cost does not include maintenance or repair (if applicable) and only includes cost for year 1 of lethal control, reproductive control and scare/harassment techniques because adaptive management would determine if the technique would be required and to what extent in subsequent years. Therefore, alternative C would result in long-term moderate adverse impacts to park operations and maintenance as a result of a need for increased staff and resources. Even though alternative C includes fewer wetland management techniques and a less intensive resident Canada goose population reduction compared to alternative B, this difference is not considered large enough to cause a change in the intensity of the impact (moderate, adverse) to park operations and maintenance since increased staff and resources would be required.

Cumulative Impacts—Actions directly related to alternative C would have long-term moderate adverse impacts on park management and operations. Therefore, the long-term minor adverse impacts of all other

actions that place demands on park management and operations, along with alternative C, would result in long-term moderate adverse cumulative impacts to park operations and management.

Conclusion—Alternative C would result in long-term moderate adverse impacts on park operations because park operations would be impacted with a readily apparent effect, and additional staff and funding would be needed, our other resources would have to be reduced. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term moderate and adverse.

Alternative D – Low Wetland, Low Resident Canada Goose Management—Alternative D proposes a primarily non-lethal, low resident Canada goose management option to offer the lowest management effort for both wetlands and resident Canada geese. Under wetland management techniques, there are no erosion control techniques proposed and no new wetland restoration efforts proposed as part of alternative D. Only one of the proposed wetland management techniques (install new rain gardens) would require additional NEPA analysis for implementation. The lethal control technique during the one-time population reduction would include round-up, capture, and euthanasia; no shooting of resident Canada geese would occur under alternative D. Therefore, techniques proposed as part of alternative D to reduce the resident Canada goose population would require qualified federal employees trained in safety (but not firearms use) as well as vehicles and crates for round-up and capture of the geese. Under alternative D, vegetation monitoring and invasive plant species management would cost approximately $243,370 annually (plus $30, 125 for equipment in the first year only) and resident Canada goose monitoring would cost approximately $10,000 annually, if quarterly surveys are conducted; these costs less than costs estimated for alternatives B and C. Other costs are associated with the implementation of the wetland and resident Canada goose management techniques even though the exact year of implementation is unknown at this time. The total cost for the implementation of alternative C is approximately $5,617,141, which assumes all proposed wetland and resident Canada goose management techniques would be implemented during the life of the plan/EIS; this cost does not include maintenance or repair (if applicable) and only includes cost for year 1 of reproductive control (no costs associated with lethal control or scare/harassment techniques since none are proposed) because adaptive management would determine if the technique would be required and to what extent in subsequent years. Therefore, alternative D would result in long-term moderate adverse impacts to park operations and maintenance as a result of a need for increased staff and resources. Even though alternative D includes the least amount of wetland management techniques and a less intensive resident Canada goose population reduction compared to alternatives B and C, this difference is not considered large enough to cause a change in the intensity of the impact (moderate, adverse) to park operations and maintenance since increased staff and resources would be required.

Cumulative Impacts—Actions directly related to alternative D would have long-term moderate adverse impacts on park management and operations. Therefore, the long-term minor adverse impacts of all other actions that place demands on park management and operations, along with alternative D, would result in long-term moderate adverse cumulative impacts to park operations and management.

Conclusion—Alternative D would result in overall long-term moderate adverse impacts on park operations because park operations would be impacted with a readily apparent effect, and additional staff and funding would be needed, our other resources would have to be reduced. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term moderate and adverse.

Alternative E – High Wetland, Moderate Resident Canada Goose Management, with No Lethal Control—This alternative includes intensive resident Canada goose management activities, but no lethal control for resident Canada geese. Under this alternative, no resident Canada geese would be removed

from the park, but a full suite of wetland management techniques are proposed. Many of the proposed wetland management techniques (creating tidal guts, altering water elevations, outfall dissipation modifications, daylighting, seawall breaks, reducing impervious areas, and new rain gardens) would require additional NEPA analysis for implementation and thus additional staff and resources because site-specific designs would be necessary to make these improvements. Resident Canada goose management techniques that are proposed as part of alternative E include habitat modification, a scare/harassment program, and reproductive control techniques. Under alternative E, vegetation monitoring and invasive plant species management would cost approximately $386,370 annually (plus $30, 125 for equipment in the first year only) and resident Canada goose monitoring would cost approximately $10,000 annually, if quarterly surveys are conducted; these costs are the same as alternatives B and C. Other costs are associated with the implementation of the wetland and resident Canada goose management techniques even though the exact year of implementation is unknown at this time. The total cost for the implementation of alternative E is approximately $16,299,543, which assumes all proposed wetland and resident Canada goose management techniques would be implemented during the life of the plan/EIS; this cost does not include maintenance or repair (if applicable) and only includes cost for year 1 of reproductive control and scare/harassment techniques because adaptive management would determine if the technique would be required and to what extent in subsequent years. Therefore, alternative E would result in long-term moderate adverse impacts to park operations and maintenance as a result of a need for increased staff and resources. Even though alternative E does not include lethal population reduction of resident Canada geese compared to alternative B, this difference is not considered large enough to cause a change in the intensity of the impact (moderate, adverse) to park operations and maintenance since increased staff and resources would be required.

Cumulative Impacts—Actions directly related to alternative E would have long-term moderate adverse impacts on park management and operations. Therefore, the long-term minor adverse impacts of all other actions that place demands on park management and operations, along with alternative E, would result in long-term moderate adverse cumulative impacts to park operations and management.

Conclusion—Alternative E would result in overall long-term moderate adverse impacts on park operations because park operations would be impacted with a readily apparent effect, and additional staff and funding would be needed, our other resources would have to be reduced. The cumulative impacts of this project when considered together with other projects in proximity to the park would be long-term moderate and adverse.

VISITOR USE AND EXPERIENCE

This section discusses the plan impacts to visitor use and experience, including visitation, visitor recreation and activities, soundscapes, and aesthetics as well as visitor and employee safety.

GUIDING REGULATIONS AND POLICIES

NPS *Management Policies 2006* 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 parks (NPS 2006a). Because many forms of recreation can take place outside of a national park setting, the NPS therefore seeks to provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in Anacostia Park. In addition, the NPS seeks to defer to others to meet the broader spectrum of recreational needs and demands that are not dependent on a national park setting. Those others can include local, state, and other federal agencies; private industry; and nongovernmental organizations.

While recreation is a key component of NPS *Management Policies 2006*, the policies also instruct park units to maintain all native plants and animals as parts of the natural ecosystem. The NPS would achieve this by preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur (NPS 2006a).

NPS *Management Policies 2006* requires restoration of degraded soundscapes to the natural condition whenever possible and protection of natural soundscapes from degradation. The NPS is directed to take action to prevent or minimize all noise that, through frequency, magnitude, or duration, adversely affects the natural soundscape or other park resources or values, or that exceeds levels that have been identified as being acceptable to, or appropriate for, visitor uses at the sites being monitored (NPS 2006a).

ASSUMPTIONS AND METHODOLOGIES

The purpose of this impact analysis is to determine if wetland and resident Canada goose management under each alternative would be compatible with the desired goals for visitor experience and the purpose of Anacostia Park as identified in the enabling legislation. The impact analysis evaluates several aspects of visitor experience, including visitor perception of the presence of resident Canada geese, perception of the visual conditions during management practices, access to park resources, and understanding and appreciation of park values.

In addition, the purpose of this impact analysis is to determine if wetland and resident Canada goose management practices would degrade the soundscape of Anacostia Park. Context, time, and intensity together determine the level of impact for an activity. The time of day influences the impact a given noise may have. This analysis assumes that the periods of greatest sensitivity to noise includes sunrise, sunset, and at night. The study area for soundscapes includes all areas within the park and the neighboring communities.

The study area for visitor use and experience includes Anacostia Park and neighboring landowners outside of the park boundaries.

IMPACT THRESHOLD DEFINITIONS

The following thresholds were used to determine impacts to visitor use and experience, including aesthetics and recreation:

Negligible: Visitors would not be affected, or changes in visitor experience and/or understanding would be below or at the level of detection. Visitors would not be likely aware of the effects associated with the alternative.

Adverse: *Minor*: Changes in visitor experience and/or understanding would be detectable, although the changes would be slight. Visitors could be aware of the effects associated with the alternative, but only slightly.

Moderate: Changes in visitor experience and/or understanding would be readily apparent. Visitors would be aware of the effects associated with management actions. Visitor satisfaction might be measurably affected (visitors could be either satisfied or dissatisfied). Some visitors would choose to pursue activities in other available local or regional areas.

Major: Changes in visitor experience and/or understanding would be readily apparent and the action would affect the majority of visitors. Visitors would be highly aware of the effects associated with management actions. Changes in visitor use and experience would be readily apparent. Some visitors would choose to pursue activities in other available local or regional areas.

The following thresholds were used to determine impacts to soundscapes:

Negligible: Human-caused or project sounds do not compete with ambient sounds. When noise is audible, it is for short duration, with significantly lengthy periods of time that are noise free.

Adverse: *Minor*: Human-caused or project sounds are detectable above ambient sounds; however, there are frequent periods of time that are noise free. Where noise is audible, impacts occur for short durations (less than one hour) during the day.

Moderate: Human-caused or project sounds compete with ambient sounds. The noise generated is perceptible for extended periods throughout the day. There are however short periods of time that are noise free.

Major: Human-caused sounds dominate the soundscape and replace natural sounds. Natural sounds in the study area are commonly impacted by noise from management activities for most of the day without periods of time that are noise free.

User Groups

Many urban areas such as Anacostia Park provide excellent resident Canada goose habitat, such as the maintained lawns, golf course, recreational fields, and other areas because they provide excellent spring, summer, and fall forage and are in close proximity to the Anacostia River water source. In addition, the traditional predators of geese (foxes, coyotes, etc.) are present in low numbers or are absent in most urban areas such as Anacostia Park, and hunting pressure is nonexistent in the park. Some people enjoy seeing geese in urban areas, while others consider them a nuisance. There would be different expectations for different users of the park and the impacts as a result of the no action alternative and management alternatives would either be positive or negative, depending on the user category. As a result, the impact analysis of visitor use and experience at Anacostia Park considered three user groups - visitors who enjoy seeing resident Canada geese at the park, visitors who do not enjoy resident Canada geese at the park, and visitors who do not care whether resident Canada geese are at the park or not.

Visitors Who Enjoy Resident Canada Geese at the Park

Canada geese are recognized by some park visitors as providing a number of public benefits. The benefits of a resident Canada goose population in urban areas such as Anacostia Park include the aesthetic value of the presence of these birds. For some park users, the resident Canada goose population at Anacostia Park may mark the only opportunity to view wildlife. The presence of these geese therefore, provides a positive park experience for this group of users. These visitors would be pleased to see and observe goslings and adult resident Canada geese year round in large numbers. Even though a percentage of the resident Canada goose population would be removed as a result of implementing this plan/EIS, some Canada geese would remain in the park, including both resident and migratory geese. The combined

wetland and resident Canada goose management would allow wetlands to reach the desired condition of predominantly self-sustaining wetland systems and would enhance habitat for migratory Canada geese that use the park on a seasonal basis. This would have benefits for migratory Canada geese which are a natural part of this ecosystem, and for the aesthetics of the park and experience of visitors who enjoy more natural fluctuations of geese populations.

Visitors Who Do Not Enjoy Resident Canada Geese at the Park

Park users who may not enjoy the resident Canada goose population at the park include visitors who golf at Langston Golf Course. Resident Canada geese are year-round inhabitants of the golf course and their presence may reduce the visitor experience for golfers. The majority of the Anacostia Park population of geese has been located at the Kingman Marsh/Langston Golf Course sites where there is open water for waddling and the open golf course for browsing (NPS 2009a). This area provides habitat that is safer from predators during the bird's flightless period. In June 2010, a mean of 371 geese were counted at the Kingman Marsh/ Langston Golf Course site (Bates 2010a). Studies have shown that a well-fed, healthy adult Canada goose can produce up to 1.5 pounds of fecal matter per day (French 2001). Goose feces can reduce the aesthetic appeal of areas such as Langston Golf Course and could ultimately reduce public use (USFWS 2005). Visitors using other public areas at Anacostia Park in addition to Langston Golf Course are also affected by the geese, including visitors utilizing open playing fields. For example, it has been documented that public areas littered with accumulated goose feces have been closed due to the contamination or the threat of personal injury resulting from falls as people lose footing on the slippery material (French 2001). Specifically, Anacostia Park has received complaints from the unpleasant experience of goose fecal matter on golfer's shoes and from park visitors falling and/or rolling in goose fecal matter while playing ballgames (NPS 2010a). The presence of these geese therefore, provides a negative park experience for this group of users.

Visitors Who Do Not Care if Resident Canada Geese Are at the Park

Some visitors of the park may not care if resident Canada geese are present within the park. This user group would continue to use Anacostia Park regardless if resident Canada geese are present or absent. The presence or absence of these geese therefore, does not impact the park experience for this group of users.

Visitor Use and Experience Alternatives Evaluation

Alternative A - No Action Alternative—Park staff would continue resident Canada goose management activities at the same level as current; lethal population reduction strategies and scare/harassment techniques are not included as part of the no action alternative. The scenic value of the park is reduced by the large amounts of trash in the river and along the shoreline. Therefore, the no action alternative, which includes continuing limited trash removal within the park, would continue to have a long-term minor adverse impact on aesthetics at the park.

Under alternative A, Canada geese would remain in the park and, therefore, the soundscape would remain unchanged. The site and sounds of [migratory] Canada geese in the areas surrounding the Chesapeake Bay have been described as both stunning and stirring and have occurred for generations of forebears to the Chesapeake Bay (CBGN 2009). Impacts to visitors who enjoy seeing resident Canada geese at the park would continue to be beneficial since visitors could continue to view goslings and adult resident Canada geese year round in large numbers.

Impacts to visitors who do not enjoy resident Canada geese at the park would continue to be long-term minor and adverse since the resident Canada goose population would not be drastically reduced as a result

of the no action alternative. It is expected that the reproductive control techniques continued as part of the no action alternative (yearly egg oiling) would not limit growth enough to be noticeable to visitors within the life of this management plan using current technologies. Some visitors may avoid the Langston Golf Course or this area may experience lower usage because of the high number of resident Canada geese that utilize turf areas of the golf course.

Cumulative Impacts—The majority of projects proposed in and near Anacostia Park would enhance visitor use and experience in the area and provide additional recreational opportunities, specifically projects under the AWI. A priority of the AWI was the establishment of a continuous Anacostia Riverwalk and Trail along the east and west banks of the Anacostia River to allow 16 miles of pedestrian and cycling opportunities along both banks of the River in the park. A future benefit of the AWI is to create an integrated open-space system connecting 1,800 acres of park land, including over 100 acres of newly created public parks and new boat launching sites in Anacostia Park (DCOP 2009). East of the Anacostia River, the 11th Street Bridge Replacement Project would change the access to Anacostia Park (DCDOT and FHWA 2007). However, mitigation for this effect includes the improved access to the park and pedestrian and bicycle facilities that lead directly into Anacostia Park and the neighborhoods on either side of the river (DCDOT and FHWA 2007). Although AWI projects and the 11th Street Bridge Replacement Project would have visual impacts to the aesthetics of the park, planting vegetation and trees in the area is proposed to soften the view; tree planting is part of the Net Benefits 4(f) Programmatic Agreement with NPS (DCDOT and FHWA 2007). The projects described above would have a beneficial impact on visitor use and experience because they would enhance recreation opportunities and improve the aesthetics in and around Anacostia Park.

Other projects either underway or planned include reducing trash and debris in the Anacostia Watershed. Using funding from NOAA and led by MWCOG, Anacostia partners developed the Anacostia Trash Reduction Strategy, which improves the aesthetics of the River and the park by removing trash from the watershed (AWRP and MWCOG 2007). This project would also have a beneficial impact on visitor use and experience because it would improve the aesthetics in and around Anacostia Park.

Under alternative A, impacts to visitors who enjoy seeing resident Canada geese at the park would continue to be beneficial. The beneficial impacts on these visitors as a result of alternative A were considered together with the effects of the projects mentioned above from other past, present, and reasonably foreseeable future actions. Since these projects would be beneficial to visitor use and experience, there would be beneficial cumulative impacts to visitors who enjoy seeing resident Canada geese at the park from alternative A. Impacts to visitors who do not enjoy resident Canada geese at the park would continue to be long-term minor and adverse due to continued issues with the resident Canada geese at Langston Golf Course. Even though the projects listed previously would be beneficial to visitor use and experience, these beneficial impacts would not help to reduce the long-term minor adverse impacts as a result of alternative A, since the issues with the geese at the golf course would still not be resolved. Therefore, long-term minor adverse cumulative impacts are expected.

Conclusion—As described above, there would be different expectations for different users of the park and the impacts as a result of the no action alternative would be either positive or negative, depending on the user category. As a result, the impact analysis of visitor use and experience at Anacostia Park considered three user groups - visitors who enjoy seeing resident Canada geese at the park, visitors who do not enjoy resident Canada geese at the park, and visitors who do not care whether resident Canada geese are at the park or not. For the no action alternative, impacts to visitors who enjoy seeing resident Canada geese at the park would continue to be beneficial but impacts to visitors who do not enjoy resident Canada geese at the park would continue to be long-term minor and adverse due to continued issues with the resident Canada geese at Langston Golf Course. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial for visitors who enjoy

Canada geese at the park, and long-term minor adverse for those visitors who do not enjoy geese at the park.

Visitor Use and Experience Impacts Common to Action Alternatives

Wetland management techniques that are common to all action alternatives include addressing upland runoff, removing sheet piling along the Anacostia River Fringe Wetlands, and installing new rain garden areas. Removing sheet piling and installing new rain garden areas would require additional NEPA compliance. Resident Canada goose management techniques that are common to all action alternatives include population monitoring, installing/maintaining goose exclusion fencing, and cultural/education efforts. The cultural/education techniques proposed for all action alternatives include installing *No Feeding* signage and/or enforcing the no feeding of wildlife CFR (through fines for violations) as well as preparing technical brochures describing resident Canada goose management techniques. Most of the techniques described above for all action alternatives would not have an impact on visitor use and experience; however, some visitors who enjoy resident Canada geese at the park may be effected by learning of the various resident Canada goose management techniques especially lethal control via the brochure resulting in a short-term minor adverse impact on visitor experience. In contrast, some visitors who do not enjoy resident Canada geese at the park may also be affected by learning of the various resident Canada goose management techniques via the brochure resulting in a short to beneficial impact on visitor experience.

Visitor Use and Experience Impacts Common to Action Alternatives (Alternatives B – High Wetland, High Resident Canada Goose Management, and Alternative C – Moderate Wetland, Moderate Resident Canada Goose Management)

For action alternatives B and C, the resident Canada goose population would be reduced. Resident Canada geese targeted for removal through round-up, capture, and euthanasia would be taken off-site to be euthanized; lethal control would also include shooting as part of alternative B. Noise suppression devices would be used so the soundscape of the park would affected. Areas where resident Canada geese are to be removed would be temporarily closed to the public. The public would be notified of any park closures in advance when feasible. The park closures would not affect visitor use, as only small areas in the 120-acre park would be closed at a time and only during a maximum of one time per year. Therefore, visitors would not be exposed to resident Canada geese being captured and/or shot. During implementation of any of these activities, the NPS would minimize disruption to visitor use and experience. In addition to reducing the resident Canada goose population, all management alternatives include a scare/harassment program that would be implemented in open grassy areas of the park where resident Canada geese tend to congregate. The scare/harassment program includes visual deterrents that would be aesthetically unappealing to visitors who use the park and although alternative C proposes a less intensive scare/harassment program compared to alternative B, the visual deterrents that would be aesthetically unappealing to visitors who use the park would be similar and the same impact thresholds would be expected.

It is the intent of NPS to manage a population of resident Canada geese within the park for all management alternatives. Impacts to visitors who enjoy seeing resident Canada geese at the park would continue to be beneficial since visitors could continue to view goslings and adult Canada geese year round within the park, but the population would be reduced for alternatives B and C.

It is important to note that although a percentage of the resident Canada goose population would be removed as a result of this plan/EIS, some Canada geese would remain in the park and would include both resident geese and migratory geese. The effort to help restore the freshwater tidal ecosystem and manage the resident Canada goose population would allow wetlands to reach the desired condition of

predominantly self-sustaining systems (containing advanced seral-stage habitat conditions) and would enhance habitat for migratory Canada geese that use the park on a seasonal basis. This would have benefits for migratory Canada geese which are a natural part of this ecosystem, and for visitors who wish to experience more natural fluctuations of geese populations at the park.

The resident Canada goose population in the park would be reduced but the migratory population within the park and beyond park boundaries would not be reduced as part of this plan/EIS. The site and sounds of [migratory] Canada geese in the areas surrounding the Chesapeake Bay have been described as both stunning and stirring and have occurred for generations of forebears to the Chesapeake Bay (CBGN 2009). The natural soundscape of the park would remain unchanged.

The scenic value of the park is reduced by the large amounts of trash in the river and along the shoreline. Action alternatives B and C include trash management as a wetland management technique that would have a beneficial impact on aesthetics at the park. As previously stated, the 2008 list of *Impaired District Waters and Pollutants* within and adjacent to Anacostia Park includes for the first time trash as a pollutant causing impairment (as defined by DCDE [2008]).

Impacts to visitors who do not enjoy resident Canada geese at the park would be beneficial since the resident Canada goose population would be reduced for alternatives B and C. Other management strategies are also included to make sites such as the Langston Golf Course less attractive to resident Canada geese, such as habitat modification techniques, including planting buffers, applying goose repellents, and making new plantings less desirable to geese would also deter the geese from using areas such as Langston Golf Course.

Visitors who do not care if resident Canada geese are present or absent within the park would still be affected by activities proposed. As stated above, visitor use would not be affected by park closures due to the size of the park and the soundscape of the park would not be affected by shooting activities because noise suppression would be used to minimize impacts. However, the aesthetics of the park may be negatively affected by the scare/harassment program that includes visual and auditory deterrents, but would be offset by the beneficial impacts to aesthetics of the proposed trash management program.

Cumulative Impacts—Under alternatives B and C, impacts to all visitors would be beneficial. The beneficial impacts on visitors as a result of alternatives B and C were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to visitor use and experience, there would be beneficial cumulative impacts to all visitors from alternatives B and C.

Conclusion—As described above, there would be different expectations for different users of the park and the impacts as a result of alternatives B and C. As a result, the impact analysis of visitor use and experience at Anacostia Park considered three user groups - visitors who enjoy seeing resident Canada geese at the park, visitors who do not enjoy resident Canada geese at the park, and visitors who do not care whether resident Canada geese are at the park or not. For alternatives B and C, it is the intent of NPS to manage a population of resident Canada geese within the park. For this alternative, impacts to visitors who enjoy seeing resident Canada geese at the park would continue to be beneficial. Similarly, impacts to visitors who do not enjoy resident Canada geese at the park would be beneficial since the resident Canada goose population would be reduced under alternatives B and C. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial for all visitors at the park.

Alternative D – Low Wetland, Low Resident Canada Goose Management—Alternative D proposes a low resident Canada goose management option with a less intensive scare/harassment program. A one-

time population reduction using lethal controls of 40 to 60 percent of the resident Canada goose population could be performed during the life of this plan/EIS through round-up, capture, and euthanasia; no shooting of resident Canada geese would occur under alternative D. Compared to alternatives B and C, alternative D has a less intensive scare/harassment program and does not include trash management. The scenic value of the park is reduced by the large amounts of trash in the river and along the shoreline; therefore, alternative D, would have a long-term minor adverse impact on aesthetics at the park. However, impacts to visitors who enjoy seeing resident Canada geese at the park would be beneficial for alternative D since visitors could continue to view goslings and adult resident Canada geese year round. Impacts to visitors who do not enjoy resident Canada geese at the park would be long-term minor and adverse since the resident Canada goose population would not be drastically reduced due to the primarily non-lethal (one-time lethal population reduction), low resident Canada goose management proposed as part of alternative D. Some visitors may avoid the Langston Golf Course or this area may experience lower usage if high numbers of resident Canada geese utilize turf areas of the golf course.

Cumulative Impacts—Under alternative D, impacts to visitors who enjoy seeing resident Canada geese at the park would be beneficial. The beneficial impacts on these visitors as a result of alternative D were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to visitor use and experience, there would be beneficial cumulative impacts to visitors who enjoy seeing resident Canada geese at the park from alternative D. Also under alternative D, impacts to visitors who do not enjoy resident Canada geese at the park would be long-term minor and adverse due to continued issues with the resident Canada geese at Langston Golf Course. Even though the projects listed previously would be beneficial to visitor use and experience, these beneficial impacts would not help to reduce the long-term minor adverse impacts as a result of alternative D, since the issues with the geese at the golf course would still not be resolved. Therefore, long-term minor adverse cumulative impacts are expected.

Conclusion—As described above, there would be different expectations for different users of the park and the impacts as a result of the alternative D would be either positive or negative, depending on the user category. As a result, the impact analysis of visitor use and experience at Anacostia Park considered three user groups - visitors who enjoy seeing resident Canada geese at the park, visitors who do not enjoy resident Canada geese at the park, and visitors who do not care whether resident Canada geese are at the park or not. For the alternative D, impacts to visitors who enjoy seeing resident Canada geese at the park would continue to be beneficial, and impacts to visitors who do not enjoy resident Canada geese at the park would be long-term minor and adverse due to continued issues with the resident Canada geese at Langston Golf Course. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial for visitors who enjoy Canada geese at the park, and long-term minor and adverse for those visitors who do not enjoy geese at the park.

Alternative E – High Wetland, Moderate Resident Canada Goose Management, with No Lethal Control—This alternative includes intensive resident Canada goose management activities, but no lethal control for resident Canada geese. Under this alternative, no resident Canada geese would be removed from the park. Other resident Canada goose management techniques are proposed as part of alternative E and include habitat modification (planting buffers, applying goose repellents, etc.), intensive scare/harassment techniques, and reproductive control techniques (egg oiling, addling, egg replacement, and applying goose hatch material). These techniques are similar to current actions, which have not had an overall reduction on the resident Canada goose population in Anacostia Park. Therefore, impacts to visitors who enjoy seeing resident Canada geese at the park would be beneficial for alternative E since visitors could continue to view goslings and adult resident Canada geese year round. Impacts to visitors who do not enjoy resident Canada geese at the park would be long-term minor and adverse since the resident Canada goose population would not be drastically reduced because no lethal population reduction

strategies are proposed as part of alternative E. Some visitors may avoid the Langston Golf Course or this area may experience lower usage if high numbers of resident Canada geese utilize turf areas of the golf course. Alternative E includes trash management, which would have a beneficial impact on aesthetics at the park. Similar to alternatives B and C, the scare/harassment program includes visual deterrents that would be aesthetically unappealing to visitors who use the park.

Cumulative Impacts—Under alternative E, impacts to visitors who enjoy seeing resident Canada geese at the park would be beneficial. The beneficial impacts on these visitors as a result of alternative E were considered together with the effects of the projects mentioned under alternative A from other past, present, and reasonably foreseeable future actions. Since the projects listed previously would be beneficial to visitor use and experience, there would be beneficial cumulative impacts to visitors who enjoy seeing resident Canada geese at the park from alternative E. Also under alternative E, impacts to visitors who do not enjoy resident Canada geese at the park would be long-term minor and adverse due to continued issues with the resident Canada geese at Langston Golf Course. Even though the projects listed previously would be beneficial to visitor use and experience, these beneficial impacts would not help to reduce the long-term, minor adverse impacts as a result of alternative E, since the issues with the geese at the golf course would still not be resolved. Therefore, long-term minor adverse cumulative impacts are expected.

Conclusion—As described above, there would be different expectations for different users of the park and the impacts as a result of the alternative E would be either positive or negative, depending on the user category. As a result, the impact analysis of visitor use and experience at Anacostia Park considered three user groups - visitors who enjoy seeing resident Canada geese at the park, visitors who do not enjoy resident Canada geese at the park, and visitors who do not care whether resident Canada geese are at the park or not. For alternative E, impacts to visitors who enjoy seeing resident Canada geese at the park would continue to be beneficial, and impacts to visitors who do not enjoy resident Canada geese at the park would be long-term minor and adverse due to continued issues with the resident Canada geese at Langston Golf Course. The cumulative impacts of this project when considered together with other projects in proximity to the park would be beneficial for visitors who enjoy Canada geese at the park, and long-term minor adverse for those visitors who do not enjoy geese at the park.

SUSTAINABILITY AND LONG-TERM MANAGEMENT

This section discusses the relationship of local short-term uses of the environment versus the maintenance and enhancement of long-term productivity as well as the irreversible and irretrievable commitment of resources and climate change.

In accordance with NEPA, and as further explained in Director's Order #12 Handbook (NPS 2001), consideration of long-term impacts and the effects of foreclosing future options should be included in any NEPA document. According to the handbook (NPS 2001), and as defined by the World Commission on Environment and Development, "sustainable development is that which meets the needs of the present without compromising the ability of future generations to meet their needs." For each alternative considered in a NEPA document, considerations of sustainability must demonstrate the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity. The NPS must consider if the effects of the alternatives involve tradeoffs of the long-term productivity and sustainability of park resources for the immediate short-term use of those resources. It must also consider if the effects of the alternatives are sustainable over the long term without causing adverse environmental effects for future generations (NPS 2001).

The NPS must also consider if the effects of the alternatives cannot be changed or are permanent (if impacts are irreversible). The NPS must also consider if the impacts to park resources could not be

restored, replaced, or otherwise retrieved (NPS 2001). A resource commitment is considered irreversible when primary or secondary impacts from its use limit future options. Irreversible commitment applies primarily to nonrenewable resources, such as minerals or cultural resources, and to those resources that are only renewable over long time spans. A resource commitment is considered irretrievable when the use or consumption of the resource is neither renewable nor recoverable for use by future generations.

RELATIONSHIP OF LOCAL SHORT-TERM USES VS. LONG-TERM PRODUCTIVITY

The no action alternative would trade any long-term productivity for short-term use of park resources. The resident Canada goose population would continue to grow over time and graze on the park's vegetation, including wetlands, at the expense of the long-term productivity and sustainability of the vegetation, as well as the park's visitors and their park experience.

For the management alternatives, there would be a short-term commitment of human resources and short-term impacts to the park's visitors and environment during resident Canada goose removal actions, but with the result of long-term productivity of the park's vegetation and habitat and a sustainable use of the resources in the park. Alternatives B, C, and E would require more resources due to more intense wetland and resident Canada goose management techniques proposed. Alternative D proposes low wetland and resident Canada goose management techniques and would require fewer resources. For any of the management alternatives to be sustainable, they would require long-term management, including monitoring and adaptive management to protect park resources.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Under the no action alternative, impacts to vegetation, including wetlands, from continued resident Canada goose herbivory could result in adverse impacts to the park's wetlands if actions are not taken to reduce the resident Canada goose population, but these impacts are not regarded as irreversible. The management alternatives present the least potential for irreversible or irretrievable commitments of resources. Although resident Canada geese would be removed by lethal control under alternatives B, C, and D, a resident Canada goose population would still be maintained within the park and the wetlands would be managed to a functional level. Therefore, there are no irreversible or irretrievable commitment of resources associated with the management alternatives or the no action alternative.

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Chapter 5: Consultation and Coordination

CHAPTER 5: CONSULTATION AND COORDINATION

The intent of NEPA is to encourage the participation of federal and state-involved agencies and affected citizens in the assessment procedure, as appropriate. This section describes the consultation that occurred during development of this *Final Anacostia Park Wetlands and Resident Canada Goose Management Plan/EIS*, including consultation with scientific experts and other agencies. This chapter also includes a description of the public involvement process and a list of the recipients of the final document.

HISTORY OF PUBLIC INVOLVEMENT

The public involvement activities for this plan/EIS fulfill the requirements of NEPA and NPS Director's Order #12 Handbook (NPS 2001).

THE SCOPING PROCESS

The NPS divides the scoping process into two parts: internal scoping and external or public scoping. Internal scoping involved discussions among NPS personnel and the interdisciplinary planning team (IPT) regarding the purpose of and need for the management actions, issues, management alternatives, mitigation measures, the analysis boundary, appropriate level of documentation, available references and guidance and other project related topics.

Public scoping is the early involvement of the interested and affected public in the environmental analysis process. The public scoping process helps ensure that people have an opportunity to comment and contribute early in the decision-making process. For this planning document and impact statement, project information was distributed to individuals, agencies, and organizations early in the scoping process, and people were given opportunities to express concerns or views and to identify important issues or even other alternatives.

Taken together, internal and public scoping are essential elements of the NEPA process. The following sections describe the various ways scoping was conducted for this plan/ EIS.

Internal Scoping

The internal scoping process began on February 14, 2007. The internal scoping meeting began with a presentation on the background of park resources and resident Canada goose management issues and the purpose of the plan and current management actions. The meeting also included a discussion of the no action alternative as well as thresholds and alternative elements. At this time the NPS was proposing to write a plan/EA.

A follow up internal scoping meeting was held June 12 and 13, 2007 at the Anacostia Park Headquarters to develop alternative concepts for the wetlands restoration plan/EA. The meeting included a site visit, project background, and purpose, need, and objectives of the project. During the meeting elements of wetland restoration were also discussed.

An agency scoping meeting was held Wednesday, March 28, 2008 and included representatives from both the NPS and the District. The meeting began with a presentation on Anacostia Park, the wetlands and resident Canada goose management proposed project and timeline and an overview of NEPA. The meeting utilized the roundtable discussion format to address management issues, alternatives, and resource impacts for the plan/EA.

A decision was made to complete an EIS rather than an EA for the plan. On May 21, 2008, an internal alternatives meeting was held to develop alternatives for analysis for the EIS. The meeting reviewed and updated impact topics, developed alternatives and discussed options for wetland management and resident Canada goose management.

In addition, the IPT identified a group of individuals to comprise an expert science team including university professors, wildlife biologists, wetland specialists, Canada goose experts, and resource management specialists. Two science team meetings were held during the alternatives development process in September and October 2008. The expectations of the science team were to review and provide available research and data pertaining to wetland and resident Canada goose management and to provide technical and scientific input on resident Canada goose management and monitoring. Members of the science team are listed with the document preparers in this chapter.

Public Scoping

Public scoping efforts for this planning process focus on techniques for including the public and major interest groups. Based on past experience, park staff places a high priority on following the NEPA process for public involvement and providing the public the opportunity to comment on proposed actions.

On June 25, 2007 Anacostia Park released the Public Scoping Brochure for the plan/EA for public review and comment. The public scoping brochure explained the background, the purpose and need, and the objectives of the project. The brochure also announced the dates, locations, and objectives of two public meetings. The public was invited to submit comments on the scope of the planning process and potential alternatives through August 10, 2007. During the comment period, two public scoping meetings were held on July 17 and July 18, 2007 at the U.S. Park Police Anacostia Operations Facility. Each meeting began with an open house followed by a short presentation by the NPS explaining the current Anacostia Park wetlands restoration and resident Canada goose management strategies, as well as the project planning process. NPS staff were available to visit with the workshop participants and answer questions and concerns. A total of 31 participants attended the public scoping meetings.

During the public scoping period, forty-nine separate correspondence were received and entered into the Planning, Environment, and Public Comment (PEPC) wither from direct entry by the commenter, or uploading of emails, faxes, transcripts, and hard copy letters by NPS staff. Comments were analyzed using a process developed by the NPS to compile and correlate similar public comments into a format that was used by decision makers and the project team. Comment analysis assisted the team in organizing, clarifying and addressing technical information pursuant to NEPA regulations. It also aided in identifying the topics and issues relevant for consideration in the plan/EA. A coding structure was developed during the internal scoping process to help sort comments into logical groups by topics and issues. The NPS PEPC database was used for management of the comments. A comment analysis report was generated and was made available on the PEPC website for the public. This report included the number and type of comments received, a summary of the substantive comments received, and a list of the organization or groups that participated in the public scoping effort.

After considering the comments received during public scoping, initially evaluating potential alternatives, and continuing to analyze data, the NPS decided to complete an EIS rather than an EA for this plan. On January 8, 2008, the NPS published a second newsletter that notified the public of the change of approach to the planning process, the scope of work and the next steps of the project. The newsletter also identified the subsequent posting of the NOI and invited comments to the plan/EIS. The NPS published a NOI in the Federal Register on January 9, 2008 in Volume 73, No. 6. The NOI served as an announcement of an additional 30-day public comment period. This notice specified that previous comments submitted in

regards to the EA would be considered as part of the planning process for the current proposed action and did not need to be resubmitted. Only one piece of correspondence was received.

After the IPT met in May 2008 to discuss preliminary alternatives, the NPS released a third newsletter to the public on August 29, 2008. The newsletter provided background on the Anacostia Park wetlands management and resident Canada goose management strategies and outlined proposed alternatives to be evaluated in the EIS. The public was invited to submit comments on alternatives through October 3, 2008. During the comment period, seven separate correspondences were received and entered into the PEPC system either from direct entry by the commenter, or uploading of emails, faxes, and hard copy letters by NPS staff. A public content analysis report was generated and made available to the public on November 6, 2008. The report included the number and type of comments received, a summary of the substantive comments received, and a list of the organization or groups that participated in the public scoping effort.

PUBLIC COMMENTS ON DRAFT PLAN/ENVIRONMENTAL IMPACT STATEMENT

On July 21, 2011, the NPS released the *Draft Anacostia Park Wetlands and Resident Goose Management Plan/EIS* for public review and comment. The draft plan/EIS included a description of the proposed project and alternatives proposed, a description of the resources found within the study area, and an analysis of the impacts of the proposed project on these resources. The draft plan/EIS was available for public review until September 26, 2011.

During the comment period, a public meeting was held at the U.S. Park Police Anacostia Operation Facility on September 7, 2011. The public meeting began at 6:30 pm with an open house, followed by a short presentation at 7:00 pm, and a hearing to take public comments from 7:15 until 8:30 pm. NPS staff were available to visit with meeting attendees and to answer questions. Formal public comment sessions were then recorded by a court reporter. A total of three individuals attended the public meeting in Anacostia, and spoke in the public hearing.

The public were able to submit their comments on the project using any of the following methods:

- Electronically through the NPS Planning, Environment, and Public Comment (PEPC) website
- In person at the public meetings
- By mailing comments to the NPS
- By emailing comments to the NPS

During the comment period on the draft plan/EIS, thirteen correspondences from 5 states (District of Columbia, Maryland, New Jersey, Pennsylvania, and Virginia) were received. Comments were received from individuals, as well as from organizations and state and federal government agencies. Commenters generally supported the draft plan/EIS for resident Canada goose and wetland management in Anacostia. However, some commenters felt that additional non-lethal options for resident Canada goose management needed to be explored, and did not support lethal management of the resident Canada goose population. All comments, regardless of their topic, were carefully read, coded, and analyzed. Under each code, all substantive comments were grouped by similar themes, and those groups were summarized with a concern statement prepared for responses. The NPS responded to the concern statements and the responses are included in appendix E. Appendix E includes both the content analysis report and the concern response report.

This final plan/EIS will be made available for public review for a 30-day no-action period, which begins with the publication of the EPA Notice of Availability. After the 30-day no action period, a record of decision (ROD) will be prepared that will document approval of the plan, select the alternative to be implemented, and set forth any stipulations required for implementation. The ROD will be signed by the Regional Director of the National Capital Region, after which Notice of Availability of the ROD will be published in the Federal Register. This publication will then complete the NEPA process.

LIST OF RECIPIENTS

The agencies and organizations listed below were notified of the availability of this document or mailed a copy. Notifications were also made to individuals on the park's mailing list, and copies were sent to those that requested a copy.

FEDERAL DEPARTMENTS AND AGENCIES

United States Army Corps of Engineers Baltimore District

United States, Environmental Protection Agency/Chesapeake Bay Program

United States Fish and Wildlife Service, Chesapeake Bay Field Office

United States Geological Survey, Patuxent Wildlife Research Center

United States National Arboretum

USDA-APHIS Wildlife Services

DISTRICT OF COLUMBIA GOVERNMENT

DC Dept. of Health

DC Dept. of Health Watershed Protection Division

DC Fisheries and Wildlife

DC Office of Planning

DC Parks and Recreation

Metropolitan Washington Council of Governments

ANCs

ELECTED OFFICIALS

Executive Office of the Mayor

The Honorable Phil Mendelson

The Honorable Kenyan McDuffie

The Honorable Anita Bonds

The Honorable David Grosso

The Honorable David Catania

The Honorable Vincent Orange

The Honorable Jim Graham

The Honorable Jack Evans

The Honorable Mary M. Cheh

The Honorable Muriel Bowser

The Honorable Tommy Wells

The Honorable Yvette Alexander

The Honorable Marion Barry

MEDIA, ORGANIZATIONS AND BUSINESSES

Anacostia Watershed Society

Anacostia Watershed Citizen Advisory Committee

Audubon Naturalist Society

Audubon Naturalistic Society of the Central Atlantic States

Defenders of Wildlife

Chesapeake Bay Foundation

Earth Conservation Corps

Eastland Gardens Civic Association

Friends of the Earth

The Fund for Animals

Golf Course Specialists, Inc., East Potomac Park Golf Course

Kingman Park Civic Assoc.

Langston Golf Course

National Audubon Society New Columbia Chapter

National Wildlife Federation

The Humane Society of the U.S.

People for the Ethical Treatment of Animals

River Terrace Civic Association

Sierra Club

The Wilderness Society

AGENCY CONSULTATION

ENDANGERED SPECIES ACT

A consultation letter was mailed to local and federal agencies and stakeholders requesting consultation and comments regarding the proposed project at Anacostia Park. In 2005, NPS consulted with the USFWS and NOAA-Fisheries to identify any endangered or threatened species within the proposed project area. In response, USFWS sent a letter on November 10, 2005 stating that none of the federally endangered or threatened species under the USFWS jurisdiction is known to occur within Anacostia Park (appendix A). Therefore, no biological assessment or further section 7 consultation with the USFWS is required. NOAA-Fisheries also sent a response on November 22, 2005 stating that the endangered shortnose sturgeon (*Acipenser brevirostrum*) has been documented in the Potomac River. Transient shortnose sturgeon may occur in the Anacostia River; however, NPS determined the types of activities associated with this project would not adversely affect the shortnose sturgeon.

The NPS also sent a consultation letter to the USFWS on December 22, 2009 explaining that subsequent to the initial consultation with USFWS, NPS was determined that an EIS was necessary for the wetland and resident Canada goose management plan. The letter further described the project. A response was received on January 6, 2010 stating that except for the occasional transient individuals, no federally listed endangered or threatened species are known to exist within the project impact area and no further section 7 consultation is required (appendix A).

On 26 October 2011, the USFWS determined Kenk's amphipod (*Stygobromus kenki*) was a candidate for listing under the ESA. NPS policy is to treat candidates as listed species, especially when a species will become listed during the life of a plan. National Capital Parks —East, administrative unit for Anacostia Park, received a letter from USFWS on 6 January 2010 stating that the activities associated with the project would not affect any federally endangered species. This remains correct because Kenk's amphipod occurs north of and not within the Anacostia Park project action area.

Additionally, on 6 February 2012, during preparation of the final plan/EIS, the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) Chesapeake Bay distinct population segment was federally listed as endangered. As a result, on October 24, 2012, NPS requested technical assistance from the National Marine Fisheries Service (NMFS) Protected Resources to help determine potential for this and other federally listed species to occur in the project area (Appendix A). The National Marine Fisheries Service responded on October 31, 2012 (appendix A) stating no federally listed or proposed threatened or endangered species and/or designated critical habitat for listed species under the jurisdiction of NMFS are known to exist in the vicinity of the proposed project. As such, no further coordination with NMFS Protected Resources Division is needed (see appendix A). A copy of the consultation letters can be found in appendix A-1. Copies of the responses are included in appendix A-2.

SECTION 106

A consultation letter was sent to the DC SHPO on December 22, 2009 describing the proposed wetland and resident Canada goose management plan. A response was received on February 1, 2010 indicating that Anacostia Park is eligible for listing on the NRHP and the DC Inventory of Historic Sites.

In accordance with Section 106 of the National Historic Preservation Act, the NPS sent a copy of the draft plan/EIS to the Maryland and DC SHPOs, with a request for concurrence with a 'no adverse effect' determination for certain elements of the preferred alternative. On August 24, 2011, the Maryland SHPO responded with their determination that there are no historic properties affected by the preferred alternative in Maryland.

After subsequent consultation, the DC SHPO responded on January 4, 2013, indicating their concurrence with the ‘no adverse effect’ determination based on the following conditions: 1) Continued Section 106 consultation on the proposed ground disturbing activities’ effects on archaeological resources; 2) Archaeological identification survey, and /or geoarchaeological survey if warranted; 3) mitigation of adverse effects if such cannot be avoided; and 4) reporting of archaeological investigations following NPS and District guidelines.

Copies of the correspondence documenting completion of Section 106 compliance can be found in appendix A-1 and A-2.

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List of Preparers/Consultants

LIST OF PREPARERS AND CONSULTANTS

NATIONAL PARK SERVICE

Employee	Title	Education/Role in Preparing EIS	Experience
Lindsay Gillham	Environmental Protection Specialist, Environmental Quality Division	B.S. Natural Resources J.D. in Law Project Manager	10 years working on NEPA documents, 4 years with NPS
Dan Niosi	Environmental Protection Specialist, EQD	B.A. Environmental Studies Natural Resources/ Project Manager	14 years working in natural resource management, planning, and compliance 3 years with NPS
Kevin Noon	Natural Resource Program Center, Water Resources Division, Wetlands Program	B.L.A. Landscape Architecture M.L.A Environmental Planning M.A. Communication Research Ph.D. Wetland Ecology Provided technical input and review	31 years working with wetland ecology research, wetland restoration, permitting, NPS wetland compliance, and environmental banking
Joel Gorder	Regional Planning and Environmental Coordinator	Provided input and review	
Sue Bennett	National Capital Parks - East	Provided input and review	
Stephen Syphax	Chief of Resources, National Capital Parks – East	B.S. General Studies NPS Natural Resource Management Training Program Provided input and review, project point of contact for the park	32 years with NPS, (includes 9 years as a Natural Resource Specialist and 19 years as Chief of the Resource Management Division)
Mikaila Milton	Park Biologist, National Capital Parks – East	B.S. Biology and Chemistry M.S. Ecology Provided input and review	10 years with NPS

Employee	Title	Education/Role in Preparing EIS	Experience
James Rosenstock	Park Ranger, National Capital Parks – East	Provided input and review	35 years with NPS as a Park Ranger; 16 years field experience in Natural Resources Management
Doug Curtis	Center for Urban Ecology	Provided input and review	
Scott Bates	Regional Wildlife Biologist NPS Center for Urban Ecology	B.S. Biology M.S. Wildlife Management Provided technical input	11 years with NPS NCR and 9 years with DOD as a wildlife biologist
Jeff Runde	Aquatic Ecologist, Center for Urban Ecology	B.S. Zoology M.S. Civil and Environmental Engineering Ph.D. Aquatic Ecology Provided input and review	12 years with the University of Notre Dame; 9 years with NPS in aquatic ecology
Diane Pavek	Research Coordinator and Botanist, Center for Urban Ecology	B.S. Botany and Zoology M.S. Botany Ph.D. Botany Provided technical input and information for monitoring protocol	26 years in botany-related fields; 10 years with NPS

EA ENGINEERING, SCIENCE, AND TECHNOLOGY, INC.

Employee	Title	Education/Role in Preparing EIS	Experience
Suzanne Boltz	Senior Scientist/Senior Project Manager, EA Engineering	B.S. Environmental Biology; M.S. Fish and Wildlife Sciences. Provided project management, input and review; attended workshops to develop management plan for wetlands and resident Canada geese	18 years with EA Engineering; 21 years of experience overall Has NPS training for Director's Order-12, CBA, PEPC
Jeff Elseroad	Senior Environmental Scientist, EA Engineering	B.A. Chemistry; M.S. Environmental Engineering Provided senior technical review of plan/EIS	26 years with EA Engineering; 37 years of experience overall

Employee	Title	Education/Role in Preparing EIS	Experience
Sarah Koser	NEPA Specialist, EA Engineering	B.S. Biology; M.S. Environmental Engineering Provided NEPA expertise and wetland support, and completed field studies; provided input and review	11 years with EA Engineering
Tracy Layfield	NEPA Specialist, EA Engineering	B.S. Biology Provided input and review; attended workshops to develop management plan for wetlands and resident Canada geese	27 years with EA Engineering
Jeannette Matkowski	Environmental Scientist, EA Engineering	B.S. Biology Utilized PEPC report to develop project alternatives; task manager for public comment database and administrative record	9 years with EA Engineering
Rich Pfingston	Senior Ecological Restoration Scientist, EA Engineering	A.A. Wildlife Fisheries; B.S. Wildlife Fisheries Provided technical review, wetland management expertise, and study preparation for alternatives; attended roundtable meeting; provided input and review	5 years with EA Engineering; over 24 years of experience overall
Mark Gutberlet, P.E.	Senior Engineer, EA Engineering	B.S. Civil Engineering M.S. Civil Engineering (Geotechnical) Provided cost estimate for wetland and goose management techniques	16 years with EA Engineering
Laura Jo Oakes, P.E.	Junior Engineer, EA Engineering	B.S. Civil Engineering M.S. Civil Engineering Provided cost estimate for wetland and goose management techniques	5 years with EA Engineering; 8 years of experience overall
Jordan Klemick	GIS Specialist, EA Engineering	B.A. Geography Produced and edited figures for plan/EIS	5 years with EA Engineering; 6 years of experience overall
Kathryn Cerny-Chipman	Environmental Scientist, EA Engineering	B.A. Environmental Biology Provided support on editing and writing of plan/EIS	2 years with EA Engineering

THE LOUIS BERGER GROUP, INC.

Employee	Title	Education/Role in Preparing EIS	Experience
Charles Lee Decker	Assistant Director, Cultural Resources, The Louis Berger Group, Inc.	BA, Anthropology; MA, Anthropology Coordination of cultural resource sections for the EA	33 years of experience in cultural resource management
Lisa Kraus	Archeologist, The Louis Berger Group, Inc.	B.A., Anthropology; M.A., Anthropology Characterization of existing conditions for archeological resources	6 years of experience as a professional archeologist
Patti Kuhn	Architectural Historian, The Louis Berger Group, Inc.	B.F.A., Architectural History; M.A., Historic Preservation Characterization of existing conditions and analysis of impacts for historic structures and cultural landscapes	6 years of experience as a professional architectural historian

SCIENCE TEAM MEMBERS

Dave Ankney, University of Western Ontario – Professor (Retired)

Suzanne Boltz, EA Engineering, Science, & Technology, Inc. – Project Manager

Scott Bates, NPS Center for Urban Ecology – Wildlife Biologist

Michael Conover, Utah State – Professor of Wildland Resources

Lindsay Gillham, NPS – EQD – Environmental Protection Specialist

Mark Graham, NPS – Wildlife Biologist

Greg Kearns, Maryland-National Capital Park and Planning Commission: Patuxent River Park – Naturalist

Mikaila Milton, NPS – National Capital Parks-East - Biologist

Tim Moser, FWS – Wildlife Biologist

Richard Pfingsten, EA Engineering, Science, & Technology, Inc. - Ecosystem Restoration and Management Leader

Claire Riegelman, NPS – EQD – Environmental Protection Assistant

Jim Sherald, NPS Center for Urban Ecology – Chief of Natural Resources and Science (Retired)

Stephen Syphax, NPS – National Capital Parks-East – Supervisory Resource Management Specialist

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