



NATIONAL CAPITAL REGION INVASIVE PLANT MANAGEMENT PLAN AND ENVIRONMENTAL ASSESSMENT



Prepared for:

National Park Service
Nation Capital Region

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EXECUTIVE SUMMARY

The National Park Service (NPS) proposes to implement an Invasive Plant Management Plan (IPMP) at the 15 parks that constitute the National Capital Region (NCR). The IPMP would ensure that all NCR parks have access to a range of methods used for the treatment of non-native invasive plant species. Such methods include chemical, biological, manual, mechanical, physical, and cultural treatment methods. This Environmental Assessment (EA) evaluates the potential impacts on the natural, cultural, and human environment of two alternatives, the No Action Alternative and the Action Alternative. It was prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), the regulations of the Council on Environmental Quality (CEQ) for implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and NPS Director's Order (DO) 12, *Conservation Planning, Environmental Impact Analysis, and Decision-making*.

Purpose and Need for the Action

The purpose of the IPMP/EA is to protect and restore natural and cultural resources in the 15 NCR parks by controlling, containing, or substantially minimizing populations of non-native invasive plant species through targeted treatment. The IPMP/EA would provide guidance to the individual NCR parks on non-native invasive plant management that would be useful both now and in the long term. To this end, the IPMP/EA would identify and implement environmentally sound, cost-effective invasive plant management strategies. These strategies would reflect an integrated pest management process that minimizes the risk to people and park resources.

The IPMP/EA is needed because non-native invasive plant species in the 15 NCR parks disrupt ecosystems, degrade cultural resources, and diminish visitor use and experience. A unified strategy for the treatment of non-native invasive plants is needed that provides the full range of available treatment strategies and a consistent approach. The IPMP/EA would facilitate the management of non-native invasive plants throughout the 15 NCR parks by establishing best management practices (BMPs) within the region and providing the parks with a broader range of options to treat non-native invasive plants.

Alternatives

The EA analyzes two alternatives: the No Action Alternative and Alternative 1 – Implement the IPMP. Alternative 1 is the Preferred Alternative.

No Action Alternative. Under the No Action Alternative, NCR parks would continue to manage non-native invasive plants as they currently do. Development of annual treatment plans by each park would continue to be optional. The prioritization of areas and non-native invasive plant species for treatment within each park would continue to fall solely on the park. The following invasive plant treatment methods would continue to be used at each park:

- Chemical (excluding aerial spraying)
- Manual
- Mechanical
- Physical (excluding prescribed fire)
- Cultural

Alternative 1 – Implement the IPMP (Preferred Alternative). Under Alternative 1, the NCR implement a region-wide IPMP that would increase the options available to staff at individual parks in a coordinated manner. Specifically, the IPMP would:

- Establish a prioritization scheme for the treatment of non-native invasive plants; and
- Provide a comprehensive range of treatment strategies and a consistent approach.

Under Alternative 1, treatment of non-native invasive plants at each park would be prioritized by both species and location. Non-native invasive plants and sites would be ranked by category (e.g., first priority, second priority, etc.) rather than precisely ranking individual species or sites. The focus would be on removing the prioritized non-native invasive plants at the highest priority places. Plants identified as early detection species would be prioritized. An adaptive management approach would be used to improve outcomes in both current and future planning years. Invasive plant treatment methods that would be available to park managers under Alternative 1 would include:

- Chemical (including aerial spraying)
- Biological
- Manual
- Mechanical
- Physical (including prescribed fire)
- Cultural

Summary of Impacts

The potential impacts of the proposed alternatives were assessed in accordance with NEPA and DO-12, which require impacts on park resources to be analyzed in terms of their context, duration, and intensity.

The EA assesses impacts on the following resources: vegetation, wildlife, cultural resources, visitor use and experience, and park operations and management. The following impact topics were dismissed from consideration because the alternatives have no potential to have perceptible effects in these areas: soils, air quality, water quality, species of special concern, floodplains, human health and safety, environmental justice and protection of children, energy resources, and climate change.

Neither alternative is anticipated to result in significant adverse impacts. Both alternatives would have long-term beneficial impacts on most of the resources considered, with Alternative 1 having generally greater such impacts. Both alternatives would have no, negligible, or minor adverse short-term impacts. Cumulative impacts would be beneficial under both alternatives.

Note to Reviewers and Respondents

We value and welcome your input on this project. The public comment period closes on June 8, 2016. The preferred method for receiving public comments is through the NPS Planning, Environment, and Public Comment (PEPC) website, where the IPMP/EA is publicly posted. The PEPC database is a tool used by the NPS to manage official correspondence and analyze public comment in the planning process. The website address is: http://parkplanning.nps.gov/ncr_ipmpea. You may complete a comment form online.

You can also mail comments to:

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Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so. Thank you for your interest in this project.

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Management Team

ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
ACHP	Advisory Council on Historic Preservation
ANTI	Antietam National Battlefield
AOE	Assessment of Effects
APE	Area of Potential Effect
APHIS	Animal and Plant Health Inspection Service
BMP	best management practice
CATO	Catoctin Mountain Park
CHOH	Chesapeake & Ohio Canal National Historical Park
CE	Categorical Exclusion
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
DBH	diameter at breast height
DDOT	District Department of Transportation
DO	Director's Order
EA	Environmental Assessment
EDDR	Early Detection and Rapid Response
EIS	Environmental Impact Statement
EO	Executive Order
EPA	US Environmental Protection Agency
EPMT	Exotic Plant Management Team
ESA	Endangered Species Act
FHWA	Federal Highway Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
GMP	General Management Plan
GPS	Global Positioning System
GREE	Greenbelt Park and Baltimore-Washington Parkway
GWMP	George Washington Memorial Parkway
HAFE	Harpers Ferry National Historical Park
IPM	Integrated Pest Management
IPMP	Invasive Plant Management Plan
MANA	Manassas National Battlefield Park
MBTA	Migratory Bird Treaty Act
MONO	Monocacy National Battlefield
MOU	Memorandum of Understanding
MP	mile post
NACE	National Capital Parks-East
NAMA	National Mall and Memorial Parks
NCR	National Capital Region
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act of 1966
NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places

PEPC	Planning, Environment and Public Comment
PISC	Piscataway and Fort Washington Park
PRWI	Prince William Forest Park
psi	pound(s) per square inch
PUPS	Pesticide Use Proposal System
ROCR	Rock Creek Park
SCA	Student Conservation Association
SDS	safety data sheets
SHPO	State Historic Preservation Office
TAG	Technical Advisory Group for Biological Control Agents of Weeds
THPO	Tribal Historic Preservation Officer
TMDL	Total Maximum Daily Load
US	United States
USDA	US Department of Agriculture
USDOI	US Department of the Interior
USFWS	US Fish and Wildlife Service
UTV	Utility Task Vehicle
WHHO	White House/President's Park
WOTR	Wolf Trap National Park for the Performing Arts

1 PURPOSE AND NEED

1.1 Introduction

The National Park Service (NPS) proposes to implement an Invasive Plant Management Plan (IPMP) at the 15 parks that constitute the National Capital Region (NCR). The 15 parks covered by this plan include the following:

- Antietam National Battlefield (ANTI)
- Catoctin Mountain Park (CATO)
- Chesapeake & Ohio Canal National Historical Park (CHOH)
- George Washington Memorial Parkway (GWMP)
- Greenbelt Park and Baltimore-Washington Parkway (GREE)
- Harpers Ferry National Historical Park (HAFE)
- Manassas National Battlefield Park (MANA)
- Monocacy National Battlefield (MONO)
- National Capital Parks-East (NACE)
- National Mall and Memorial Parks (NAMA)
- Piscataway and Fort Washington Park (PISC)
- Prince William Forest Park (PRWI)
- Rock Creek Park (ROCR)
- White House/President's Park (WHHO)
- Wolf Trap National Park for the Performing Arts (WOTR)

The IPMP would ensure that all NCR parks have access to the suite of methods currently used for the removal of widespread non-native invasive plant species. Such methods consist of chemical, biological, manual, mechanical, physical, and cultural treatment methods. The accompanying and incorporated environmental assessment (EA) analyzes the environmental impacts that may result from the implementation of the IPMP.

Impacts on the natural, cultural, and human environment potentially resulting from the action alternative and the No Action Alternative are identified and analyzed in this IPMP/EA in accordance with the National Environmental Policy Act of 1969 (NEPA), the regulations of the Council on Environmental Quality (CEQ) for implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and NPS Director's Order #12 (DO-12): Conservation Planning, Environmental Impact Analysis, and Decision-making.

The NPS is also consulting with the District of Columbia, Virginia, West Virginia, and Maryland State Historic Preservation Offices (SHPOs) in compliance with Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, to evaluate the potential effects of the proposed IPMP on historic properties.

1.2 Purpose and Need for Taking Action

1.2.1 Purpose for Taking Action

The purpose of the IPMP/EA is to protect and restore natural and cultural resources in the 15 NCR parks by controlling, containing, or substantially minimizing populations of non-native invasive plant species through targeted treatment. The IPMP/EA would provide guidance to the individual NCR parks on non-native invasive plant management that would be useful both now and in the long term. To this end, the IPMP/EA would identify and implement environmentally sound, cost-effective invasive plant management strategies. These strategies would reflect an integrated pest management (IPM) process that minimizes the risk to people and park resources.

1.2.2 Need for Taking Action

The IPMP/EA is needed because non-native invasive plant species in the 15 NCR parks disrupt ecosystems, degrade cultural resources, and diminish visitor use and experience. A unified strategy for the treatment of non-native invasive plants is needed that provides the full range of available treatment strategies and a consistent approach. The IPMP/EA would facilitate the management of non-native invasive plants throughout the 15 NCR parks by establishing best management practices (BMPs) within the region and providing the parks with a broader range of options to treat non-native invasive plants.

1.3 Scope of the National Capital Region IPMP/EA

1.3.1 Objectives

The primary goal of the IPMP/EA is to provide park staff with adaptive, cost-effective strategies for invasive plant management that use one or more site-appropriate treatment options. These strategies would enable parks to minimize invasive plant impacts and maximize park-specific IPM success. Overall, the goal of the IPMP/EA reflects the NPS's mission to preserve "... unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations. The NPS cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world."

A comprehensive evaluation of potential impacts associated with invasive plant management and identification of standardized BMPs would inform park staff of the effects potentially resulting from various treatment methods and provide an opportunity to alter planned actions in a manner that reduces potential impacts on park and visitor activities. Due to the diversity of NPS parks within the project area, a regional IPMP/EA is needed that would provide resource managers with multiple treatment options that fit the needs of specific sites. More importantly, the IPMP/EA would establish a procedure for treatment selection. In consultation with regional staff, resource managers would select the most appropriate treatment option or combination of treatments to minimize potential impacts and maximize overall management success.

When completed, the NCR IPMP/EA would provide strategies for park staff to manage terrestrial, wetland, and aquatic invasive plants on lands owned and managed by the NPS within the fee boundaries of the NCR parks (fee boundaries are the park boundaries that have been legislated by Congress). There is an economy of scale associated with preparing a region-wide document, and the IPMP/EA would help standardize guidance tools and help prioritize invasive plant species management throughout the region.

1.3.2 Jurisdiction of the IPMP/EA

The IPMP/EA is intended to provide Integrated Pest Management (IPM) guidance to manage invasive plants within the fee boundaries of the 15 NCR parks on NPS-owned lands.

Invasive plant management activities that occur within park boundaries would be conducted in accordance with all applicable federal, state and local laws as well as NPS policies and guidelines. The NPS may consult with its partners prior to implementing management activities for non-native invasive plants. Invasive plant management activities implemented under this IPMP/EA may also involve pooling of resources and/or the development of Memorandums of Understanding (MOUs) between the NPS and adjacent or nearby landowners/stakeholders. Measures for collaboration with tribal governments, other federal offices, the District of Columbia, and states, counties, private entities, volunteers, and other stakeholders are discussed in Section 2.3.1 of this IPMP/EA.

Invasive plant management activities located outside of the park fee boundaries would not fall within the jurisdiction of this IPMP/EA. Similarly, invasive plant management activities on non-NPS-managed lands that do not use NPS resources and/or are conducted by other entities, such as counties, state and District of Columbia agencies, and/or non-governmental organizations, would not fall within the jurisdiction of this IPMP/EA. In summary, invasive plant management within the jurisdiction of this IPMP/EA would be limited to activities that occur within NPS park unit boundaries and involve NPS resources. Such resources include personnel, activities, and operations funded directly by the NPS as well as volunteers or organizations working on behalf, at the request, or with the permission of the NPS but not receiving NPS funding.

1.3.3 Lifespan of the IPMP/EA

This IPMP is intended to provide NPS with long-term invasive plant management strategies. However, the IPMP/EA would be reevaluated periodically by NPS staff to determine whether updates and/or additional/new analysis under NEPA are needed.

1.3.4 Definition of Non-native Invasive Plants

This IPMP/EA defines management strategies for non-native invasive plant species only. Non-native species are also commonly referred to as alien or non-indigenous species. Non-native invasive plants are alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order [EO] 13112, Invasive Species). Because any given non-native species did not evolve in conjunction with the species native to the surrounding environment, the non-native species is not a natural component of the natural ecosystem at that location (NPS 2006). Not all non-native plants are invasive. Additionally, some native plants have the ability to exhibit invasive or weedy tendencies.

1.3.5 NPS Criteria for Invasive Plant Management

Under NPS Management Policies 2006, an invasive plant must meet the following criteria to be managed:

All exotic plant and animal species that are not maintained to meet an identified park purpose will 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;*
- *Disrupts the genetic integrity of native species;*

- *Disrupts the accurate presentation of a cultural landscape;*
- *Damages cultural resources;*
- *Significantly hampers the management of park or adjacent lands;*
- *Poses a public health hazard as advised by the US Public Health Service (which includes the Centers for Disease Control and the NPS Public Health Program); or*
- *Creates a hazard to public safety.*

For species that meet these criteria, management priorities would be assigned to each invasive plant. Invasive plants would then be managed according to relative management priority. In accordance with Management Policies 2006, Section 4.4.4.2, relative management priorities would be determined as follows:

Higher priority will be given to managing invasive species that have, or potentially could have, a substantial impact on park resources, and that can reasonably be expected to be successfully controlled. Lower priority will be given to invasive species that have almost no impact on park resources or that probably cannot be successfully controlled.

It is important to note that not all plants defined as invasive would necessarily be managed under this plan, as some of the parks maintain invasive plant species that have historic or cultural significance. Management Policies 2006, Section 4.4.4.1, provides for the maintenance of invasive species, and includes criteria such as when the species is:

... needed to meet the desired condition of a historic resource, but only where it is noninvasive and is prevented from being invasive by such means as cultivating (for plants), or tethering, herding, or pasturing (for animals). In such cases, the exotic species used must be known to be historically significant, to have existed in the park during the park's period of historical significance, to be a contributing element to a cultural landscape, or to have been commonly used in the local area at that time; or an agricultural crop used to maintain the character of a cultural landscape, with rigorous review given to any proposal to introduce a genetically modified organism...

Similarly, as defined in Management Policies 2006, Section 4.4.2.5, the use of [non-native] species may be permitted:

Where necessary to preserve and protect the desired condition of specific cultural resources and landscapes, plants and plant communities generally will be managed to reflect the character of the landscape that prevailed during the historic period.

In addition to species-specific priorities, procedures establishing priorities for management would be determined based on the alternative that is eventually selected through this NEPA process.

1.3.6 Management Partnerships and Stakeholder Coordination

Under this IPMP/EA, individual parks may cooperate with state, District of Columbia, county, tribal, and federal officials, private landowners, and applicable management partnerships/stakeholders to implement approved invasive plant management strategies.

1.3.7 NEPA Compliance

The IPMP/EA would serve as a programmatic NEPA document for invasive plant management within each of the 15 parks. Plans that identify invasive plant management treatments or potential impacts

that have not been considered in this IPMP/EA may require additional compliance with NEPA. In addition, actions involving prescribed fire, biological agents, and aerial application of chemical or biological treatments may require additional compliance with NEPA and/or other relevant federal and state regulations.

1.4 Regulatory Measures Applicable to the IPMP/EA

A number of federal, state, District of Columbia, and local regulatory measures, as well as NPS policies and guidelines, directly or indirectly address the management of invasive plant species. As such, these measures are applicable to the alternatives considered in this IPMP/EA. Regulatory measures include laws, executive orders, regulations, and policies defined as follows:

- **Federal Laws:** Acts passed by the US Congress and approved by the president. Federal laws take precedence over state and local laws.
- **Executive Orders (EO):** Directives from the president to departments and agencies of the executive branch.
- **Regulations:** Rules for complying with a federal law developed by the authorized department or agency that also include codification of agency policy. For example, Title 36 CFR Section 1-199 contains general and specific regulations for the management and use of the National Park System (these regulations are augmented by the superintendent's compendium for each unit).
- **Policies:** Guiding principles or procedures that set the framework and provide direction for management decisions. They may prescribe the process by which decisions are made, how an action is to be accomplished, or the results to be achieved.

A detailed discussion of regulatory measures applicable to the IPMP/EA is included in Appendix F.

1.5 National Capital Region Parks

The NCR is one of seven regional directorates of the NPS. Fifteen parks across the region manage NPS-owned lands within the Washington, DC, regional area, and they are shown in Figure 1-1. The history, purpose, and summary of each park included in the NCR IPMP/EA are described in the following sub-sections. Based on available information, the descriptions include the purpose and significance of each park (i.e., the basis for establishing the park), the unique features of the park, and the landscape types and vegetation communities known to exist in the park.

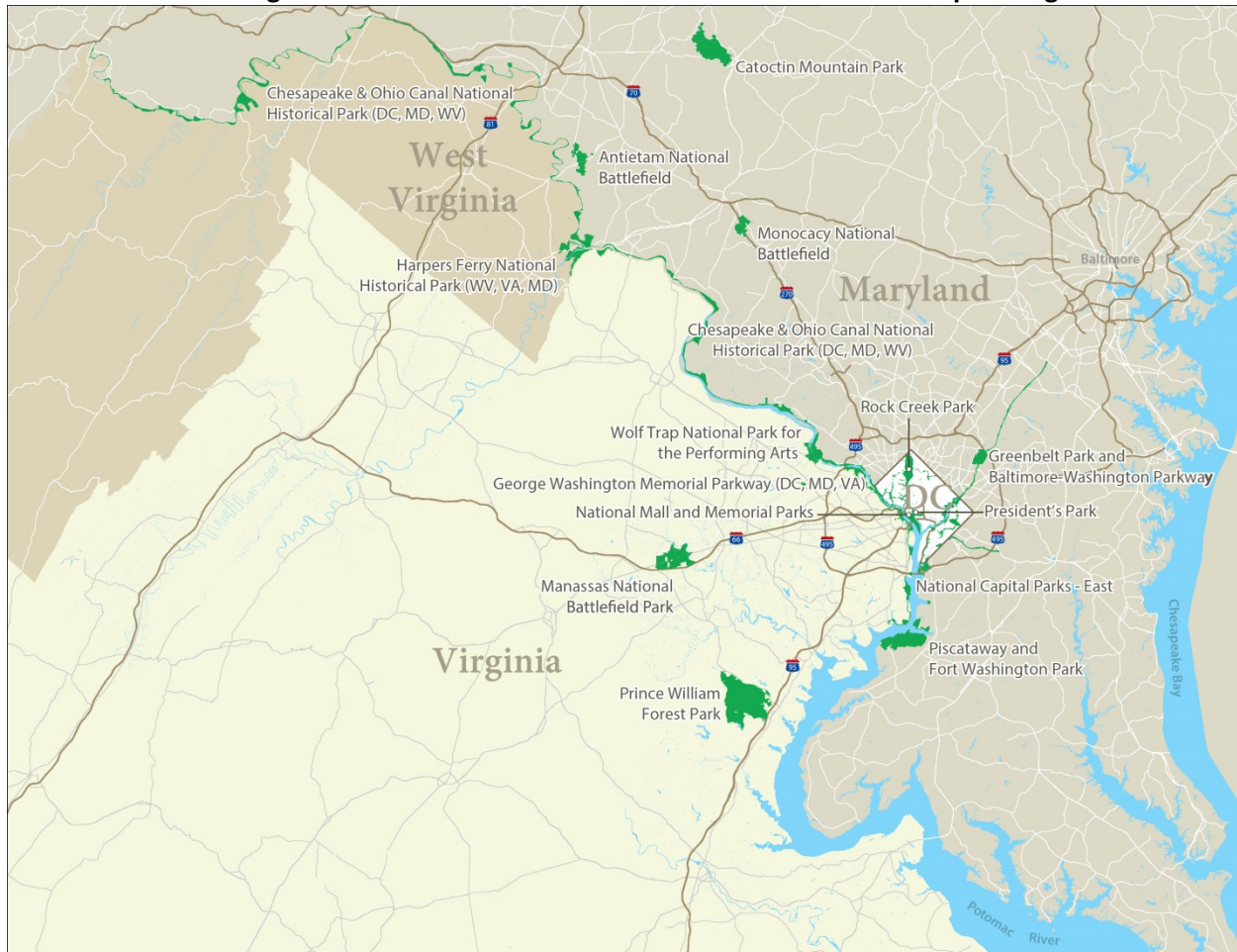
1.5.1.1 Antietam National Battlefield

Antietam National Battlefield is located in north-central Maryland, approximately 12 miles south of Hagerstown. The first battlefield of the Civil War to occur on northern soil, ANTI encompasses over 3,200 acres of farmland, pastures, woodlots, and limestone forests. The majority of the park is centered on the battlefield, but the park also includes several outparcels for cemeteries and memorial sites. Established by the War Department in 1890 to commemorate the 1862 Battle of Antietam, the land was later transferred to the NPS. The 1992 Antietam National Battlefield General Management Plan outlines goals for restoring the battlefield to its 1862 appearance. The plan includes projects such as replanting of historic woodlots and orchards; reestablishing original fence lines, lanes and trails; and maintaining the integrity of the historic farmsteads (NPS 2014a, 2015a).

The majority of the park is composed of maintained agricultural fields interspersed with forested lands and riparian buffers (NPS 2014a). There are two types of ecological systems identified at ANTI (see Appendix A for a park map and a table of ecosystems by park). Common forest canopy species include

white oak¹, northern red oak, hackberry, sugar maple, tuliptree, and bitternut hickory. Common understory forest species include flowering dogwood, spicebush, witch-hazel, blackhaw, and hophornbeam. Restoration of native grasses has focused on increasing populations of little blue stem, red top, Indian grass, and switch grass. Wildflowers inventoried included common blue violet, common cinquefoil, small-flowered crowfoot, golden ragwort, horsetail, white snakeroot, white vervain, and white wood aster. Documented non-native plant species in ANTI include tree-of-heaven, garlic mustard, Oriental lady's thumb, multiflora rose, and Japanese honeysuckle (NPS 2015a, NPS 2015b, VDCR 2011a).

Figure 1-1: Parks of the National Park Service's National Capital Region



1.5.1.2 Catoctin Mountain Park

Catoctin Mountain Park encompasses roughly 5,600 acres near the town of Thurmont, MD. The park was originally established on 10,000 acres in 1935 as part of a Depression-era New Deal program to increase recreation areas. It was subsequently used as a training area for the Office of Strategic Services during World War II as well as a retreat for President Franklin D. Roosevelt. Over 4,000 acres of the original park were transferred to the State of Maryland in 1954 and ultimately became Cunningham Falls State Park. The remaining federally owned land was designated as Catoctin Mountain Park under the jurisdiction of the NPS NCR (NPS 2007a).

¹ Common names are used for animal and plant species throughout the IPMP/EA. See Appendix B for a comprehensive list of corresponding scientific names for all species discussed.

Today, approximately 97 percent of CATO is forested; the park is a prime example of a regenerated eastern deciduous forest that reflects the geology and plant communities in the Appalachian Mountains. Seven ecological systems have been identified at CATO (see Appendix A for a park map and a table of ecosystems by park) (VDCR 2011a). Tree species such as chestnut oak, table mountain pine, and pitch pine can be found on the drier ridge tops. On lower slopes and ravines, where the soil is richer, white oak, tuliptree, red maple, black birch, American beech, blackgum, and eastern hemlock can be found. The western portion of the park has deeper, richer, and moister soils. Most of the trees on the western portion are larger and the forest contains more species. Tree species found here include sugar maple, basswood, hickory, hornbeam, white ash, beech, and tuliptree (VDCR 2011a). Of the 700 species of vascular plants recorded within the park, 60 species are trees and 100 are non-native species (NPS 2007a). A few scattered stands of eastern white pine also exist, some of which are remnant tree plantations. Invasive plant species of concern at CATO include, but are not limited to, mile-a-minute, beefsteak plant, Japanese stiltgrass, garlic mustard, tree-of-heaven, multiflora rose, and Japanese barberry (NPS 2015c).

1.5.1.3 Chesapeake & Ohio Canal National Historical Park

The Chesapeake & Ohio Canal National Historical Park is a generally linear park encompassing more than 22,000 acres and extending 184.5 miles along the Potomac River through portions of Washington, DC, Maryland, and West Virginia. Established in 1971, CHOH features the last fully intact towpath from the mule-drawn barge transportation era in the United States (NPS 2014b). The purpose of CHOH is to preserve and interpret the nineteenth century transportation canal from Washington, DC to Cumberland, Maryland, and its associated scenic, natural, and cultural resources, and to provide opportunities for education and appropriate outdoor recreation.

CHOH is one of the most biologically diverse parks in the NCR, particularly for plant species. Sixteen ecological systems have been identified at CHOH (see Appendix A for a park map and a table of ecosystems by park) (VDCR 2011b). The park has recorded over 1,500 species of vascular plants, including over 260 non-native plant species. Several species occurring within the park are globally rare and are dependent upon the special habitats and ecological conditions present along the Potomac River. Common overstory species at CHOH include American sycamore, green ash, northern red oak, red maple, sugar maple, and white ash (VDCR 2011b). Invasive plant species of concern at CHOH include, but are not limited to, tree-of-heaven, common reed, fig buttercup, Japanese knotweed, wineberry, Japanese honeysuckle, autumn olive, Japanese stiltgrass, garlic mustard, and Japanese barberry (NPS 2015d, 2015e).

1.5.1.4 George Washington Memorial Parkway

The George Washington Memorial Parkway encompasses approximately 4,000 acres of noncontiguous parkland in the District of Columbia, Virginia, and Maryland. GWMP was originally established under the Capper-Cramton Act as the Mount Vernon Memorial Highway in 1932 to commemorate the 200th anniversary of George Washington's birth, to connect Washington, DC, with George Washington's presidential home, and to protect the Potomac River Gorge. The construction of GWMP was slowed by the Great Depression and World War II, and the parkway opening was delayed until 1962 (NPS 2008a, 2015f). Notable outparcels of the GWMP include Great Falls Park, Fort Hunt Park, and Theodore Roosevelt Island.

The park's topography and hydrology create a variety of habitats, which include floodplain forests, tidal marshes, and other communities. Most of the forests have been previously disturbed, although some are 100 years old. Fourteen ecological systems have been identified within the park boundaries of GWMP (see Appendix A for a table of ecosystems by park) (VDCR 2011a). Studies conducted in GWMP

have documented 81 rare, threatened, or endangered species in Virginia or Maryland (NPS 2015f). Common overstory tree species that can be found at GWMP include white oak, American sycamore, northern red oak, eastern cottonwood, and silver maple (VDCR 2011a). Common understory tree species include American hornbeam, northern spicebush, and boxelder (NPS 2015f). Invasive species of concern along the GWMP include, but are not limited to, purple loosestrife, phragmites, porcelainberry, kudzu, garlic mustard, multiflora rose, Japanese honeysuckle, and Japanese stiltgrass (NPS 2015g).

1.5.1.5 Greenbelt Park and Baltimore-Washington Parkway

Greenbelt Park and Baltimore-Washington Parkway encompasses approximately 2,500 acres in Prince George's and Anne Arundel Counties, Maryland. Greenbelt Park was proposed as part of the development of Greenbelt, the first federally planned community in the United States. The park received its national park designation in 1950 (NPS 2005). The Baltimore-Washington Parkway is a 29-mile road running northeast between the eastern boundary of the District of Columbia and Baltimore, Maryland. Originally proposed as a New Deal-era parkway, the route opened for traffic in October 1954. NPS manages a 19-mile section of the Baltimore-Washington Parkway from the District of Columbia boundary to Fort Meade in Maryland (NPS 2012a).

Due to the linear nature of the Baltimore-Washington Parkway, the park bisects nine mapped ecological systems (see Appendix A for a park map and a table of ecosystems by park) (VDCR 2011b). Common forest canopy species include white oak, scarlet oak, pitch pine, and hickories, with an understory composed of common shrub species such as southern arrowwood, sassafras, and flowering dogwood. Common wildflowers found at the park include Jack-in-the-pulpit, mayapple, Indian-tobacco, and black-eyed susan. Invasive species of concern along the Baltimore-Washington Parkway include, but are not limited to kudzu, porcelainberry, garlic mustard, and English ivy (NPS 2012a).

1.5.1.6 Harpers Ferry National Historical Park

Harpers Ferry National Historical Park consists of approximately 3,645 acres of noncontiguous parcels in West Virginia, Virginia, and Maryland at the confluence of the Potomac and Shenandoah Rivers. HAFE is the site of the nation's second federal armory and became an area of military importance by the 1850s due to the armory, railroad tracks, and connection to the C & O Canal. Additionally, the park is historically significant as the site of John Brown's raid and the location of Storer College, a historically black college that closed in 1955. The park was designated a national monument by Congress in 1944 and subsequently declared a national historical park in 1963 (NPS 2008b).

HAFE property includes Harpers Ferry's Lower Town, the former Storer College campus, landscapes of Civil War significance, and lands preserving the historic viewshed in Virginia, West Virginia, and Maryland. A small section of the CHOH bisects HAFE on the northeastern bank of the Potomac.

Seventy percent of the park is forested and provides habitat for multiple species. Nine ecological systems have been identified within the park boundaries of HAFE (see Appendix A for a park map and a table of ecosystems by park) (VDCR 2011b). Common forest canopy species include chestnut oak and tuliptree, with an understory dominated by common hackberry, red maple and common shrub species such as spicebush and mountain laurel. Vegetation inventories conducted in the 1990s identified over 260 non-native invasive species, including garlic mustard, Japanese honeysuckle, tree-of-heaven, Japanese stiltgrass, and wineberry. A survey conducted by the NCR's EPMT between 2002 and 2003 found that garlic mustard alone infests over 2,000 acres of HAFE (NPS 2008b).

1.5.1.7 Manassas National Battlefield Park

Manassas National Battlefield Park is located in Prince William County, Virginia, and encompasses nearly 4,500 acres. Congress established MANA in 1940 to protect the sites of two major Civil War-era battles,

the Battles of First and Second Manassas (also known as First and Second Bull Run, respectively). In addition to preserving much of the landscape at the time of the battles, the park contains Civil War-era buildings, cemeteries, ruins, and monuments to the soldiers who died there. In addition to providing ample opportunities for education and recreation, MANA also serves to protect natural and cultural resources. MANA promotes grasslands and grassland-dependent bird species through agricultural leasing programs and other actions (NPS 2014a).

Seven known ecological systems can be found within the boundary of MANA (see Appendix A for a park map and a table of ecosystems by park) (VDCR 2011a). Almost half of the park's 4,500 acres are forested. Common overstory tree species include black walnut, eastern hemlock, eastern red cedar, red maple, and white oak (VDCR 2011a). The second-largest plant community at MANA is grasslands, which cover 1,500 acres. Grassland species that are actively managed include Indiangrass and little bluestem. At least 700 vascular plants have been documented at MANA, including six state-listed rare species. Invasive plant species of concern at MANA include tree-of-heaven, Oriental bittersweet, garlic mustard, Japanese barberry, Japanese honeysuckle, multiflora rose, and Japanese stiltgrass (NPS 2013).

1.5.1.8 Monocacy National Battlefield

Monocacy National Battlefield was established by Congress in 1934 and covers approximately 1,600 acres in Frederick County, Maryland. The park was created to memorialize the Battle of Monocacy, also referred to as the "battle that saved Washington, DC." Congress did not commit funds when establishing MONO and thus land acquisition for the park did not occur for nearly 50 years. Due to the delay in land acquisition, Interstate 270 was built through the former Civil War battlefield, resulting in a fragmentation of the historic landscape. In addition to preserving much of the landscape at the time of the battle, the park contains Civil War-era buildings, earthworks, and monuments to the soldiers who died there. The cultural landscape of the battlefield is maintained in part by using grassland management and an agricultural leasing program (NPS 2014a).

Five ecological systems have been identified at MONO (see Appendix A for a park map and a table of ecosystems by park) (VDCR 2011b). About 35 percent of MONO is forested. Common overstory trees in upland forests in MONO include northern red oak, bitternut hickory, and American beech, while lowlands are dominated by American sycamore, common hackberry, and white ash (VDCR 2011b). One hundred of the 375 plant species found at the park are invasive. Further, recent surveys indicate that invasive species, including multiflora rose, tree-of-heaven, Japanese honeysuckle, garlic mustard, and Japanese stiltgrass, infest the majority of the park's non-agricultural land. Non-native invasive plant species in the agricultural areas include Johnsongrass, Canada thistle, and bull thistle (NPS 2008c).

1.5.1.9 National Capital Parks-East

National Capital Parks-East is an administrative grouping of NPS park sites east of the US Capitol in the District of Columbia and suburban Maryland. The land managed by NACE consists of approximately 2,600 acres of noncontiguous parcels. Park-managed parcels include urban parklands (such as Anacostia Park), parkways (such as Suitland Parkway), memorial sites, marinas, historic sites, and Civil War-era defense forts that formerly protected the capital city (NPS 2015h). NACE provides ample opportunities for recreation while also serving to protect the watershed of both the Anacostia and Potomac Rivers. Recreational opportunities at NACE include hiking, boating, jogging, golfing, fishing, bird watching, and bicycling (NPS 2008d).

National Capital Parks-East serves an important role in the conservation of biodiversity in the heavily developed Washington, DC metropolitan area. Seven ecological systems have been identified at NACE (see Appendix A for a park map and a table of ecosystems by park) (VDCR 2011b). A substantial portion of the park's natural resources consist of riparian forests, wetlands, river shoreline, and floodplain areas.

Some of the more common tree species found in NACE include American sycamore, chestnut oak, red maple, sweetgum, tuliptree, and white oak (VDCR 2011b). Invasive plant species of concern at NACE include, but are not limited to, multiflora rose, Oriental bittersweet, English ivy, garlic mustard, and Japanese stiltgrass (NPS 2008d).

1.5.1.10 National Mall and Memorial Parks

The National Mall and Memorial Parks encompass over 1,000 acres containing many significant cultural resources, including over 80 historic structures and over 150 major, named historic parks, squares, circles, and triangles. NAMA administers, interprets, maintains, and preserves the numerous historic sites, gardens, statues, memorials, and parkland within its boundaries. Park resources include the 2,000 American elms that frame the National Mall and the 3,000 internationally renowned Japanese cherry trees that border the edge of the Tidal Basin. The NPS assumed management duties at NAMA between 1933 and 1934 (NPS 2010a).

After more than 200 years of development, no natural plant communities remain on the National Mall. American elm trees are generally used to create borders around the mall's open areas. Open areas themselves consist of a mixture of native and introduced plant species. At least 18,500 trees have been recorded at NAMA and at least 500 acres are managed as turfgrass. East Potomac Golf Course has several volunteer stands of native grasses. Invasive species of concern at NAMA include, but are not limited to, English ivy, porcelainberry, Japanese honeysuckle, and multiflora rose (NPS 2010b).

1.5.1.11 Piscataway and Fort Washington Park

Piscataway and Fort Washington Park is a conglomerate of park units that includes Fort Foote and Oxon Hill Farm and encompass about 5,800 acres, mostly in Prince George's County, Maryland, with smaller parcels in Charles County, Maryland, and Washington, DC. The land comprising Piscataway Park was donated to the NPS by the Alice Ferguson Foundation and neighboring landowners to prevent industrial development and "protect the scenic resources visible from Fort Washington and Mount Vernon estate on the Virginia side of the Potomac River" (NPS 2012b). Fort Washington served as a US Army post from 1808 to 1945, and briefly as a recovery hospital after World War II until it was turned over to the Department of the Interior and repurposed as a park (NPS 2008d). Piscataway and Fort Washington Park provides ample opportunities for education and recreation while also serving to protect natural and cultural resources, including the watershed of the Potomac River.

Nine ecological systems have been identified at PISC (see Appendix A for a park map and a table of ecosystems by park) (VDCR 2011b), which is home to many rare species and old growth trees. Common overstory tree species include pin oak, tuliptree, northern red oak, blackgum, sycamore and hickories (VDCR 2011b). Common species in the tidal marsh areas of the park include narrowleaf cattail, rice cutgrass, jewelweed, halberdleaf tearthumb, and river bulrush. Species likely to occur along the banks of riverine systems are blisterwort, dogtooth violet, field horsetail, bent sedge, and wild hydrangea. Invasive plant species of concern at PISC include, but are not limited to, common reed, multiflora rose, Oriental bittersweet, English ivy, garlic mustard, and Japanese stiltgrass (NPS 2012b).

1.5.1.12 Prince William Forest Park

Prince William Forest Park covers approximately 15,000 acres in southeastern Prince William County, Virginia, approximately 22 miles southeast of Washington, DC. The park was originally designated as Chopawamsic Recreation Demonstration Area and was constructed in the 1930s by Depression-era relief agencies such as the Civilian Conservation Corps. The Chopawamsic Recreation Demonstration Area was transferred to the NPS by an executive order in 1936 and was renamed Prince William Forest Park in 1948. The same year, 5,000 acres of the neighboring Quantico Marine Corps Base were

transferred to the NPS to protect the water quality of Quantico Creek. PRWI is the third largest national park in Virginia and is one of the largest examples of undeveloped land in the region (NPS 2009).

Prince William Forest Park is the largest contiguous piedmont forest in the National Park Service. Eight ecological systems have been identified at PRWI (see Appendix A for a park map and a table of ecosystems by park) (VDC 2011a). Rare plant communities in the park include eastern hemlock and a seepage swamp. A 2003-2004 survey found over 700 plant species at PRWI. Some common species include northern red oak, red maple, Virginia pine, American beech, sweetgum, tuliptree, and white oak (VDCR 2011a). Common understory trees and shrubs include sassafras, mountain laurel, American holly, and lowbush blueberry. Invasive plant species of concern at PRWI include, but are not limited to, tree-of-heaven, multiflora rose, garlic mustard, Japanese honeysuckle, and Japanese stiltgrass (NPS 1999).

1.5.1.13 Rock Creek Park

Rock Creek Park was first established in 1890 to protect the natural and historical landscape of the Rock Creek Valley in Washington, DC. Stretching from the Maryland state line to the National Zoo, Rock Creek Park is located in the highly urbanized Northwest quadrant of Washington, DC. The park was one of the first designated federal park units, and among these early parks was unique due to its proximity to an urban center.

Rock Creek Park is both a distinct park area as well as an administrative unit. The park administers 98 additional areas totaling approximately 2,900 acres in the Northwest and Northeast quadrants of the District, and includes areas such as the Rock Creek and Potomac Parkway, the Old Stone House, part of the Civil War Defenses of Washington (CWDW), Dumbarton Oaks Park, Meridian Hill Park, and Glover-Archbold Park. These sites were not included in the original enabling legislation of the park, but were authorized for their own unique features and significance.

As the largest forest in the District of Columbia, the park plays an important role in local biodiversity. Four ecological systems have been identified at ROCR (see Appendix A for a park map and a table of ecosystems by park) (NatureServe 2011). At least 700 species of vascular plants have been documented in ROCR, including 31 rare or uncommon species. Generally, ROCR is composed of a mix of deciduous trees in later stages of succession that are typical of eastern forests, and deciduous forests constitute the majority of the park's canopy. Approximately 80 percent of the forest in ROCR is at least 125 years old, with some individual trees that are almost 300 years old and may be virgin growth. Other common species include chestnut oak, northern red oak, red maple, and tuliptree (AIS 2002). Invasive plant species of concern at ROCR include, but are not limited to, tree-of-heaven, multiflora rose, garlic mustard, Japanese honeysuckle, and Japanese stiltgrass (NPS 2011a).

1.5.1.14 White House/President's Park

The White House and President's Park occupy approximately 82 acres immediately north of the National Mall in central Washington, DC. The park includes Lafayette Park, West Executive Avenue, the Dwight D. Eisenhower Executive Office Building and grounds, the First Division Monument, East Executive Park, the Treasury Building and grounds, Sherman Park, the White House, and President's Park South (also known as the Ellipse). The park has 60 historic sites and overlaps with five historic districts (NPS 2010c).

No natural plant communities remain on the grounds of the park. Vegetation at the park may be best described as a managed arboretum-like setting with much of the space in between the trees being turfgrass. The park also has several flower and vegetable gardens along with landscaped areas of native and horticultural varieties of shrubs, grasses, and small trees.

1.5.1.15 Wolf Trap National Park for the Performing Arts

Wolf Trap National Park for the Performing Arts (WOTR) occupies approximately 117 acres in Fairfax County, Virginia, near Tyson's Corner. The park was established by Congress in 1966 "for the purpose of establishing in the National Capital area a park for the performing arts and related educational programs and recreation use" following the donation of land by a private citizen who wished to protect the land from future suburban development (NPS 2007b). It is the only national park dedicated to presenting the performing arts. The NPS shares management responsibility for the park with the Wolf Trap Foundation, a nonprofit organization (NPS 2015j).

Approximately 52 acres within the park remain undeveloped. Three ecological systems have been identified at WOTR (see Appendix A for a park map and a table of ecosystems by park) (VDCR 2011b). Forested areas consist of hardwoods such as northern red and white oaks, with understory species including sassafras and mountain laurel (VDCR 2011b). Wetlands and floodplains along Wolf Trap Creek include tuliptree, red maples, and river birch, while understory species in these areas consist of wild azalea and American holly. Landscaped areas of the park are maintained with turf and ornamental species, and include planting areas designed as pollinator gardens (NPS 2015k).

1.6 Summary of Public Involvement

1.6.1 Public Scoping

Public scoping for the IPMP/EA was conducted for a period of 30 days between May 11, 2015, and June 10, 2015 all (see Appendix E for all public scoping materials to date). A scoping courtesy letter describing the IPMP/EA and soliciting comments was mailed to 32 agencies and 132 individuals. The letter directed individuals and agencies to the project web page on the NPS Planning, Environment and Public Comment (PEPC) website, where they could learn more about the project and submit comments. A scoping newsletter and press release providing additional information on the project were also posted to the PEPC website.

Comments received focused on existing vegetation resources, impacts of invasive plants, suggestions for new alternatives or elements to consider, and environmental and public health concerns. NPS considered all scoping comments in the preparation of this EA. Key issues identified during the scoping process are summarized below.

Alternative / Alternative Element Suggestions: Comments suggested ways to select areas for treatment, including identification of biologically significant areas at risk and use of a decision analysis tool; specific geographic areas that should be given priority; and treatment methods.

Natural Resource Issues: Comments focused on environmental health concerns related to herbicide use and questioned whether there are long-term benefits to herbicide use and whether damage would occur to soils and wildlife. Natural resource concerns were also expressed over the impact of invasive plants and the potential to alter and destroy habitat, which require early detection and mitigation to protect agricultural and natural resources.

Visitor Use and Experience: The comments centered on public health concerns related to herbicide use, in particular regarding the use of chemicals near highly used portions of Rock Creek Park, around both people and animals.

Support and Opposition to Alternatives/Project Elements: Comments were received both in support of and in opposition to the alternatives. Supporting comments were in reference to the overall concept of invasive plant management, the prioritization of non-native, invasive vegetation treatment, and the treatment of invasive plants prioritized by area. Comments in opposition were in reference to

maintaining the status quo; prioritization by species, which could have minimal beneficial impacts and/or could fail; and selective removal of a species, which could allow other invasive species to replace them.

1.6.2 Public Comment Period

The Final IPMP/EA will be released in spring 2016 for public review. Substantive comments received on the Final IPMP/EA will be addressed in a comment/response document.

1.7 Issues and Impact Topics

The impact topics analyzed in this IPMP/EA reflect the resources that have the potential to be affected (positively or adversely) by the alternatives being considered, as identified through internal NPS discussions, input from park managers, and comments received during the public scoping period.

The following impact topics are analyzed in this IPMP/EA:

- Vegetation
- Wildlife and habitat
- Cultural resources
- Visitor use and experience
- Park operations and management

1.8 Impact Topics Dismissed from Analysis

In accordance with 40 CFR 1501.7(a)(3), the impact topics presented in Table 1-1 were dismissed from further analysis in the EA because the alternatives would have no or barely perceptible effects on them.

Table 1-1: Impact Topics Dismissed from Analysis in the IPMP/EA

Impact Topic Dismissed from Further Analysis	Rationale for Dismissal
Soils	Potential impacts on soils resulting from the proposed action could include absorption of chemicals and physical alteration, such as increased erosion of exposed soils during or after removal of the vegetative cover, or increased compaction as a result of treatment methods. With regard to the potential for impacts from chemical absorption, the primary source of potential impacts would be herbicide application. Potential impacts from herbicide application vary depending on soil characteristics such as percentage of organic matter, available water capacity, and soil permeability. Most herbicides that are absorbed by soils dissipate within days or weeks, reducing the potential for more than negligible impacts. However, some herbicides remain in the soil longer, persisting for up to two years. Effects from these kinds of herbicides would be localized and would decrease over time, with no long-term adverse impacts on the productivity of the affected soils and their ability to support native vegetation. In all cases, the NPS and/or its contractors would be licensed herbicide applicators and apply all chemicals in accordance with the manufacturer's EPA accepted label. BMPs described in the IPMP would be used to ensure that any impacts from herbicide application are minimal. Several of the proposed treatment methods could have physical impacts on soils. BMPs described in the IPMP would prevent significant changes to surface conditions, erosion, or compaction of soils, resulting in negligible impacts at most. For these reasons, the proposed action has no potential to have more than minimal, short-term impacts on soils. Therefore, this impact topic was dismissed from further consideration in the EA.

Impact Topic Dismissed from Further Analysis	Rationale for Dismissal
Air Quality	<p>Emissions from activities associated with the proposed action would be temporary and would occur during brief periods of time (i.e., 1 to 8 hours per day, 1 to 5 days per week) over a period of several years. At most, these emissions would be similar to small- or medium-scale farming and agricultural activities and are not anticipated to exceed the <i>de minimis</i> thresholds for criteria pollutants regulated by the EPA in nonattainment or maintenance areas in which some of the parks are located. In the long term, the proposed action would not create new, permanent sources of emissions. The proposed action is not intended to increase the number of visitors and associated vehicle trips to the NCR parks. Air quality in the vicinity of the NCR parks would return to pre-treatment conditions following the implementation of the proposed action. Therefore, air quality was dismissed from further analysis as an impact topic in this EA.</p>
Water Quality	<p>In the short-term, the proposed action could result in limited adverse effects on water quality, i.e., runoff of small quantities of chemicals into bodies of surface water, leaching of small quantities of chemicals into ground water, and increased sedimentation from the erosion of soils exposed during treatment from wind and water. These potential impacts, however, are not likely to be measurable. There are two potential ways for chemicals to enter bodies of surface water: directly through the use of herbicides near the water or indirectly through stormwater runoff. The risk of application of herbicides directly in water bodies would be minimized through coverage under a state programmatic general National Pollution Discharge Elimination System (NPDES) permit or directly under an EPA-administered permit in the case of the District of Columbia. Only herbicides approved for aquatic use would be applied in wetlands, marshes, floodplains or similar aquatic environments. Approved herbicides for aquatic use have been determined not to pose a risk to water quality. Any pollution associated with stormwater discharges would be minimized through coverage under a General Permit for Construction Activities (i.e., sediment erosion control). As part of coverage under this permit, BMPs would be identified that reduce or prevent untreated runoff from directly discharging into water bodies. Additionally, any erosion impacts resulting from land disturbance or vegetation removal as a result of the proposed action would be very small, further reducing the risk of pollution. In accordance with each herbicide's EPA-accepted label, applications would be planned with attention to the weather and parks would avoid applying herbicide when rainy weather is anticipated, thus limiting the risk of the product migrating to nearby bodies of water via stormwater runoff. For these reasons, the proposed action is not anticipated to have measurable impacts on water quality. Therefore, water quality was dismissed from further analysis in this EA.</p>
Species of Special Concern	<p>The NPS is conducting coordination with the US Fish and Wildlife Service (USFWS) in accordance with Section 7 of the Endangered Species Act on a quarterly basis during the preparation of the IPMP/EA. Consultation would continue as necessary prior to the application of the proposed treatment methods to determine the potential for species of special concern to be affected by a proposed treatment. Depending on the outcome of this coordination and as necessary, the NPS would conduct habitat assessments and/or species surveys, adhere to time of year restrictions, use BMPs, and/or implement other specified measures to eliminate or minimize adverse effects on species of special concern. Park managers would evaluate the proposed treatment methods prior to their application and would stop work if impacts are anticipated to adversely affect species of special concern. In general, it can be anticipated that the proposed action would have beneficial long-term impacts on species of special concern by eliminating or substantially reducing non-native invasive plants and enabling native vegetation that provides habitat and forage for such species to thrive. For these reasons, the proposed action has no potential to result in adverse impacts on species of special concern. Therefore, this impact topic was dismissed from further consideration in the EA.</p>

Impact Topic Dismissed from Further Analysis	Rationale for Dismissal
Floodplains	<p>While the proposed action would have some potential to affect the capacity of floodplains to store flood waters, such potential impacts would be so small as to be negligible. In most cases, treatments of non-native invasive plants would be localized and affect relatively small areas. In the immediate short-term, processes like interception, transpiration, and evaporation would be modified but this would be quickly offset by re-vegetation. Appropriate BMPs would be implemented by resources managers in the unlikely case vegetation removal activities were thought to be reaching a level that would result in significantly altering the local floodplain storage capacity (e.g., removal of larger trees.) Further, in all cases but especially in the case of treatment by aerial spraying, which would generally affect greater areas than other treatment actions, parks would further plan their actions with attention to the weather and avoid conducting them when the risk of flooding is increased by ongoing or predicted weather events at or upstream of the treatment site (e.g., significant rain storm or quick melting of large snowpack). Therefore, the risk of more than negligible impacts to floodplains is minimal and this impact topic was dismissed from further analysis in this EA.</p>
Human Health and Safety	<p>NPS policies promote a safe work environment for employees and a safe experience for park visitors. The equipment that would be used to implement the treatment options included in the IPMP, such as hand tools, chainsaws, portable sprayers, and UTVs, are standard devices commonly used in the parks. Training on the proper use of equipment is required under NPS policy. Safety protocols for storing, mixing, transporting, handling spills, and disposing of unused herbicides and containers are described on the EPA-approved manufacturer labels. These protocols would be followed in all cases. For an herbicide to be approved, the EPA conducts rigorous analysis of all the scientific studies and considers all public comments. Herbicides used by NPS show very low risks according to health risk assessments, supporting a determination that the pesticide's use, as approved and according to manufacturer label, will cause no health risks to humans. At a minimum of every 15 years, the EPA reviews all registered products which includes evaluating new information and data on each product. After public comments are considered, the EPA will incorporate any changes in language that need to be included. These adjustments may include changes in the label or other adjustments to reduce risk as appropriate. BMPs as outlined in the IPMP would further protect the public from accident and injury. In particular, areas to be treated would be closed to unauthorized persons during treatment (including, as needed, a buffer in the case of aerial spraying). Therefore, the proposed action has no potential to have measurable impacts on human health and safety, and this impact topic was dismissed from further analysis in this EA.</p>
Environmental Justice and Protection of Children	<p>The proposed action would be implemented entirely within the boundaries of the 15 NCR parks and would have no potential to displace or otherwise adversely affect environmental justice communities or concentrations of children living in the vicinity of the parks. Thus, these impact topics were dismissed from further analysis in this EA.</p>
Energy Resources	<p>In the context of the NCR, the implementation of the proposed action would require no or minimal inputs of energy resources such as petroleum products, natural gas, and electricity. Thus, the proposed action would have no or negligible effects on such resources, and they were dismissed from further analysis in this EA.</p>
Climate Change	<p>Climate change resulting from emissions of greenhouse gases such as carbon dioxide (CO₂) and methane (CH₄) is a global effect and requires that such emissions be assessed on a global scale. Emissions of greenhouse gases from activities analyzed in this EA would be temporary and would constitute negligible fractions of such gases emitted on a global scale. Because the proposed action would have no bearing on global climate change, this topic was dismissed from analysis in the EA.</p>

2 ALTERNATIVES

2.1 Introduction

This chapter discusses the alternatives analyzed in the IPMP/EA; treatment methods and associated techniques included in the alternatives analyzed in the IPMP/EA; the BMPs that would be used to minimize the impacts potentially resulting from the implementation of the alternatives; and the alternatives considered but eliminated from further analysis in the IPMP/EA. A summary of the detailed impact analysis presented in Chapter 4 is also included in this chapter.

Generally, Chapter 2 is organized as follows:

- Section 2.2 presents the alternatives retained for analysis in the IPMP/EA.
- Section 2.3 describes the treatment methods and associated techniques for each included in the alternatives analyzed in the IPMP/EA.
- Section 2.4 discusses mitigation measures and BMPs applicable to the proposed action.
- Section 2.5 discusses the alternatives considered but eliminated from further analysis in the IPMP/EA.
- Section 2.6 provides a summary of impacts by alternative.
- Section 2.7 identifies the environmentally preferable alternative.

2.2 Alternatives Analyzed in the IPMP/EA

The IPMP/EA analyzes the No Action Alternative and Alternative 1 – Implement the IPMP. These alternatives are described in Section 2.2.1 and Section 2.2.2, respectively. Both alternatives include a number of methods that would be available to the 15 NCR parks for the treatment of non-native invasive plants. Detailed descriptions of the treatment methods and techniques associated with each are presented in Section 2.3. Mitigation measures and BMPs applicable to the alternatives are discussed in Section 2.4. Treatment specific BMPs are presented in Sections 2.3.3.4 (herbicide application methods) and 2.3.4.1 (biological treatment methods).

2.2.1 No Action Alternative

Under the No Action Alternative, NCR parks would continue to manage non-native invasive plants as they currently do. Treatment methods would continue to be applied primarily by either natural resource or maintenance staff, contractors, or volunteers. Development of annual treatment plans by each park would continue to be optional. Treatment activities would continue to occur as practicable within the constraints of available funding. The prioritization of areas and non-native invasive plant species for treatment within each park would continue to fall solely on the park; advice and guidance on treatment methods and strategies would be provided by the region only when requested.

2.2.1.1 Treatment Methods Included in the No Action Alternative

The following invasive plant treatment methods would continue to be used at each park:

- Chemical (excluding aerial spraying), as described in Section 2.3.3
- Manual, as described in Section 2.3.5
- Mechanical, as described in Section 2.3.6

- Physical (excluding prescribed fire), as described in Section 2.3.7
- Cultural, as described in Section 2.3.8

In addition to aerial spraying and prescribed fire, the application of biological treatment methods described in Section 2.3.4 would likely require additional compliance at the 15 NCR parks under the No Action Alternative.

2.2.1.2 Implementation of the No Action Alternative

Under the No Action Alternative and as applicable, parks would continue to manage invasive plants in accordance with existing regulations and policies (see Section 1.4, *Regulatory Measures Common to All Alternatives*, and detailed discussion in Appendix F) and using some or all of the previously defined treatment methods. Invasive plant management activities would continue on a limited and fragmented basis without fully employing all of the available treatment methods. Park resource managers would continue to use treatment options that either qualify as being categorically excluded from analysis under NEPA or whose impacts have been previously addressed in other NEPA documents. If warranted, a separate NEPA process would be conducted.

Any proposed treatments that are not covered under a CE or under another existing NEPA document would require preparation of additional NEPA documentation, such as an EA or an Environmental Impact Statement (EIS), and/or would adhere to any other applicable compliance requirements.

Existing guidance for current management of invasive plants at each park is also provided under existing Resource Management Plans (RMPs) and General Management Plans (GMPs), which identify the management objectives for various environmental resources within each park (see Section 1.8, *Impact Topics Dismissed from Analysis*). Manassas National Battlefield Park has also developed an invasive plant management guidance document (NPS 2013) for the park and Rock Creek Park has a draft (NPS 2004).

2.2.2 Alternative 1 – Implement the IPMP (Preferred Alternative)

The NCR would implement a region-wide IPMP under Alternative 1 that would increase the options available to staff at individual parks in a coordinated manner. Specifically, the IPMP would:

- Establish a prioritization scheme for the treatment of non-native invasive plants; and
- Provide a comprehensive range of treatment strategies and a consistent approach.

Under Alternative 1, treatment of non-native invasive plants at each park would be prioritized by both species and location. Non-native invasive plants and sites would be ranked by category (e.g., first priority, second priority, etc.) rather than precisely ranking individual species or sites. The focus would be on removing the prioritized non-native invasive plants at the highest priority places. Plants identified as early detection species would be prioritized. Each park within the NCR would develop an annual non-native invasive plant treatment strategy based on the NEPA- and NHPA-compliant IPMP that reflects the current needs and funding resources of the 15 NCR parks. An adaptive management approach would be used to improve outcomes in both current and future planning years. The annual availability of treatment resources (i.e., labor, funding, tools, equipment, chemicals, and the like) would determine the number of treatments that would be implemented. As needed, regional NCR staff would provide support to the parks in developing their lists of high-value sites and implementing treatment methods. Under Alternative 1, NCR staff would do the following:

- Develop a prioritized invasive plant list for the region;
- Support parks in developing priority treatment areas;

- Support parks in developing priority species lists;
- Assist parks with inventory and monitoring of invasive plants; and
- Provide support in implementing treatment methods.

2.2.2.1 Prioritization: Non-native Invasive Plant Species

Under Alternative 1, each year, NCR regional staff would develop a prioritized regional list of non-native invasive plant species for treatment. Each species would be ranked with a protocol that includes the following 20 questions divided into four components:

- Ecological Impact
 - Impact on ecosystem processes and system-wide parameters
 - Impact on ecological community structure
 - Impact on ecological community composition
 - Impact on individual native plant or animal species
 - Conservation significance of the communities and native species threatened
- Current Distribution and Abundance
 - Current range size in region
 - Proportion of current range where species is negatively impacting biodiversity
 - Proportion of region's biogeographic units invaded
 - Diversity of habitats or ecological systems invaded in region
- Trend in Distribution and Abundance
 - Current trend in total range within the region
 - Proportion of potential range currently occupied
 - Long-distance dispersal potential within the region
 - Local range expansion or change in abundance
 - Inherent ability to invade conservation areas and other native species habitats
 - Similar habitats invaded elsewhere
 - Reproductive characteristics
- Management Difficulty
 - General management difficulty
 - Minimum time commitment
 - Impacts of management on native species
 - Accessibility of invaded areas

2.2.2.2 Prioritization: Target Areas

Park managers would develop a list of priority target areas based on factors established at the park level. The following factors may be used:

- Potential for the invasive species present to spread to a larger area if left untreated
- Presence of sensitive natural or cultural resources within the site, such as:
 - Rare plants and plant communities
 - Rare wildlife habitat
 - Wetlands
 - Architectural resources

- Historic landscapes
- Known and potential archaeological resources
- Site accessibility
- Site location relative to nearby sensitive land uses (e.g., residential areas)
- Feasibility of effectively treating the area in compliance with the BMPs and mitigation measures in the IPMP/EA

2.2.2.3 Treatment Methods

Invasive treatment methods that would be available to park managers under Alternative 1 would include the following:

- Chemical, as described in Section 2.3.3
 - Foliar spray
 - Aerial spray
 - Cut surface
 - Basal bark
 - Hand wicking
- Biological, as described in Section 2.3.4
- Manual, as described in Section 2.3.5
 - Hand pulling
 - Digging tools such as shovels and trowels
 - Non-motorized tools such as hand-held pruners and clippers
- Mechanical, as described in Section 2.3.6
 - Gasoline-powered mowers, trimmers, or chainsaws
 - Bulldozers, tillers, heavy loaders
- Physical, as described in Section 2.3.7
 - Smothering
 - Solar sterilization
 - Thermal control
 - Prescribed fire
- Cultural, as described in Section 2.3.8
 - Prevention
 - Seeding/planting
 - Cover crops and nurse crops
 - Livestock grazing

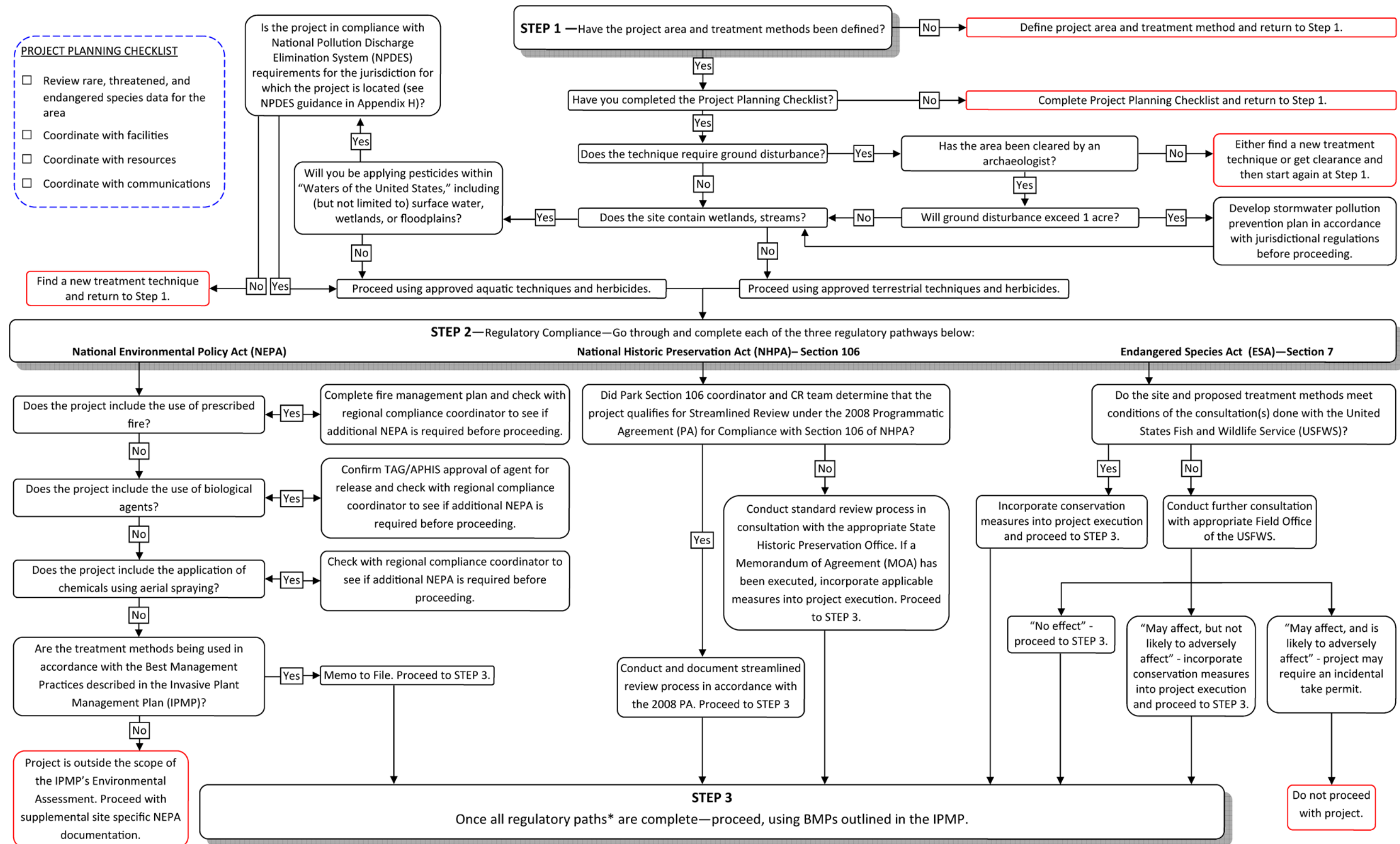
Based on local or regional conditions and as determined necessary by park and/or NCR staff, the implementation of the treatment methods included in Alternative 1 at a particular park could be subject to additional compliance requirements not included in the scope of this IPMP/EA. Aerial spraying, biological treatment methods, and prescribed fire may be subject to additional NEPA review and/or other compliance measures that are not included in the scope of this IPMP/EA.

2.2.2.4 Implementation

Following the development of lists of priority species to target and sites to protect, the park would first treat the prioritized non-native invasive plant species in the highest-priority places. Once first-priority projects are completed, the park would move on to second-priority sites and second-priority species. If the quantity of available resources is not sufficient to treat all second-priority species and all second-priority sites, the sites and species would be broken down further and some sites and species would be moved down to a lower priority, until the resources available matches the number of planned projects. This process would require professional judgment by the park managers implementing the treatment.

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Figure 2-1: Project Compliance Decision Tree



* This decision tree provides guidelines for the current understanding of laws and regulations that apply to invasive plant management. Additional laws and regulations may apply or existing laws and regulations may change. Consult with a compliance specialist before proceeding with any project.

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Under some circumstances, lower-priority species could be treated if:

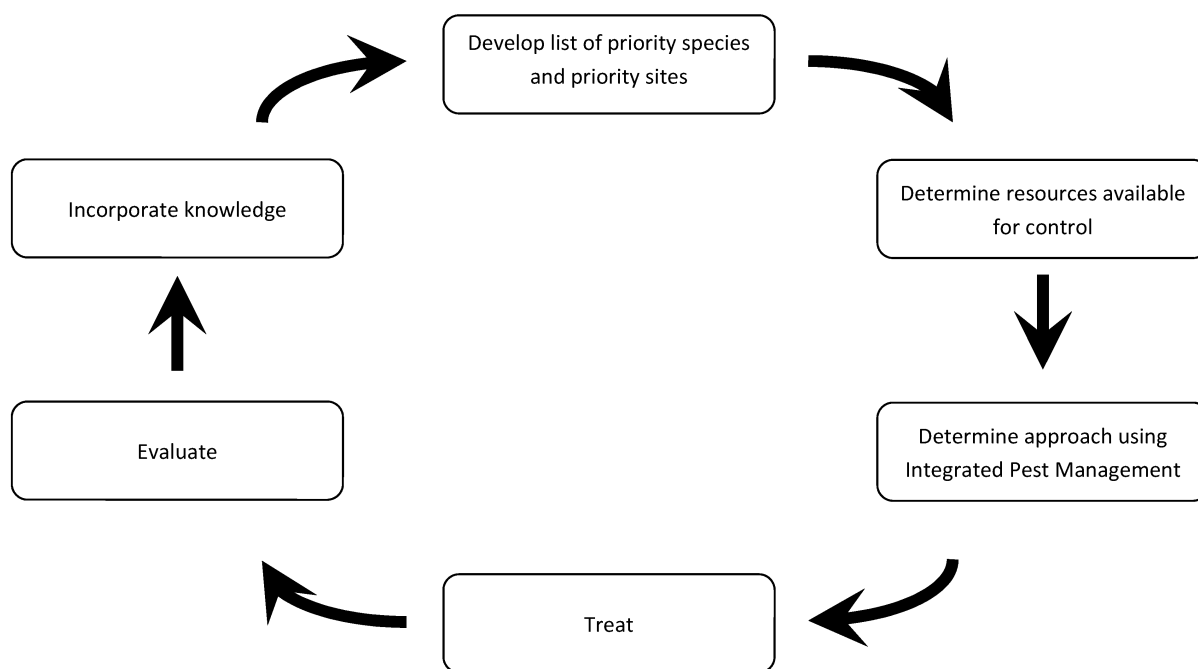
- Resources are already mobilized to a site selected for treatment;
- Other park activities mean a lower-priority area is accessible;
- Volunteers are available to implement a lower-priority project;
- There are other opportunities for low-cost/high-gain treatment scenarios; or
- A plant found on site is identified as an Early Detection Rapid Response (EDDR) species.

Once a project site has been selected, parks would use the decision tree shown in Figure 2-1 to determine whether the proposed treatment method is in compliance with commonly applicable federal statutes and regulations, including NEPA, NHPA Section 106, ESA Section 7, and provisions of the CWA. Additional guidance on compliance with the National Pollution Discharge Elimination System (NPDES) as implemented under the CWA is provided in Appendix H. When the decision tree has been followed and the project is deemed in compliance with commonly applicable federal statutes and regulations, a Memorandum to Files should be filed. A template for such a memorandum is provided in Appendix G.

2.2.2.5 Adaptive Management Cycle

Adaptive management would be incorporated into the IPMP as illustrated in Figure 2-2. The IPMP's adaptive management process consists of six steps which must be completed sequentially. It is important to note that adaptive management operates on multiple timescales. Thus, some aspects of adaptive management can apply to routine actions that can be adjusted every time they are performed, or annually to update protocols based on the experiences of the prior season, or over multiple years to update the invasive plant management plan based on multiple years of implementation.

Figure 2-2 Adaptive Management Process as Applied to the IPMP



2.3 Treatment Methods and Actions Included in the Alternatives Analyzed in the IPMP/EA

The following paragraphs describe the review and approval process and treatment methods that are included in the alternatives retained for analysis in the IPMP/EA.

Under Alternative 1, the parks would annually review the invasive non-native plant management program. Resources for the treatment of non-native invasive plants under each alternative would primarily come from the parks and the region. The parks and the region would have the flexibility to pursue additional funding from various funding sources to augment their base programs. Additional resources could include programs such as Washington Office funds, Regional Office funds, and park partners.

Each individual requested use of herbicide would be approved through the Pesticide Use Proposal System (PUPS) using the following process:

- The request would be reviewed by the park IPM coordinator.
- Once approved by the IPM coordinator, the request would be reviewed by the regional IPM coordinator.
- Under certain circumstances (e.g., aquatic applications, aerial applications, herbicide use on 400 or more contiguous acres, or to use a restricted-use herbicide), the request would also be reviewed by the national IPM coordinator.

Detailed descriptions of the treatment methods included in the alternatives and specific techniques associated with each method are presented in Sections 2.3.3 through 2.3.8. As noted in Section 2.2.1, the following treatment methods or techniques are not included in the No Action Alternative: aerial spraying (a specific chemical treatment technique); biological treatment methods; and prescribed fire (a specific physical treatment technique). Based on local or regional conditions and as determined necessary by park and/or NCR staff, the implementation of the treatment methods analyzed in this IPMP/EA at a particular park could be subject to additional compliance requirements not included in the scope of this IPMP/EA.

Mitigation measures and BMPs applicable to the alternatives are discussed in Section 2.4. BMPs specifically applicable to the biological treatment methods included in Alternative 1 are presented in Section 2.3.4.1.

2.3.1 Collaboration Measures

Created in 2000 through the National Resources Challenge, the NPS's EPMT program currently supports 17 teams in over 225 parks. EPMTs are led by individuals with specialized knowledge and experience in invasive plant management. Each team operates over a wide geographic area and serves multiple parks to increase operational efficiency. In addition to NPS staff, the EPMTs work with volunteers and contractors to meet the NPS's mission. The NCR EPMT provides support to the 15 parks evaluated in this IPMP/EA. The NCR EPMT would be only one of many tools that the parks would have access to.

The individual parks may also collaborate with tribal governments; other federal agencies; state, District of Columbia, and county governments; volunteer groups; non-governmental organizations; and other parks. The type and extent of collaboration varies from park to park.

Under the NCR IPMP/EA, collaboration activities could include:

- Working with universities; federal, state, and District of Columbia agencies; and other organizations to develop education programs and training for resource managers and others responsible for managing potential and emerging invasive plants;
- Cooperating with other agencies to develop and disseminate educational materials (publications, posters, videos, Internet postings) to the public, interested organizations, and agency employees;
- Working with the horticultural industry to increase awareness of the invasive plant problem and to encourage the industry to discontinue selling problem species;
- Working with non-profit organizations and volunteers, such as local conservation districts, park conservancies, park friends groups, and youth conservation corps, on costly larger-scale projects; and
- Developing and joining collaborative groups such as cooperative weed management areas.

2.3.2 Integrated Pest Management

National Park Service policy (NPS 2006) requires the use of an IPM process when managing pest organisms. Pests are defined as organisms interfering with the site management objective. Invasive plants are considered pest organisms. The concept of IPM is defined in policy as follows:

“4.4.5.2. Integrated pest management is a decision making process that coordinates knowledge of pest biology, the environment, and available technology to prevent unacceptable levels of pest damage by cost-effective means while posing the least possible risk to people, resources, and the environment.” (NPS 2006)

The NPS IPM Program uses the following prescribed process:

- Identification of the pest;
- Monitoring pest populations and damage levels;
- Establishing injury and threshold/action levels:
 - Injury level is the population size at which the pest causes unacceptable damage.
 - Threshold or action level is the population size at which some management action must be taken to prevent the population from reaching the injury level.
- Implementing treatments;
- Indirect suppression, such as habitat modification or modifying human activities;
- Direct suppression, such as physical or mechanical removal, biological control, or chemical treatment;
- Evaluation of treatment results; and
- Education of staff and others regarding pest identification and prevention.

IPM often employs a combination of treatment strategies specific to a species and location, focusing on those strategies that are least disruptive of natural controls, least hazardous to human health, least toxic to non-target organisms, least damaging to the general environment, most likely to produce permanent reduction in the pest, easiest to carry out effectively, and most cost-effective in both the short and long term. For example, cultural practices (e.g., flooding or drying out an area) can be used to prevent the

spread of invasive plant seeds, along with the use of manual and chemical treatment of incipient and established populations.

2.3.3 Chemical Treatment Methods

Chemical treatment methods include multiple types of herbicides² that could be used to control non-native invasive plant species.

Selective herbicides affect all plants but control certain target plants while limiting effects to non-target plants. Non-selective herbicides can be effective for treating pure stands of a single invasive plant species in areas where desirable plants are scarce or absent. Herbicides can also be used to treat small patches of invasive plants where hand pulling or cutting is not feasible.

The use of chemical treatment methods consists of applying herbicides as prescribed by their labels, using a variety of application methods.

Recent advances in technology have produced specialty herbicides that are selective in the control of certain invasive plant species at low application rates. These low application rates greatly reduce non-target plant effects and have improved control efforts in native plant communities.

Parks must obtain approval from either the Regional or National IPM Coordinator before using an herbicide. The combination of an active ingredient with compatible inert ingredients is referred to as a formulation. The unique combination of active ingredient and formulation of the other ingredients makes each herbicide unique. Active ingredients usually must be formulated in a manner that:

- Increases herbicide effectiveness in the field;
- Improves safety features; and
- Enhances handling qualities.

An herbicide's formulation gives the product its unique physical form and specific characteristics. The formulation enables an herbicide to treat specific species or to treat species in specific ecosystems. Some of the herbicides contemplated in this IPMP/EA, for example, are formulated specifically for aquatic use.

Herbicides are identified by three characteristics: active ingredient, trade name, and chemical name (formula). For example:

- Rodeo® (trade name);
- Glyphosate (active ingredient); and
- N-(phosphonomethyl) glycine (chemical name).

A summary of the most common herbicides available for parks to use under the NCR IPMP is provided in Table 2-1. Additional herbicides may be used. Should additional herbicides appropriate for the NCR be approved by the EPA within the lifespan of this IPMP/EA, those herbicides would also be available for use by the parks if all NPS compliance requirements are met.

² Herbicides are the only type of pesticides that would be used under this plan, as the NCR IPMP/EA is specific to treating invasive plant species. The term "pesticide" is occasionally used in this document to remain consistent with NPS policy definitions and other pesticide reference materials. In such cases, "pesticide" must be understood to mean "herbicide."

Table 2-1: Sample List of Herbicides with Typical Targets and Application Methods

Example Trade Name	Active Ingredient	Primary Targets			Aquatic Approved?	Methods				
		Herbs	Woodies	Monocots		Pre-emergent	Cut Stump	Foliar	Hack/Squirt	Basal Bark
Vastlan	Triclopyr salt (choline)	X	X		Yes		X	X	X	
Garlon 3A, Element 3A	Triclopyr salt (triethanolamine)	X	X		Yes		X	X	X	
Garlon 4 Ultra, Pathfinder II	Triclopyr ester	X	X		No		X	X		X
Rodeo, Aquaneat	Glyphosate salt	X	X	X	Yes		X	X	X	
Roundup Pro Concentrate	Glyphosate salt	X	X	X	No		X	X	X	
Poast, Segment	Sethoxydim			X	No			X		
Milestone	Aminopyralid salt	X			2016	X		X	X	X
Escort XP	Metsulfuron methyl	X	X	X	No	X		X		
Transline, Stinger	Clopyralid salt	X	X		No		X	X		
Tordon 22K	Picloram salt	X	X	X	No			X		
Tordon 101M	Picloram salt and 2,4-D	X	X	X	No		X	X	X	X
Plateau	Imazapic salt	X	X	X	No		X	X	X	
Habitat, Polaris	Imazapyr salt	X	X	X	Yes	X	X	X	X	X
Method 240SL, Method 50 SG	Aminocyclopyrachlor	X	X	X	No	X	X	X	X	X
Pendulum 3.3 EC, Prowl H2O	Pendimethalin	X		X	No	X				

- Notes:
- 1) This list is incomplete and subject to change as products are developed, labels are changed, and new research is conducted.
 - 2) Applicators are required to follow the label. The label contains far more information than is found in this table.
 - 3) Although most labels do not note temperature restrictions it is generally a good idea to apply well above freezing.
 - 4) Although specific temperature guidelines are not provided for triclopyr products they tend to volatilize at temperatures greater than 80° F. Triclopyr ester products are more volatile than Triclopyr salt products. Lower humidity and smaller droplets increases volatilization.
 - 5) The Method 240 SL formulation of aminocyclopyrachlor has labeling for basal bark. Method 50 SG and the premixes (Perspective, Streamline, Viewpoint) do not have basal bark labeling.

Under the NCR IPMP/EA, the use of herbicides would be considered under a range of conditions. Under some circumstances, herbicides may be the only feasible option for managing an invasive plant. Herbicides and formulations selected for treatment would be known to be effective on the target invasive plant and known to have a minimal effect on the environment. To minimize potential environmental effects, herbicides and their respective formulations would be selected based on the presence of non-target plants (including sensitive, threatened, and endangered plants), soil texture, depth and distance to water, and environmental conditions.

As previously discussed, only those herbicides that have been registered by the EPA and permitted for use by a state or the District of Columbia would be used under the NCR IPMP/EA. When considering the use of a chemical treatment, the resource manager would consider whether its use is necessary and whether all other treatment options are either not acceptable or not feasible. The resource manager would also consider whether use of the selected herbicide is appropriate for the site and whether it has the potential to be effective on the target species. Similarly, to determine the potential for surface water contamination, the resource manager would consider the potential effects of any selected herbicide based on its distance to streams, rivers, or other water bodies; soil types where application is proposed; and the leaching potential of the selected herbicide. These extra steps are required to ensure that the most appropriate and cost-effective herbicide is selected and protect resources.

2.3.3.1 Herbicide Application Methods

Application methods available to the parks under the action alternative are described in the following sections. In all of the application methods described below, a non-toxic marking dye may be added to the chemical to aid in the detection of treated areas. A summary of the most common herbicides and their available application methods under the NCR IPMP is provided in Table 2-1.

Foliar spraying

Foliar spraying applications involve spraying green foliage with the herbicide. Herbicides used for foliar application are mixed at low concentrations (in accordance with their label) and are typically mixed with water. Some herbicides require the addition of an adjuvant to work effectively. A surfactant is one kind of adjuvant; it lowers surface tension of the herbicide on the leaf surface and therefore increases contact.

Spray is applied to the leaves of target plants using a consistent back and forth motion to promote complete and consistent coverage. Foliar herbicide applications are typically applied so that they thoroughly cover foliage, but not to the point of run-off. Foliar applications are typically either made using a low-pressure backpack sprayer or tank sprayer, or at higher pressures with larger equipment. Herbicides are typically applied with a backpack, motorized spray tank, or similar hand-operated pump sprayer. Foliar treatments are applied after full leaf expansion in the spring and before leaves senesce in the fall. Drying time and temperature varies with the chemical and formulation. In areas that receive significant public use, and depending on what herbicide is used, it may be necessary to close off the treatment area until the herbicide has completely dried or until re-entry interval has passed.

Aerial Spraying

As previously noted, aerial spraying is only included in Alternative 1; see Section 2.2.2 for additional discussion. Aerial spray application of herbicides would only be conducted at sites that meet one of the following criteria:

- The infestation covers a large area and would be most effectively treated from the air. There is no acre limit for using aerial application (though aerial application sites are typically over 20 acres and have fairly dense invasive plant coverage).

- The infestation covers a small area but can be successfully treated using a microfoil boom mounted on the plane's wing or similar apparatus that allows for a limited band of spray. (A microfoil boom can be used to spray widths as small as 12 feet, effectively treating small infestations. Microfoil booms are designed specifically to minimize herbicide drift.)
- The infestation is very remote and treatment using other application methods would require an inordinate amount of time for crews to arrive and apply ground treatment.
- The infestation is on rough, steep terrain that prevents ground application and is too dangerous for employees on foot.

Cut and Injection

Cut and injection applications include cut-stump methods, girdling, hack and squirt, and stem injection. Higher concentrations of herbicide (10 to 50 percent by volume, mixed with either water or penetrating oil) are usually used in cut-stump applications. The main advantages to these methods are (1) there is minimal risk of non-target damage through drift or overspray; (2) application time is minimal; and (3) they can be used in the winter with appropriate herbicide as long as snow depth does not impede proper application to cambium. Winter application of herbicide may not be as effective as application during other times of the year because of the low translocation rates resulting from dormancy. Backpack sprayers or spray bottles are effective for most of these methods. Cut and injection methods that could be implemented under the IPMP/EA include those listed below:

- **Cut-Stump Method:** Stems are cut horizontally at or near ground level; all cuts should be level, smooth, and free of debris. Herbicide is applied immediately to the cambium layer (i.e., the lateral meristem, including the vascular cambium and cork cambium) of the stump and root collar.
- **Girdling Method:** A 1-inch layer of bark is removed from the entire circumference of the trunk of a woody plant with herbicide applied to the exposed area, resulting in the death of plant tissues above the damage.
- **Hack and Squirt Method:** Using an axe or similar cutting tool, uniformly spaced cuts are made around the base of the stem. The cuts should angle downward, 1.0 to 1.5 inches apart, and extend into the cambium layer. Herbicide is applied to each cut to the point of overflow.
- **Stem Injection Method:** Using a syringe or special injection tool, herbicide is injected directly into the plant's vascular system. Injection holes may be established using power or hand drilling methods. Typically, continuous holes are drilled around the base of the stem. The holes are angled downward, less than 1.5 inches apart, and they extend into the sapwood. Herbicide is applied to the entire cut area to the point of overflow.

As necessary, park managers would evaluate other cut and injection methods not listed above prior to their implementation and would comply with additional compliance requirements as applicable if impacts are anticipated to exceed those described for chemical treatment methods in Chapter 4.

Basal Bark

Basal bark applications involve applying herbicide to the bark of uncut woody stems above ground level to avoid collateral problems with roots of other plants growing in and around the target species. This method can be used on any woody species, and applications are usually mixed at higher concentrations than foliar spraying, but lower concentrations than cut surface. A variant of this method is injecting stems/trunks with a small dose of herbicide. Basal bark treatments are effective for controlling woody vines, shrubs, and trees. Treatments can be made at any time of year, including the winter months,

except when snow or water prevents spraying the basal parts of the stem. Proper plant identification is crucial during the dormant season due to the absence of foliage. To treat trees with a basal bark application, an herbicide-oil mixture is applied from just above the soil surface, up the trunk and fully encircling the trunk. The distance up the trunk varies by tree diameter; the larger the tree, the higher up the treatment must go. Herbicide mix is applied to the point of run-off, and according to the label. The label for Garlon 4 Ultra instructs the user to apply no higher than 15 inches. Basal bark treatments are not usually the method of choice for trees over 6 inches DBH.

Additional Application Methods

Individual plant treatments can also be applied with the use of glove applications, wicking, soil applications, and water applications. Glove applications involve the selective application of herbicide to targeted plants. This treatment is achieved by first applying herbicide to an absorbent glove covering an impermeable glove that protects the applicator's hand from contact with the herbicide. The herbicide is then transferred to the targeted plant by rubbing it with the saturated glove. Hand wicking is well suited for applications on spot patches of invasive plant species. Wicking is typically done with an apparatus consisting of a fabric-wrapped bar or wand that has been treated with herbicide. The bar, which may be held by two individuals or mounted on equipment, is passed over the target species. The bar can be raised as needed to selectively treat certain species while minimizing contact with shorter-stature non-target species. Herbicide may be applied directly to the soil in order to control germinating seeds or to be taken up by roots. Herbicides approved for aquatic use may be sprayed directly onto floating, emergent aquatic plants or applied directly to the water in either liquid or dry form.

2.3.3.2 Herbicide Classification

Herbicides are classified according to their mode of action, which is determined by the active ingredients. For example Pathfinder® II and Garlon® 4 Ultra, whose active ingredient is triclopyr, controls target woody and herbaceous broadleaf plants by mimicking the plant hormone auxin, causing uncontrolled plant growth. Once applied, triclopyr is transported through the plant's vascular tissue. Residues can persist in the plant until the tissues are degraded in the environment. In another example, Tordon®, Grazon® PC, Tordon® K, and Tordon® 22K, whose active ingredient is picloram, is absorbed through plant roots, leaves, and bark. Picloram moves both up and down within the plant and accumulates in new growth. It acts by interfering with the plant's ability to make proteins and nucleic acids.

Herbicides containing active ingredients that are not listed in Table 2-1 may also be used under the IPMP/EA. However, the use of any herbicide must meet all conditions outlined in this document and must also be approved by the Regional or National IPM Coordinator. Each herbicide varies in terms of its chemical and biological behavior in the environment, and those behaviors are typically disclosed on the product's label and/or manufacturer's website. However, for informational purposes in this IPMP/EA, factors that affect environmental fate include herbicide properties, soil characteristics, and climatic conditions (NPS 2012). Some of the factors that influence the behavior of herbicides in the environment are summarized below:

- **Acid or Base Strength:** indicates whether an herbicide has basic, acidic, or neutral properties. This factor determines the ability of an herbicide to exist in soil water or be adsorbed to soil particles. In general, herbicides whose pH is close to the pH of soil are strongly retained and are not susceptible to runoff, erosion, and/or leaching. In contrast, herbicides whose pH is not close to that of the soil are less strongly retained and have a greater likelihood of runoff, erosion, and/or leaching. These herbicides are also more available for plant uptake than those herbicides that are strongly retained onto soil solids.

- **Water Solubility:** indicates how readily an herbicide dissolves in water and determines the extent to which an herbicide is in the solution (water) phase or the solid phase. An herbicide that is water soluble generally does not have long-term residual effects.
- **Volatility:** refers to the tendency of a liquid herbicide to become a vapor. Herbicides with high vapor pressures are likely to escape from the soil or foliage and vaporize in the atmosphere.
- **Soil Retention:** an index of the binding capacity of the herbicide molecule to soil organic matter and clay. In general, herbicides with high soil retention are strongly bound to soil and are not subject to leaching. Those not exhibiting high soil retention are not strongly bound and are subject to leaching.
- **Soil Persistence:** refers to the longevity of an active or bound herbicide molecule, typically expressed in terms of a half-life, as determined under normal conditions in the region where the herbicide would be used.
- **Weather Conditions:** such as wind, temperature, relative humidity, and precipitation influence the effectiveness of herbicide applications and the potential for waste by run-off and drift. Temperature extremes can render some herbicide formulations useless by causing active ingredients to separate or become inert. Excessive heat may cause certain chemicals to volatilize, rendering their formulations diluted, or overly concentrated. Precipitation can cause herbicide to be washed off the plant before absorption.
- **Photodegradation:** depending on light intensity, ambient temperature and length of exposure, herbicides may be altered by excessive exposure to light. Photodegradation is typically caused by oxidation and hydrolysis as a result of exposure to sunlight and air.

2.3.3.3 Pesticide Approval Process

Once an herbicide has been selected, the park IPM Coordinator submits a pesticide use proposal to the Regional IPM Coordinator, who is responsible for reviewing and approving proposed herbicide uses. Additional review and approval from a National IPM Coordinator would be required for herbicide uses that involve aquatic applications or situations in which the applied herbicide could reasonably be expected to enter waters or wetlands, herbicide use involving aerial application, herbicide use on 400 or more contiguous acres, and/or use of a restricted-use herbicide as defined by the EPA.

2.3.3.4 Herbicide Best Management Practices

BMPs would be followed to ensure that the overall effectiveness of herbicides is maximized and the potential for impacts is minimized. All contractors would comply with this IPMP/EA and NPS policy when applying herbicides. These general BMPs include the following:

- Herbicides would be applied at the appropriate time based on the herbicide's mode of action.
- Herbicides would be applied according to application rates specified on the product label.
- Herbicides would be applied to the target plant.
- Herbicide application would account for meteorological factors such as wind speed, wind direction, inversions, humidity, and precipitation in relation to the presence of sensitive resources near the treatment area and the directions provided on labels. Herbicides would only be applied when meteorological conditions at the treatment site allow for proper application, which would minimize drifting of spray and allow sufficient drying time before precipitation events.

- Herbicide application would be timed and applied to minimize impact on non-target sensitive resources and reduce the risk of human exposure, including exposure to both the applicator and the general public.
- In areas where there is the potential to affect surface water or groundwater resources, herbicide pH and soil pH would be considered to select the herbicide with the least leaching potential.
- In areas where there is potential to affect surface water or groundwater resources, only herbicides approved for use in and around aquatic environments would be applied.
- Herbicides with high volatility would be applied during weather conditions that reduce volatilization risk.
- Safety protocols for storing, mixing, transporting, handling spills, and disposing of unused herbicides and containers would be followed at all times.
- Equipment would be maintained and calibrated before use. During all applications, droplet size would be controlled to decrease the risk of herbicide drift to non-target species outside the immediate treatment area. Droplet size is controlled by the nozzle and adjuvants.

2.3.3.5 Monitoring and Record Keeping

If herbicides are used, record keeping and reporting about the use of herbicides would be completed in compliance with NPS guidelines and applicable regulations. Under the NCR IPMP/EA, monitoring of areas impacted by invasive plant species should be employed at each park. Monitoring and record keeping efforts could include documentation of known populations using Global Positioning System (GPS) units, monitoring to determine the efficacy of control methods, monitoring to determine the effects of invasive plant management treatment options on non-target impacts, monitoring to determine the efficacy of recovery efforts for native species (i.e., restoration), and inventories and monitoring for new infestations.

2.3.4 Biological Treatment Methods

As noted above, biological treatment methods are included in Alternative 1 only; see Section 2.2.2, *Alternative 1: Implement the IPMP (Preferred Alternative)*, for additional discussion. Biological treatment methods, also known as biological control or biocontrol, involve the importation and release of host-specific natural enemies (or “agents”) to aid in the management of non-native invasive plants (Van Driesche et al. 2010). This method can be used to manage certain invasive non-native plants that lack effective natural enemies in areas where such plants occur.

To avoid damaging non-target species, biological control agents must be highly host specific. Agents are tested for host specificity initially in their native range and then in quarantine conditions in the United States. Agents are only approved for release if testing indicates a very low likelihood of non-target effects, as determined by the Technical Advisory Group for Biological Control Agents of Weeds (TAG), a group of experts that reports to the US Department of Agriculture’s (USDA) Animal and Plant Health Inspection Service (APHIS). “Low likelihood of non-target effects” means that such effects are expected to occur rarely, based on multiple, concurring published studies. Permission for release must also be secured from the US Fish and Wildlife Service (USFWS), which has primary responsibility for protecting threatened and endangered species (Hough-Goldstein 2015; Van Driesche et al. 2010).

Some agents introduced into the United States before the 1980s were not adequately host-specific. For example, several insect species imported for control of non-native thistles also impacted native North

American thistle species. These agents would probably not be approved for importation today, because more value is now placed on conservation of native species (Van Wilgen et al. 2013). Deliberate release is not recommended for areas where agents have not yet dispersed on their own. The safety record of agents approved in the current regulatory environment is very good (Paynter et al. 2015; Pemberton 2000; Van Wilgen et al. 2013).

Biological control agents can have rapid and dramatic effects, but in other cases they may take time to develop or may provide only partial control (Suckling 2013; Van Driesche et al. 2010). Results can vary depending on weather and ecological conditions, which may have different impacts on a biological control agent, the target plant, and the competitive ability of the resident community (Berg et al. 2015; Hough-Goldstein et al. 2015). Suppression of a target plant can also sometimes allow other non-native invasive plants to take over, and therefore restoration planting may be required in some situations (Cutting and Hough-Goldstein 2013; Lake et al. 2014). If available and effective, biological control agents can help suppress non-native invasive plant species over large areas, including areas that are difficult or impossible to access for mechanical or herbicidal control. From a land manager's point of view, very little or no intervention is required to use this technique once the agent is established (Van Driesche and Center 2013). Organisms used for biological control reproduce and spread on their own, often increasing in effectiveness over time, and may not reach maximum effectiveness for up to 20 years or more (Suckling 2013).

Host-specific agents are not available for all invasive species, especially if there are closely related native species present in the introduced range. Nevertheless, several invasive plant species in Mid-Atlantic natural areas have one or more host-specific insect species that have been tested and approved for release (Swearingen et al. 2014). These invasive plant species include mile-a-minute weed, purple loosestrife, and spotted knapweed. Insect species targeting these plants are present in the US and would likely eventually spread on their own to most infestations. This process can be accelerated by releasing these insects on lands where the target non-native invasive plant species are a problem (Van Driesche and Center 2013). Multiple species of other invasive plants have had extensive studies conducted on host-specific insects, with petitions for release in preparation or submitted to TAG, but with proposed releases still under review. These include garlic mustard, Japanese and other knotweeds, pale and black swallow-worts, and common reed (Hough-Goldstein 2015).

2.3.4.1 Biological Treatment Best Management Practices

Release of biological control agents would adhere to the following BMPs:

- The number of biological control agents released should account for the size and density of the treatment area and the number of agents required to maintain a viable biological control agent population.
- The reproductive capacity of the biological control agent, and its ability to overwinter and naturalize, should be evaluated prior to its use as a treatment option.
- More than one release in an area may be necessary for successful establishment.
- Releases should be synchronized with the time period when the host is present.
- Biological control agents should be released at times of the day when they will not disperse from the treatment area.
- Surveys for biological control agents should be completed several times during the season to monitor biological control agents.

A summary of biological control agents available for use under the NCR IPMP/EA (or currently under investigation) is provided in Table 2-2. Should additional biological treatment methods be approved by APHIS within the lifespan of this IPMP/EA, those methods would also be available for use by the parks after additional compliance requirements, which may include NEPA requirements, are completed.

Table 2-2: Summary of Biological Control Agents Available for Use by NCR National Parks to Control Invasive Plant Species

Target Species	Biological Control Agent	References
Canada thistle	Stem mining weevil, seed head weevil, stem and shoot gallfly, flowerhead weevil, defoliating beetle, painted lady butterfly caterpillars (all with limited effectiveness); rust fungus	Cripps et al. 2011 Berner et al. 2013
Leafy spurge	Flea beetles, leafy spurge gall midge, stem boring beetle, root-boring moth	Bourchier et al. 2006
Purple loosestrife	Leaf beetle	Blossey et al. 1994
Garlic mustard	Research – pending approval	Gerber et al. 2009
Spotted knapweed	Root weevils, flower weevils, seedhead feeders	Story 2002 Knochel and Seastedt 2010 Winston et al. 2012
Japanese stiltgrass	Two species of <i>Bipolaris</i> ; research on-going	Kleczewski et al. 2012
Common reed (<i>Phragmites</i>)	Research ongoing	Tewksbury et al. 2002
Nodding and plumeless thistles	Several insects established, but may harm native thistles; rust fungus	Kok 2001 Cripps et al. 2011 Havens et al. 2012
Knotweeds	Psyllid – pending APHIS approval	Grevstad et al. 2013
Multiflora rose	Eriophyid mite, rose-seed chalcid	Smith et al. 2010 Jesse et al. 2010
Tree-of-heaven	Research ongoing	Herrick et al. 2012 Schall and Davis 2009a, b
Mile-a-minute	Host-specific stem-boring weevil	Hough-Goldstein et al. 2012
Swallowworts	Host-specific moth – pending APHIS approval	Hazlehurst et al. 2012
Eurasian watermilfoil	Research ongoing	Cock et al. 2008 Menninger 2011
Parrotfeather	Research ongoing	Cilliers 1999
Giant salvinia	Salvinia weevils; research ongoing	Tipping et al. 2008
Hydrilla	Host-specific semiaquatic weevil; research ongoing	Center et al. 2013
European water chestnut	A promising leaf beetle, but no petitions have been submitted to APHIS	Ding et al. 2006, 2007
Water hyacinth	Two weevils and a moth (limited effectiveness)	Center et al. 1999 Center and Dray 2010

2.3.5 Manual Treatment Methods

Manual treatment methods refer to pulling or otherwise removing non-native invasive plants by hand, or with the use of simple non-motorized tools such as hand-held pruners and clippers. Manual treatments are generally considered a labor intensive activity. Manual treatment is most effective for pulling shallow-rooted species. Manual pulling of deep-rooted species may require repeated treatment to effectively deplete the root system. Portions of roots can break off, remain in the soil, and regenerate. Hand pulling is conducted by removing as much of the root as possible while minimizing soil

disturbance. However, it should be noted that disturbance of the soil can stimulate the seed germination of both native and non-native species. Manual treatment methods could be used to treat individual plants or larger areas encompassing multiple plants.

2.3.6 Mechanical Treatment Methods

Mechanical treatment methods involve the use of cutting tools, pulling tools, power tools, and/or heavy equipment to inflict physical damage on or remove part or all of one or more non-native invasive plants. Hand-cutting tools are a treatment option for removing the above-ground portions of annual or biennial plants. The use of hand tools, like trowels, shovels, and pulaskis, is a simple form of mechanical treatment. These tools can be used to remove a larger portion of the root system or to sever the plant's taproot below the point where nutrients are stored. Efforts would be made to collect and dispose of viable seeds from plants that are cut or to cut plants when seeds are not viable. Pulling tools are a treatment option for removing individual plants that are deep-rooted. Pulling tools (e.g., weed wrenches™) could be used to control small infestations, such as when an invasive plant is first identified in an area. Such tools grip the plant stem and remove the root by providing leverage.

Power tools like mowers are used to treat infestations of varying size. Mowers work best in large, relatively flat treatment areas that do not include sensitive environmental resources. String trimmers and brush cutters can be used at small sites, selectively around sensitive vegetation, or at sites that are inaccessible or too rocky to be mowed. Power tools (like string trimmers, brush cutters, chainsaws, tractors, or mowers pulled by Utility Task Vehicles [UTVs]) remove aboveground biomass, reduce seed production, and reduce plant growth. It may be necessary to use additional treatment methods in conjunction with mechanical methods to remove non-native plant biomass. Power tools are useful for controlling annual plants before they set seed. Power tools can also be used along with other treatments, such as chemicals or prescribed fire, to treat perennial invasive plants.

Heavy equipment (such as bulldozers, tilling equipment, or heavy loaders) can be used to treat dense invasive plant infestations with efficiency. Heavy equipment would only be used in areas of dense invasive plant infestations, such as invasive tree infestations and conifer plantations, and where there are no natural or cultural resources that could be impacted by such equipment. The use of heavy equipment could trigger the need for additional, site-specific compliance requirements, such as review under NEPA and/or the NHPA. Depending on the outcome of site-specific NEPA analyses, parks could decide to implement the use of heavy equipment or determine that such activities would result in substantial impacts and therefore preclude their use.

Mechanical methods can be highly selective for individual plants and would generally be employed in concert with other treatments, such as the use of herbicides. For example, manual or mechanical treatments may be followed by application of herbicides or prescribed fire to treat re-sprouts and new seedlings. As with manual treatments, mechanical treatment methods could be used to treat individual plants or specific treatment areas.

2.3.7 Physical Treatment Methods

Physical treatment methods include smothering/solar sterilization, thermal control and prescribed fire. These methods are described in the following subsections. It is likely that the use of prescribed fire would be subject to additional compliance requirements that are not included in the scope of this IPMP/EA.

2.3.7.1 Smothering and Solar Sterilization

Infestations of non-native invasive plants can be smothered in small areas by covering the area with thick woven geotextile shade fabric, cardboard, plastic sheeting, or mulch. Shading the area will generally kill all vegetation if left in place for an extended period of time. The fabric, cardboard, or sheeting is typically held to the ground using stakes, staples, or heavy items.

Solar soil sterilization (also referred to as soil solarization) is a technique used to control vegetation and/or soil-borne pathogens. Clear plastic is spread over the soil surface and secured tightly around the edges. The plastic is left in place during the growing season for extended periods of time (weeks or months). Heat builds up between the soil and plastic on sunny days. Solar sterilization, as the term implies, is non-selective. It is an aggressive technique and should only be used where the intent is to kill everything under the plastic. A benefit of this technique is that the seed banks of unwanted plants are largely destroyed near the soil surface. However, the technique also kills the majority of soil microbiota near the soil surface.

2.3.7.2 Thermal Control

Treating non-native invasive plants with heat destroys plant cells and alters compounds within the plant, disabling normal plant function and weakening the plant. Sources of thermal action can include open flame, hot water, steam, hot foam, or radiant heat.

Non-native invasive plants vary in their response to thermal control. Newly emerged, small plants with small root reserves are more susceptible to thermal control methods. Conversely, well-established plants, perennial plants, plants with substantial root systems, and plants adapted to survive natural fire occurrence are more likely to recover from thermal control methods. The consistent, repeated application of thermal control treatments is often necessary to substantially reduce the quantities of non-native invasive plants in a particular area (PPR 2015).

Flaming units

Devices that emit an open flame can be used to control non-native invasive plants by burning such plants or disrupting their cellular functions through the application of heat. Using this method, and depending on the species targeted, it is not always necessary to completely burn a non-native invasive plant to achieve the intended reduction. Rather, desired results may be achieved by exposing the targeted plant to heat long enough to “cook” it and inhibit further growth or reproduction (PPR 2015).

Steam and Hot Water

This technique involves the use of equipment that emits hot water or steam to damage plant tissues and weaken or kill the targeted plant, and is similar to the heat exposure method described above for flaming units (PPR 2015).

Hot Foam

This technique involves the use of special equipment powered by a diesel-fueled boiler that mixes water with a surfactant to generate hot foam that is then applied to targeted vegetation through a hose. The foaming action enables the heat to surround the targeted non-native invasive plant and insulate the targeted area from non-targeted species (both plant and animal). The foam aids in lengthening the duration of the heat application (PPR 2015).

2.3.7.3 Prescribed Fire

As noted above, prescribed fire is included in Alternative 1 only; see Section 2.2.2 for additional discussion. Prescribed fire treatments consist of applying fire to a predetermined area to reduce the

growth of invasive plants and to increase the growth of desirable plants. The success of prescribed fire differs substantially among species. Prescribed fire is typically most effective when the invasive plant is more susceptible to the effects of fire when compared with intermingled native plants. Prescribed fire may also be used to control invasive cool-season plants or for fuel reduction following large-scale mechanical treatment (e.g., removal of burn piles).

It should be noted that prescribed fire can exacerbate some invasive plant problems, and a single prescribed fire generally has minimal effect. Single prescribed fires typically have limited success in treating invasive plants, and therefore, repeated use of prescribed fire in infested areas has a higher rate of success.

The use of prescribed fire is also limited by the fire ecology of the infested area and current fuel loads. Prescribed fire is best used in situations where fire was part of the pre-European ecology and where native fire-adapted species still exist. Sufficient fuel loads must be present for prescribed fires to be successful.

Parks that are covered by a fire management plan that includes the use of prescribed fire and appropriate NEPA documentation would be able to use prescribed fire treatments to manage invasive plants. Fire management plans prepared to date can be found in Table 2-3. Invasive plant management objectives for each prescribed fire treatment are defined in a project-specific prescribed fire plan. These plans may also include follow-up treatments for post-fire invasive plant discoveries.

Table 2-3: Summary of Fire Management Plans in the National Capital Region

Park	Plan Title	Year Approved
CATO	Fire Management Plan for Catoclin Mountain Park	2004
CHOH	Chesapeake & Ohio Canal National Historical Park Wildland Fire Management Plan	2004
ANTI	Antietam National Battlefield - Fire Management Plan and Environmental Assessment	2004
GWMP	George Washington Memorial Parkway Wildland Fire Management Plan	2012
HAFE	Fire management Plan for Harpers Ferry National Historical Park	2013
WOTR	Wolf Trap National park for the Performing Arts. 2014 Wildland Fire Management Plan	2014
MANA	Manassas National Battlefield Park Fire Management Plan	2015
Note: Additionally, MONO and PRWI have draft fire management plans and most parks in the RNC are covered under a draft multi-park fire management plan that includes the use of fire as a tool to control invasive plants.		

2.3.8 Cultural Treatment Methods

Cultural treatments are practices that promote the growth of desirable plants and reduce the opportunities for invasive plants to grow. Examples include irrigation and seeding of native plant species. Cultural treatment methods involve manipulating treatment areas to present invasive plants with effective native competitors. Examples of cultural treatments that could be implemented by parks include:

- Prevention
- Seeding/planting
- Cover crops and nurse crops
- Livestock grazing

2.3.8.1 Prevention

Under either of the alternatives, parks could employ programs to limit the potential for introduction and expansion of invasive plants as a result of human activities. Examples of preventative measures include boot brush stations, interpretive education, use of clean fill, proper grading and road maintenance, cleaning of lawn mowers and other equipment, timing of mowing (i.e., mowing before species go to seed), and contractor and cooperator guidelines and communication. Under either alternative, park staff would inform park contractors about the threats posed by invasive plant species and how infestations can be prevented (e.g., cleaning vehicles, equipment, and boots prior to beginning work and following the completion of daily non-native invasive plant treatment activities).

2.3.8.2 Reseeding/Planting and Restoration

Reseeding could be used to encourage the reestablishment of native plants and to prevent the establishment of invasive plants. As part of restoring native plant communities, parks could reseed areas that do not have adequate seed banks to recover naturally or areas where native plant species can be used to out-compete invasive plant species. For this treatment option, parks would require that materials used for reseeded, planting, and restoration be non-invasive and preferably native plant species. Native seeds would be collected from populations as closely related genetically and ecologically as possible to park populations and preferably from similar habitats in adjacent or local areas (NPS 2006). Overseeding (i.e., seeding on top of established vegetation) could be used in areas where park staff anticipate seeded species to outcompete existing invasive plants.

2.3.8.3 Cover Crops and Nurse Crops

Under the NCR IPMP/EA, parks would have the ability to use cover crops or nurse crops to aid in the prevention of invasive plants and encourage the growth of native plants. Cover crops are typically considered place holders when reseeded with desired plant species is delayed for various reasons. Nurse crops typically consist of an annual species used to assist in the establishment of perennial vegetation. For this treatment option, parks would require that cover or nurse crop seeds used in seeding, planting, and restoration be non-invasive and preferably native species. Seeds would be collected from populations as closely genetically and ecologically related as possible to park populations, and preferably from similar habitats in adjacent or local areas (NPS 2006).

2.3.8.4 Livestock Grazing

When and where feasible, livestock animals would be used to control non-native invasive plant species. Prescribed grazing tactics manipulate three basic variables—herbivore selection, seasonal timing, and intensity—to cause a predictable plant community response. The goal of prescribed grazing for invasive plant management is to manipulate patterns of defoliation and disturbance to place a target plant at a competitive disadvantage relative to other plants in the community. Ecologically based grazing prescriptions pay careful attention to positively directing plant community change, and are not just focused on removing the non-native invasive plant species. Grazing prescriptions may put target plants at a competitive disadvantage using two general approaches (USFWS 2015):

1. Use grazing management that harms the target plant species by grazing at a time and frequency when the target plant is most vulnerable.
2. Modify the grazing behavior of animals to cause them to concentrate their grazing efforts on the target plant instead of the desirable vegetation.

Table 2-4 summarizes the variables that parks would consider when selecting the type of livestock animal(s) to use for grazing treatment methods.

Table 2-4: Comparison of Livestock Characteristics for Grazing Treatments

Variable	Animal		
	Goats	Sheep	Cattle
Diet	Prefer to browse woody plants, then forbs	Prefer forbs, then grasses	Prefer grasses
	Most tolerant of secondary plant compounds	Tolerant of secondary plant compounds	Least tolerant of secondary plant compounds
Behavior	Narrow, strong mouths evolved for stripping individual leaves and chewing branches	Narrow muzzle allows for selective grazing	Foraging is less selective than sheep and goats
	Can reach taller branches by standing on hind legs or climbing	Do not graze uniformly	Graze more uniformly than sheep or goats
	Able to navigate steep hills/inclines, other rugged terrain	Prefer open field grazing	Larger animals may have greater physical impact than sheep or goats
	Do not graze uniformly	(blank)	(blank)
Care	Require herding, or can be tethered to concentrate grazing activity	Require herding	Require periodic movement, but do not require herding
	Temporary, portable fencing is sufficient for containment	Temporary, portable fencing is sufficient for containment	Require stable fencing; kept contained by portable solar-powered electric fencing
	Susceptible to predation	Susceptible to predation	Less susceptible to predation than sheep or goats

Source: USFWS 2015

2.4 Mitigation Measures and BMPs

The NPS places a strong emphasis on avoiding, minimizing, and/or mitigating potentially adverse environmental impacts on non-targeted resources. Under the IPMP/EA, parks would employ mitigation measures and BMPs to ensure that adverse impacts on non-targeted resources resulting from the application of treatment methods included in the IPMP/EA are eliminated or minimized to the extent practicable. As applicable, mitigation measures or BMPs would be designed and implemented with regard to the following factors:

- The particular treatment method selected
- The context and setting of the targeted area
- The non-targeted resource(s) to be protected
- The severity of impacts on non-targeted resources potentially resulting from the treatment method

Mitigation measures and BMPs would be employed in accordance with applicable federal, state and local laws and regulations. The NPS would conduct monitoring throughout the IPMP/EA's implementation period to ensure that mitigation measures and BMPs are properly implemented and achieving their intended results.

Mitigation measures and BMPs for this IPMP/EA include, but would not be limited to, those described in Section 2.4. Mitigation measures and BMPs specifically applicable to biological treatment methods are described in Section 2.3.4.1.

2.4.1 General BMPs and Mitigation Measures

To minimize the potential impacts from personnel and equipment, the following general BMPs would be implemented where appropriate:

- Equipment used for invasive plant management would be power washed and/or vacuumed regularly to reduce the potential for accidentally introducing invasive plants from another area.
- As feasible, the application of treatment methods would be completed before seed becomes viable to limit the potential for the seeds of non-native invasive plants to be spread by treatment equipment and vehicles.
- Vehicles and UTVs would use existing roads and trails when possible.
- UTVs would be transported by trailer from one general area of the park to another. Trailers would be used to avoid unnecessary cross-country travel and tracks and to promote safe operation.
- Staff and contractors would be educated on the importance of invasive plant species prevention, including the power washing of vehicles and equipment prior to entering parks, cleaning clothes and footwear, and cleaning chainsaws and other hand tools.

2.4.2 Cultural Resource BMPs and Mitigation Measures

To ensure that invasive plant management activities do not adversely affect cultural resources, parks would employ the following BMPs and mitigation measures where appropriate:

- NPS cultural resource specialists would be consulted to determine if cultural resources are present in areas proposed for invasive plant treatment or if the area needs to be surveyed for cultural resources prior to work being done.
- Parks would determine the necessity of project or site-specific consultation with the applicable SHPO and/or tribes associated with the park regarding the potential impact to cultural resources. Decisions surrounding the need for project or site-specific consultation would be based on input from NPS cultural resource specialists and on review of relevant cultural resource survey reports, cultural landscape inventories, and cultural landscape reports.
- Individual parks may consider developing a Programmatic Agreement in consultation with their respective SHPO / Tribal Historic Preservation Officer (THPO), as appropriate, to define the invasive plant management activities that would be appropriate under a streamlined review process.
- Herbicides would not be directly applied to historic structures with limestone grout, hearth features, or cultural resources consisting of organic material such as bone, pollen, seeds, and materials made from plant fiber. However, herbicides may be used in lands surrounding cultural or historic sites in accordance with BMPs.
- If cultural resources are discovered during sub-surface ground-disturbing activities, the NPS would suspend operations at the site and immediately contact the appropriate cultural resource specialist, who would arrange for a determination of eligibility in consultation with the SHPO and, if necessary, would develop a recovery plan.
- Traditional-use native plants are plants used or held sacred by Native American tribes for medicinal, ceremonial, religious, or other cultural purposes. Where traditional-use plants are

known to occur, parks would identify them in consultation with tribes to avoid or minimize the impacts of treatment methods to the maximum extent practicable on such plants.

2.4.3 Visual Resource and Noise BMPs and Mitigation Measures

To minimize the impacts of invasive plant management on visual resources and landscapes, parks would employ the following BMPs and mitigation measures where appropriate:

- UTVs and other equipment would be routed along breaks in topography or behind existing tree groupings where possible.
- As feasible, UTVs used in high-visibility areas would follow slope contours to minimize the potential for visual disturbance.
- Use of UTVs and other noise-producing equipment for treatment (e.g., chainsaws) would be limited in soundscapes and/or timed to reduce activities that impact ambient noise levels in soundscapes outside peak use.

2.4.4 Erosion, Sedimentation, and Stormwater BMPs and Mitigation Measures

To minimize the impacts of invasive plant management on soil resources, surface water, and wetlands, parks would employ the following BMPs and mitigation measures when treatment activities involve soil disturbance exceeding one acre or applicable thresholds otherwise specified by state or District of Columbia law:

- Any limits of disturbance would be shown on the drawing prepared for the project for compliance.
- NPS staff would protect and maintain all existing trees, shrubs, and plants unless otherwise noted.
- Staging, parking, and material handling would be limited to the space(s) designated.
- The NPS would comply with the governing National Pollutant Discharge Elimination System (NPDES) construction requirements and would provide appropriate mitigation measures or protection and restoration at all locations affected by their operations.
- The NPS would conform to the rules and regulations of the state/county regulatory authority.
- Streams and wetlands within the project would be identified.
- The NPS must predetermine the layout for access roads where heavy equipment is planned to be used. If any grading is required, appropriate permits must be obtained from the state/county regulatory authority. NPS staff must plan to prevent soil compaction and damage to vegetation in accordance with local regulations.
- Stream crossings used to access treatment areas should be limited to existing crossings where culverts or bridges are in place. If temporary stream crossings are necessary, appropriate permits would be obtained from the state regulatory authority and the US Army Corps of Engineers.
- Any excavated or stockpiled material left overnight would be covered with impermeable material. Sediment control should be provided for all staging and stockpiled areas.
- Silt fencing would be placed along the low side of excavated material or as designated in the approved erosion and sediment control plans.

- Additional silt fencing or other erosion and sedimentation control devices not shown on the plans may be required.
- Silt removed from control devices should be placed in an approved area either on site or off site of the project. Material stored on site may be reused when dry.
- No construction activities would be undertaken within specified sensitive areas of the project without prior notification of the regulatory authority and park staff. All work in these areas would be monitored by a responsible party designated by the NPS to ensure reasonable care is taken in or adjacent to these areas. Areas considered sensitive are defined as floodplains, wetlands (tidal and nontidal and associated buffers), critical areas, forested areas, archeological sites, historic sites, and open water.
- Following initial soil disturbance or redistribution, permanent or temporary stabilization must be put in place.
- Personnel operating equipment would avoid areas predetermined to have erodible soils and areas that are prone to erosion, such as steep slopes.
- The NPS would plan Utility Task Vehicle (UTV) routes to avoid wetlands and prevent adverse impacts to associated hydrology, soils and vegetation. If temporary access is necessary, appropriate permits would be obtained from the state regulatory authority and the US Army Corps of Engineers.
- UTVs would be operated in such a way as to minimize disturbance of vegetation and soils.
- The number of off-road vehicles and UTVs would be minimized to the extent possible.
- Most areas where bare soil has been exposed would be reseeded with an approved seed mix prepared for the site.
- Limit the amount of herbicide that can be transported in a vehicle to 20 gallons of concentrated herbicide or 200 gallons of diluted herbicide to avoid potential for large spills. When possible, mixing should take place at the application site to avoid transportation of large amounts of diluted herbicide.
- Transport concentrated herbicides in a spill-proof container.
- Mix and load herbicides in areas where a potential spill would be most easy to contain.
- Mixing areas should have few native plants or other desirable species, have easy access to contain potential spills, and be located a minimum of 100 feet from water bodies.
- A spill kit should be available when herbicide is transported and should be used to contain and remove any accidental spills immediately.

2.4.5 Wildlife BMPs and Mitigation Measures

To minimize the impacts of invasive plant management on general wildlife species (i.e., species that are not federally or state listed), parks would employ the following BMPs and mitigation measures where appropriate:

- Identify which species to look out for:
 - Likely classes of animals affected are insects, reptiles and amphibians, fish and aquatic invertebrates, mammals, and birds.

- Identify which taxa are likely to be encountered and/or at risk from treatment methods.
- Identify high-priority animals for the project site.
- Plan out the work:
 - If possible, avoid working in areas where wildlife may be nesting or actively occupying.
 - If possible, avoid mowing during primary nesting season (4/1-8/31).
 - Use a selective herbicide if appropriate.
 - Use the lowest effective dose.
 - Avoid rainy and windy conditions that contribute to drift.
- Train workers:
 - How to identify wildlife and wildlife habitat.
 - How to identify area of high likelihood of wildlife and wildlife habitat (e.g., nests, seeps, and springs).
- Survey the project site:
 - Watch for bird nesting behavior (e.g., carrying nesting material or food back to a central location, defensive or distraction displays, and white wash).
 - Survey areas surrounding treatment locations for the active presence of raptor nests, burrows, or other evidence of habitation by a sensitive species. The survey buffer radii (e.g., 500 feet) around proposed treatment areas would be determined by park resource manager or expert biologists. If active raptor nests or other evidence are found, treatment activities would not occur during the nesting season for that species within a species-specific spatial buffer that would be determined by NPS or expert biologists based on the presence of vegetative or topographic screening and/or the stage of the nesting activity.
 - Flush slow moving animals (e.g., turtles, frogs, salamanders) if ground disturbance is planned.
 - Identify surface water such as seeps/springs, mark clearly and map for future use in the area.
 - Identify area that large equipment and staff will enter/exit the location. Ensure this area is free of slow moving animals and nests.
- Protect sensitive areas
 - Flag off areas to avoid (e.g., rare species habitat, seeps and springs, sensitive soils).
 - Avoid spraying fruits if possible.
 - If flowers must be sprayed, spray when bees are less active (i.e., cooler periods).
 - Minimize physical disturbance to ground nesting birds and burrowing animals.
 - Avoid treatments in the immediate vicinity of any nests or burrows. If broadcast spraying, consider rotation of treatment areas so birds and animals can relocate.
 - If spraying in an area where amphibians are assumed to be present (e.g. wetlands, marshes, seeps, springs) use products approved for aquatic use.

2.4.6 Threatened, Endangered, and Sensitive Species BMPs and Mitigation Measures

Multiple federally listed threatened, endangered, and/or candidate species have been identified or are otherwise known to occur in the 15 NCR parks. Section 7(a) of the ESA requires federal agencies to evaluate their actions with respect to any species that are proposed or listed as endangered or threatened, and their critical habitat, if any has been formally designated. Section 7(a)(2) requires the NPS to ensure that activities that they authorize, fund, or carry out are not likely to “adversely affect” or

“jeopardize the continued existence” of a federally listed species or result in the adverse modification or destruction of its critical habitat. If a federal action “is likely to adversely affect” a federally listed species or its critical habitat, the NPS is required to enter into formal consultation with the USFWS or NMFS. Candidate species for listing under the ESA are also managed as if listed to prevent future listing as threatened or endangered.

Under the NCR IPMP/EA, parks would employ the following BMPs to reduce or eliminate potential impacts on federally listed threatened, endangered, candidate, and/or otherwise special-status species:

- Field personnel would be trained to recognize and avoid threatened, endangered, and candidate species in their work sites and travel routes, and would be provided information on locations of known habitats for listed or candidate species.
- Before working at a site, staff would be instructed on any known or suspected rare species. Training will include looking at pictures or the species itself.

If federally listed or candidate species occur in the action area, parks would consult with the USFWS prior to any action. Under the NCR IPMP/EA, parks would also implement several species-specific BMPs designed to prevent non-target impacts of invasive plant treatments on native plants, wildlife, or fish species listed as threatened, endangered, or candidates for listing under the ESA. Some of these measures are described below. However, as new protective conservation measures for federally listed or candidate species are developed by the USFWS, those measures would also be implemented as appropriate. Similarly, as new species are listed under the ESA, parks are responsible for consulting and implementing protective measures for those newly listed species prior to invasive plant treatment actions, as appropriate.

2.4.6.1 Migratory Birds

To implement the Migratory Bird Treaty Act (MBTA), the NPS has an MOU with the USFWS that defines the roles and responsibilities of each agency in protecting migratory birds from federal actions on NPS lands. In accordance with this MOU, the NPS would cooperate with the USFWS on a project-specific basis prior to implementation of any treatment option that has the potential to adversely affect migratory birds. The NPS would incorporate bird conservation measures into any actions and planning process for the treatment of invasive plant species. The NPS would also follow regulatory requirements for activities subject to 50 CFR Part 21 and report any migratory birds taken to the USFWS.

- Prior to invasive plant treatments in migratory bird habitats during the spring breeding and nesting season, NPS or expert biologists would determine whether proposed treatment areas require surveys for the presence of active bird nests.
- If surveys are determined necessary, nest surveys would be completed to ensure that active nests would not be affected by treatment activities. If active nests are located, NPS biologists could require that treatment be postponed within a defined spatial buffer around the nest during the species-specific nesting period and/or until the young have successfully fledged the nest.
- If active nests are documented during treatment activities, treatment personnel would cease activities and contact the park resource manager for further direction. Park staff could require that the treatment be postponed during the species-specific nesting period and/or until young have successfully fledged the nest.
- If a nest is present, staff should avoid checking on the nest repeatedly unless authorized by park resource manager, as repeated activity could alert nearby predators of the nest location.

- MANA's Important Bird Area is a significant bird site under this MOU. Conservation measures must be implemented with care in this grassland habitat.

2.4.6.2 Bald Eagle

Although delisted by the ESA, bald eagles are still protected under the Bald and Golden Eagle Protection Act, and protection is encouraged by the USFWS to prevent the need for relisting. The BMPs listed below have been adopted from the National Bald Eagle Management Guidelines (USFWS 2007), and would be considered and implemented when feasible prior to invasive plant treatment in bald or golden eagle habitats:

- Treatment areas would be evaluated for suitable bald eagle nesting and roosting habitat prior to conducting invasive plant management activities.
- As feasible, invasive plant treatment activities that involve tree removal or mechanized activity (e.g., chainsaws and UTVs) would not be completed within a buffer of 660 feet (200 meters) of bald eagle nest sites during the nest-building, egg-laying, and early brooding period (mid-December to June in the Chesapeake Bay region).
- Clearing of live or dead trees greater than 12 inches in diameter at breast height along streams, rivers, and wetlands would be avoided to the extent possible to help preserve potential bald eagle roosting or nesting habitat.
- Parks would avoid clear-cutting or removal of overstory trees within 330 feet (100 meters) of both active and alternate nests at any time.
- If burning during the nesting season is necessary, parks would implement the following BMPs in known bald eagle habitats:
 - Parks would conduct burns only when adult eagles and young are absent from the nest tree (i.e., at the beginning of, or end of, the nesting season, either before the particular nest is active or after the young have fledged from that nest).
 - Parks would take precautions like raking leaves and woody debris from around the nest tree to prevent crown fire or fire climbing the nest tree.

2.4.6.3 Indiana Bat and Northern Long-eared Bat

The NPS has implemented and would continue to implement a number of measures to avoid adverse impacts on the federally endangered Indiana bat and the federally threatened northern long-eared bat. Non-native invasive trees receiving herbicide treatment would be treated with basal bark or cut and injection treatment methods (see Section 2.3) and would be left to become standing dead material. Such material would only be removed in areas where it poses a risk to the public, historic structures, or other property, and would be surveyed for the presence of bats prior to removal. Overall, it is anticipated that tree cutting and herbicide application would occur only in small, noncontiguous areas throughout NCR parks. Parks would employ the following BMPs and mitigation measures where appropriate:

- No alteration of the environment, including tree removal, would occur within ¼ mile of known northern long-eared bat hibernacula.
- Trees would not be removed within 150 feet of any known northern long-eared bat maternity roost tree during the pup-rearing season (June 1 through July 31).

- Between February 15 and October 15, known northern long-eared bat and Indiana bat roost trees would not be removed unless necessary to address a direct threat to human life or property (i.e., hazard trees).
- Within the geographic summer range of the Indiana bat, the clearing of highly suitable roost trees would be minimized. This includes snags (dead trees), shagbark hickories (*Carya ovata*), other trees with shaggy or exfoliating bark, and trees of any species more than 26 inches in diameter.

2.4.6.4 Threatened and Endangered Plants

- Herbicide applicators would receive training on identification of threatened and endangered plants. If these plants are identified in the field, treatments would be halted until buffer areas are established.
- Where chemical treatment is needed near threatened or endangered plants, hand spraying or hand wicking would be prioritized.
- If boom treatments are used (UTVs or aircraft) to apply herbicides, a 50-foot no-spray zone would be established around threatened and endangered plants.
- Plowing, harrowing, or other forms of tilling would not be used in areas where such activity would have an adverse impact on known populations of threatened or endangered plants.
- UTVs and off-road vehicle traffic would be used on a limited basis in areas where threatened or endangered plants are known to occur or have the potential to occur.

Northeastern Bulrush

A number of measures would be implemented by the NPS to specifically avoid adverse impacts on the federally endangered northeastern bulrush. Earth-disturbing activities in wetland areas to control non-native invasive plants would be limited to manual activities and would generally occur in small, non-contiguous areas throughout the NCR parks. The application of herbicides would be in accordance with the manufacturer's instructions and would generally occur in small areas. Before herbicides would be applied in areas of potential habitat, a qualified biologist would review the site for the presence of northeastern bulrush. Generally, no bodies of surface water would be redirected as part of the proposed action.

2.4.7 Revegetation, Rehabilitation, and Restoration BMPs and Mitigation Measures

Post treatment revegetation, rehabilitation, and restoration techniques would be used as needed to assist the recovery of the plant community of the project site so that it functions in a state similar to its pre-project state. Parks would employ the following BMPs and mitigation measures where appropriate:

- Revegetate and/or mulch disturbed soils as soon as possible to reduce the likelihood of invasive plant reestablishment.
- Select plants for revegetation based on soil conditions, site hydrology, and shade tolerance.
- Identify a native plant community as your target for post-revegetation success.
- Plan to mimic the distribution, abundance, and structure of the target plant community.
- Only select species native to the project site.
- Determine the best time to plant or seed for the selected native species.

- Select locally collected seeds or plants grown from locally sourced seeds, when possible. Avoid pre-made mixes from unknown or far away sources.
- Consider live planting for those species that do not readily establish from seeding into natural landscapes.
- Select species that provide a range of flowering and fruiting times to maximize wildlife habitat.
- If topsoil will be removed as part of the project, plan carefully. Use locally salvaged topsoils if needed. Add commercially available weed-free organic materials if local topsoil is not available. If a large site contains only mineral soils you may need to inoculate with native soil. If so, collect native soil plugs locally.
- In areas of high erosion potential, seed with weed-resistant species.
- Encourage passive regeneration of native species present in the seedbank.
- Avoid the use of fertilizer because it may favor, accelerate, and spread invasive plants over desirable native plants. When fertilizer is necessary consider compost or organic slow release types and apply in the bottom of planting holes instead of to the soil surface.
- Limit amount and intensity of disturbance during pre-planting site preparation in order to discourage non-native invasive plants.
- Carefully consider, and mitigate to the extent possible, the potential for plantings to introduce new soil and plant pathogens as well as other invasive species.
- Inspect plant and seed material for quality and vigor prior to installation or dissemination and to verify non-invasive native species are being installed.
- Consider on a site by site basis the planting of live plant materials, which should be based on anticipated post-treatment native plant response, typical propagation techniques used for establishment of desired species (e.g., propagation using poles, plugs, containerized, bare root), and accessibility of the site for post-planting care and maintenance.
- Evaluate seed application methods based on site location, conditions and species requirements, and may include drilling, broadcast, seedballs, hydroseeding, mulching, or other regional approaches.
- When possible, protect revegetation areas from deer and other damaging wildlife. Such measures should be short-term, localized, typically confined to areas that are relatively accessible, tested to ensure they do not negatively impact wildlife, particularly threatened and endangered species, through entrapment, entanglement or collision.
- When possible, assist plant establishment with techniques such as irrigation and mulching.

2.5 Alternatives Considered but Eliminated from Further Analysis

Alternatives initially considered by the NPS for fulfilling the purpose and need for the proposed action but ultimately dismissed from further analysis in this IPMP/EA include the following:

- The NPS considered analyzing each of the treatment methods described in Sections 2.3.3 through 2.3.8 as a separate alternative in the IPMP/EA. Through additional consideration, however, it was determined that ultimately making only one treatment method available to the 15 NCR parks as the preferred alternative would substantially limit the parks' ability to manage

invasive plant species, given the wide range of such species and affected resources found throughout the region. For this reason, alternatives based on singular treatment methods were dismissed from analysis in the IPMP/EA.

- Alternatives that prioritized the treatment of non-native invasive plant species by the adverse impact they pose to particular park resources (e.g., natural resources, cultural resources, visitor resources) using all of the treatment methods described in Sections 2.3.3 through 2.3.8 were considered by the NPS. Because the value of specific types of resources in each park varies widely throughout the NCR, it was determined that such an approach would not provide the parks with sufficient flexibility in implementing the treatment methods. Therefore, such alternatives were dismissed from further analysis in the IPMP/EA.
- The NPS considered making all of the treatment methods described in Sections 2.3.3 through 2.3.8 available to the NCR parks and implementing a protocol by which the parks would initially apply the least aggressive treatment methods followed by increasingly aggressive methods. Similarly, the NPS considered an alternative whereby all of the treatment methods could be applied, beginning with the most aggressive method followed by decreasingly aggressive methods. However, following further discussion, it was determined that what constitutes a “more aggressive” treatment or “less aggressive” treatment would vary widely from site to site throughout the NCR and would not provide the parks with sufficient flexibility to choose and implement the various treatment methods. Thus, these alternatives were dismissed from further consideration in the IPMP/EA.
- An alternative was considered by the NPS under which non-native invasive plants would only be treated during the regional growing season. Similarly, the NPS also considered an alternative in which non-native invasive plants would be treated year-round. After further analysis, it was determined that limiting the treatment of non-native invasive plants to the regional growing season would unnecessarily restrict the parks’ application of treatment methods and was dismissed from further consideration. Providing parks with the flexibility to treat non-native invasive plants was incorporated as an element of the proposed action analyzed in the IPMP/EA.
- An alternative that would prioritize the treatment of non-native plants that primarily impact forested areas of the NCR was initially considered by the NPS during the development of the IPMP/EA. This alternative was ultimately dismissed from further consideration, however, as it was determined that it would unnecessarily limit parks in the treatment of non-native invasive plants that impact other resources in NCR parks, such as cultural and visitor resources.
- Alternatives were considered by the NPS that would establish short-term (1 to 3 years) or longer-term (3 to 5 years, beyond 5 years) goals for the implementation of non-native invasive plant methods in the NCR. However, such alternatives were ultimately dismissed from consideration, as they would unnecessarily restrict the flexibility of the NCR parks in applying the necessary treatment methods. The NPS ultimately determined that the IPMP/EA should remain an open-ended plan with regard to timeframe for implementation, which is reflected in this document.
- The NPS considered an alternative that singularly prioritized the treatment of non-native invasive plant species by their abundance throughout the NCR. However, it was determined that conditions with regard to non-native invasive plant species vary widely throughout the NCR and that such an approach would limit the flexibility of the parks in applying treatments. Therefore, this prioritization approach was dismissed from analysis as an individual alternative and was merged to develop the action alternative analyzed in the IPMP/EA.

- The NPS considered an alternative that singularly prioritized the treatment of non-native invasive plant species by their presence in high-value areas of each NCR park. However, it was determined that conditions with regard to non-native invasive plant species vary widely throughout the NCR and that such an approach would limit the flexibility of the parks in applying treatments. Therefore, this prioritization approach was dismissed from analysis as an individual alternative and was merged to develop the action alternative analyzed in the IPMP/EA.

2.6 Summary of Impacts by Alternative

Table 2-5 summarizes the impacts of each alternative on resources analyzed in the IPMP/EA. As applicable for each resource, the NPS would use BMPs to minimize short-term impacts resulting from the application of treatment methods included in the alternatives.

Table 2-5: Summary of Impacts by Alternative

Impact Topic	No Action Alternative	Alternative 1 – Implement the IPMP (Preferred Alternative)
Vegetation	The No Action Alternative would have no or negligible adverse short-term impacts on native vegetation, depending on the non-native invasive plant treatment method used. It would have long-term beneficial impacts. It would have beneficial cumulative impacts.	Alternative 1 would result in slightly greater short-term adverse impacts than the No Action Alternative because it would additionally include biological treatment methods, aerial spraying, and prescribed fire. Short-term impacts would be negligible or minor, depending on the treatment method. Alternative 1 would have beneficial long-term impacts. It would have beneficial cumulative impacts.
Wildlife and Habitat	The No Action Alternative would have no, negligible, or minor short-term adverse impacts depending on the non-native invasive plant treatment method used. It would have no or negligible long-term impacts depending on the treatment method used, which would be offset by beneficial impacts from increase in native species. It would have beneficial cumulative impacts.	Alternative 1 would result in slightly greater short-term adverse impacts than the No Action Alternative because it would additionally include biological treatment methods, aerial spraying, and prescribed fire. Short-term adverse impacts would remain negligible. Alternative 1 would have long-term beneficial impacts and beneficial cumulative impacts.
Cultural Resources	The No Action Alternative would have no short- or long-term adverse impacts on cultural resources. While some treatment methods have the potential to affect historic resources, each treatment action would be reviewed in accordance with Section 106 of the National Historic Preservation Act and the 2008 Programmatic Agreement (PA) for the operation, management, and administration of the National Park System. Review under Section 106 and the PA would ensure any potential adverse effects are avoided, minimized, or mitigated. The No Action Alternative would have beneficial long-term impacts and beneficial cumulative impacts.	Alternative 1 would have no short- or long-term adverse impacts on cultural resources. While some treatment methods have the potential to affect historic resources, each treatment action would be reviewed in accordance with Section 106 of the National Historic Preservation Act and the 2008 PA for the operation, management, and administration of the National Park System. Review under Section 106 and the PA would ensure any potential adverse effects are avoided, minimized, or mitigated. The No Action Alternative would have beneficial long-term impacts and beneficial cumulative impacts.

Impact Topic	No Action Alternative	Alternative 1 – Implement the IPMP (Preferred Alternative)
Visitor Use and Experience	The No Action Alternative would have no, negligible, or minor adverse impacts on visitor experience depending on the park and the treatment method used. These adverse impacts would be localized and limited in time and space. The No Action Alternative would have beneficial long-term impacts and beneficial cumulative impacts.	Alternative 1 would have no, negligible, or minor adverse impacts on visitor experience depending on the park and the treatment method used. These impacts could be slightly greater than under the No Action Alternative because Alternative 1 additionally includes biological treatment methods, aerial spraying, and prescribed fire. They would remain localized and limited in time and space. Alternative 1 would have beneficial long-term impacts and beneficial cumulative impacts.
Park Operations and Management	The No Action Alternative would have no short-term or long-term impacts on park operations and management. It would have no adverse cumulative impacts.	Alternative 1 would have no adverse short-term or long-term impacts on park operations and management. It would have long-term beneficial impacts and beneficial cumulative impacts.

2.7 Environmentally Preferable Alternative

The NPS is required to identify the environmentally preferable alternative in its NEPA documents for public review and comment. The NPS, in accordance with the policies of the Department of the Interior contained in the Departmental Manual (DM) (516 DM 4.10) (Department of the Interior) and the CEQ's *NEPA's Forty Most Asked Questions Concerning CEQ's National Environmental Policy Regulations* (CEQ 1981), defines the environmentally preferable alternative (or alternatives) as the alternative that best promotes the national environmental policy expressed in NEPA (Section 101(b) (516 DM 4.10). In their *Forty Most Asked Questions*, CEQ further clarifies the identification of the environmentally preferable alternative, stating "Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources."

After completing the environmental analysis, the NPS identified Alternative 1 as the environmentally preferable alternative in this IPMP/EA because it best meets the definition established by the CEQ.

The implementation of the No Action Alternative would fail to meet the purpose and need of the NCR IPMP/EA because a targeted strategy for the treatment of non-native invasive plants would not be enacted and the full suite of methods available to the 15 NCR parks for the treatment of such plants would be restricted. This would continue to have an adverse impact on natural and cultural resources in the NCR because the treatment of non-native invasive plants would continue to be inconsistent and less than optimal. Thus, the No Action Alternative fails to meet the purpose and need of the IPMP/EA and does not meet the definition established by the CEQ.

Alternative 1 would provide the parks with a programmatic plan that identifies long-term strategies for the treatment of non-native invasive plants and includes a full suite of treatment methods and techniques. The implementation of Alternative 1 would reduce the impacts of (or threats from) non-native invasive plants on natural and cultural resources and provide opportunities for restoring native plant communities and cultural landscapes. Therefore, Alternative 1 meets the purpose and need of the IPMP/EA and the definition established by the CEQ, and it is the NPS's environmentally preferable alternative.

3 AFFECTED ENVIRONMENT

This chapter describes the environment of the area that would be affected by the proposed action, as required by the CEQ's regulations implementing NEPA (40 CFR Part 1500).

For the purposes of the IPMP/EA and when applicable to the topic, this chapter describes the affected environment for the impact topics discussed under two separate categories: (1) upland environments and (2) aquatic, riparian, and wetland environments. Generally, aquatic, riparian, and wetland environments include naturally occurring and human-made bodies of surface water (e.g., rivers, streams, creeks, ponds, and canals), marshes, swamps, bogs, vernal pools, bottomland forests, and floodplains. Any non-wetland forests, grasslands, fields, or other open areas are categorized as uplands. These two categories encompass the range of environments occurring in NCR parks and provide an appropriate context for the discussion of impacts that uniquely affect those environments. A list of scientific names for all species of vegetation and wildlife referenced in this chapter, alphabetized by species common name, is included as Appendix B. Impacts resulting from the implementation of the proposed treatment methods are presented in Chapter 4.

Consistent with the IPMP/EA's intended use as a programmatic document, the descriptions in this chapter are broad in scope and characterize existing conditions within NCR parks in general terms. Before the implementation of the treatment methods included in the Environmentally Preferable Alternative, park managers would consider park- and site-specific conditions and determine whether additional compliance requirements are applicable to the proposed treatment methods.

3.1 Vegetation

This section describes plant communities and representative species of native plants that are known to commonly occur in upland and aquatic, riparian, and wetland environments in NCR parks. Ecological systems present in each park are shown on the figures included in Appendix A. Species of non-native invasive plants known to occur in the region are also discussed. "Commonly" denotes that the species described in this section are generally considered to be abundant and are not protected under federal, state, or District of Columbia legislation. However, given the wide variations in climate, topography, and other factors across the NCR, many of the plants and communities described in this section are not evenly distributed and may be more likely to occur in some areas of the region than others. Generally, species of vegetation listed in this section are presented as representative examples of those commonly occurring in the region and are not intended to provide a comprehensive listing of vegetation in the NCR.

The physiographic provinces of the mid-Atlantic United States provide a starting point for understanding the occurrence and distribution of plant species and communities in the NCR. The NCR straddles four physiographic provinces: the Ridge and Valley, Blue Ridge, Piedmont, and Coastal Plain. Table 3-1 shows the distribution of the NCR parks across these four provinces.

Each province is unique in its climate, soils, and overall habitat conditions. Though many plant species occur in all four provinces and the entire NCR, each province has its own specific concentrations and assemblages of plant communities. Each province also displays variations along a north-south axis related to climate and along an east-west axis related to topography and elevation (Weakley et al. 2012).

Table 3-1: Physiographic Provinces within the National Capital Region

Park	Ridge and Valley	Blue Ridge	Piedmont	Coastal Plain
ANTI	X			
CATO		X		
CHOH	X	X	X	X
GWMP			X	X
GREE				X
HAFE	X			
MANA			X	
MONO			X	
NACE			X	X
NAMA			X	X
PISC				X
PRWI			X	
ROCR			X	X
WHHO			X	X
WOTR			X	

3.1.1 Upland Environment Vegetation

This section describes upland environments within the four physiographic provinces. These descriptions also apply in general terms to the NCR parks within each province. Table 3-2 presents common plant species found in the NCR's uplands. The following paragraphs provide more detailed descriptions of each physiographic province.

Table 3-2: Common Plant Species Occurring in Upland Environments of the NCR

Growth Habit	Common Name
Overstory Trees	American beech
	northern red oak
	white ash
	chestnut oak
	pignut hickory
	Virginia pine
	white oak
Understory Trees/Shrubs	deerberry
	flowering dogwood
	mountain laurel
	redbud
	winged sumac
	Serviceberry

Growth Habit	Common Name
Forbs/Herbs/Grass-like	common milkweed
	common woodrush
	downy rattlesnake plantain
	Indianhemp
Vines	eastern poison ivy
	summer grape
	Virginia creeper

3.1.1.1 Ridge and Valley Vegetation

ANTI, HAFE, and a portion of CHOH are within the Ridge and Valley physiographic province. As shown in Table 3-3, ten ecological systems occur within uplands in the Ridge and Valley province. At least one park or portion of park is within each system.

Table 3-3: Ecological Systems Occurring in Upland Environments of the Ridge and Valley

Ecological System Name	ANTI	CHOH	HAFE
Appalachian (Hemlock)-Northern Hardwood Forest			X
Appalachian Shale Barrens		X	
Central Appalachian Alkaline Glade and Woodland		X	
Central Appalachian Dry Oak-Pine Forest		X	X
Central Appalachian Pine-Oak Rocky Woodland		X	X
North-Central Appalachian Acidic Cliff and Talus		X	X
North-Central Appalachian Circumneutral Cliff and Talus		X	X
Northeastern Interior Dry-Mesic Oak Forest	X	X	X
Southern and Central Appalachian Cove Forest		X	X
Southern and Central Appalachian Mafic Glade and Barrens			X

Forests characterize the uplands of the Ridge and Valley physiographic province, covering areas that are not maintained as grasslands, agriculture, or meadows. Forests cover 63 percent of the province, with 88 percent of those forests made up of deciduous hardwoods. Dry-mesic upland forests are present on large expanses at low to mid elevations, where the topography is flat to gently rolling, and occasionally steep. Species characteristic of these forests include northern red oak, chestnut oak, scarlet oak, black oak, white oak and Virginia pine, with mixtures of blueberries, mountain laurel, and various shrubs adapted to acidic soils making up the understory. Ravines, coves, and concave landforms support slightly more diverse forests characterized by mixtures of oaks, hickories, sugar maple, American basswood, eastern Hemlock, cucumber tree, and tuliptree. Representative understory species include chinquapin oak, eastern redbud, and flowering dogwood. Lower elevation ridges and associated valleys are known for their high density of herbaceous plants and possibility for numerous rare species (NatureServe 2015; Weakley et al. 2012).

3.1.1.2 Blue Ridge Vegetation

CATO and a portion of CHOH are within the Blue Ridge physiographic province. As shown in Table 3-4, six ecological systems occur within uplands in the Blue Ridge. Dry-mesic upland forests are common in this province. They are characterized by species such as northern red oak, chestnut oak, scarlet oak, and

Virginia pine. Northern hardwood forests are another common forest in the Blue Ridge province. These forests consist of tree species such as sugar maple and American beech, with species such as black cherry, red maple, and sweet birch interspersed. The understory is usually well developed, with species such as flowering dogwood, mountain laurel, blueberry, viburnum, and deerberry. Common herbaceous species are wintergreen, wild sarsaparilla, violet wood-sorrel, jack-in-the-pulpit, trout-lily, and numerous others. Rocky outcrops in this province support a patchy mosaic of open woodland and grassy herbaceous vegetation, sometimes with a predominant woody short-shrub community present. In the partially wooded cliffs and talus slopes, the vegetation is patchy and often sparse, punctuated by patches of small trees that may form woodlands in places. (NatureServe 2015, Weakley et al. 2012).

Table 3-4: Ecological Systems Occurring in Upland Environments of the Blue Ridge

Ecological System Name	CATO	CHOH
Appalachian (Hemlock)-Northern Hardwood Forest	X	
Central Appalachian Dry Oak-Pine Forest	X	
Central Appalachian Pine-Oak Rocky Woodland	X	
North-Central Appalachian Acidic Cliff and Talus	X	
Northeastern Interior Dry-Mesic Oak Forest	X	
Southern and Central Appalachian Mafic Glade and Barrens	X	
Note: 1. CHOH does not have any ecological systems denoted as upland mapped within NPS boundaries for the Blue Ridge physiographic province.		

3.1.1.3 Piedmont Vegetation

MANA, MONO, PRWI, WOTR, and portions of CHOH, GWMP, and ROCR are within the Piedmont physiographic province. As shown in Table 3-5, eleven ecological systems occur within the uplands of the Piedmont, with a NCR park or portion of one in each of them. Approximately 59 percent of the uplands of the Piedmont are forested. The vegetation of the Piedmont has a long history of disturbance, including clearing, logging, and conversion to agriculture. Species composition in hardwood stands varies with soil type and topography. In the northern Piedmont, Virginia pine and tuliptree are common early successional trees.

Dry-mesic upland forests in the Piedmont province are characterized by species such as northern red oak, chestnut oak, scarlet oak, and Virginia pine. Moist soils often support northern red oak and black oak, while drier soils are dominated by chestnut oak, scarlet oak, and southern red oak. Other common trees include shagbark hickory, American beech, white ash, red maple, and black gum. Piedmont Hardpan Woodland and Forest occur in places where a particularly dense clay hardpan has developed over rocks. White oak, pignut hickory, and white ash are characteristic overstory in this type of forest. Understory trees and herbaceous plants vary widely due to climate and soil type, but include species such as eastern boxelder, flowering dogwood, lowbush blueberry, and black huckleberry (Weakley et al. 2012).

Table 3-5: Ecological Systems Occurring in Upland Environments of the Piedmont

Ecological System Name	CHOH	GWMP	MANA	MONO	PRWI	ROCR	WOTR
Appalachian (Hemlock)-Northern Hardwood Forest			X		X		
Central Appalachian Dry Oak-Pine Forest	X	X	X	X	X	X	X
Central Appalachian Pine-Oak Rocky Woodland	X	X					
North-Central Appalachian Acidic Cliff and Talus				X			
North-Central Appalachian Circumneutral Cliff and Talus	X	X					
Northeastern Interior Dry-Mesic Oak Forest	X	X	X	X	X		
Northern Atlantic Coastal Plain Hardwood Forest	X				X	X	
Piedmont Hardpan Woodland and Forest	X	X	X				
Southern and Central Appalachian Cove Forest	X	X					
Southern and Central Appalachian Mafic Glade and Barrens	X						
Southern Atlantic Coastal Plain Mesic Hardwood Forest	X	X		X	X	X	X

3.1.1.4 Coastal Plain Vegetation

GREE, NACE, PISC, and portions of GWMP and ROCR are within the Coastal Plain physiographic province. As shown in Table 3-6, four ecological systems occur within the uplands of the Coastal Plain, with NCR parks or portions of NCR parks in each. Approximately 59 percent of the uplands in the Coastal Plain are forested. The upland forests that originally covered much of the province have been extensively cleared or altered for agriculture. Upland forests in the Coastal Plain are characterized by species such as northern red oak, chestnut oak, American beech, scarlet oak, and Virginia pine. Secondary trees include sourwoods, blackgum, and red maple. Common understory species include American holly, mountain laurel, flowering dogwood, and deerberry. Christmas fern, downy rattlesnake-plantain, Virginia heartleaf, and partridge-berry are frequent evergreen herbs found in Coastal Plain forests (NatureServe 2015; Weakley et al. 2012; VDCR 2013).

Table 3-6: Ecological Systems Occurring in Upland Environments of the Coastal Plain

Ecological System Name	GWMP	GREE	NACE	PISC	ROCR
Central Appalachian Dry Oak-Pine Forest	X	X	X	X	X
Northern Atlantic Coastal Plain Hardwood Forest			X		
Northern Atlantic Coastal Plain Pitch Pine Barrens		X			
Southern Atlantic Coastal Plain Mesic Hardwood Forest	X	X	X	X	X

3.1.2 Aquatic, Riparian, and Wetland Environment Vegetation

This section describes the aquatic, riparian, and wetland environments within the four physiographic provinces in the NCR. These descriptions also apply in general terms to the NCR parks within each province. Table 3-7 presents plant species that are commonly found in aquatic, riparian, and wetland

environments of the NCR. The following paragraphs provide more detailed descriptions for each physiographic province.

Table 3-7: Common Plant Species Occurring in Aquatic, Riparian, and Wetland Environments of the NCR

Growth Habitat	Common Name
Overstory Trees	American sycamore
	blackgum
	eastern cottonwood
	green ash
	pin oak
	river birch
Understory Trees/Shrubs	black willow
	buttonbush
	common elderberry
	northern spicebush
	poison sumac
	box elder
Forbs/Herbs/Grass-like	wingstem
	cardinal flower
	smallspike false nettle
	jewelweed
	cattail
	skunk cabbage
	Virginia wild rye
Ferns	sensitive fern
	Virginia chain fern
Vines	common greenbrier

3.1.2.1 Ridge and Valley Vegetation

ANTI, HAFE, and a portion of CHOH are within the Ridge and Valley physiographic province. As shown in Table 3-8, two ecological systems are associated with the aquatic, riparian, and wetland environments of the Ridge and Valley, with a park or part of a park within each. Ecological systems in the NCR for this physiographic province are associated with the Potomac River and its tributaries.

Floodplain systems consist of wetland and upland vegetation on river deposits and scoured vegetation on depositional bars. Characteristic vegetation includes sugar maple, sweet birch, eastern cottonwood, and sycamore. Common understory species include pawpaw, southern arrowwood, and northern spicebush. Depressional swamps occur in more generally upland settings of the Ridge and Valley province where water pools due to limited soil drainage. Vegetation in open ponds is typically zoned with an outer ring of trees, a more interior ring of shrubs, herbs and vines, and a central area with or without standing water year-round, depending on precipitation. Common species in this type of environment include red maple, black gum, sweetgum, and buttonbush (NatureServe 2015; Weakley et al. 2012; VDCR 2013).

Table 3-8: Ecological Systems Occurring in Aquatic, Riparian, and Wetland Environments of the Ridge and Valley

Ecological System Name	ANTI	CHOH	HAFE
Central Appalachian River Floodplain	X	X	X
Piedmont Upland Depression Swamp		X	

3.1.2.2 Blue Ridge Vegetation

CATO and a portion of CHOH are within the Blue Ridge physiographic province within the NCR. As shown in Table 3-9, two ecological systems occur within aquatic, riparian, and wetland environments of the Blue Ridge. Only a small portion of the Blue Ridge province's land area is classified as aquatic or wetlands; however, NCR land within the province is disproportionately within areas influenced by the Potomac River and its tributaries. Floodplain systems in the province consist of wetland and upland vegetation on river deposits and scoured vegetation on depositional bars. Characteristic vegetation includes sugar maple, sweet birch, eastern cottonwood, and sycamore. Common understory species include pawpaw, southern arrowwood, and northern spicebush. Vegetation near streams and other drainage features is often a mosaic of forest, woodland, shrubland, and herbaceous communities. Areas adjacent to stream systems often lack a broad flat floodplain because of steeper side slopes, higher gradient, or both. Plant communities in these areas are influenced by flooding, erosion, or groundwater seepage. Central Appalachian seepage swamps are known to occur in the province and are characterized by nutrient-demanding wetland species (NatureServe 2015; Weakley et al. 2012; VDCR 2013).

Table 3-9: Ecological Systems Occurring in Aquatic, Riparian and Wetland Environments of the Blue Ridge

Ecological System Name	CATO	CHOH
Central Appalachian River Floodplain		X
Central Appalachian Stream and Riparian	X	

3.1.2.3 Piedmont Vegetation

MANA, MONO, PRWI, WOTR and portions of CHOH, GWMP, and ROCR are located in the Piedmont physiographic province. Seven aquatic, riparian and wetland ecological systems occur within this province, and approximately 3 percent of the province is classified as riverine or wetland. As shown in Table 3-10, all of these ecological systems are represented within Piedmont physiographic province parks.

Common wetlands in the province include upland depression swamps, floodplain forests, and alluvial swamps. River floodplain forests are characterized by pin oak, willow oak, sweet birch, sweetgum, and sycamore. Shallow seasonally flooded upland depressions are also frequently associated with the Piedmont. Overstory trees commonly associated with these wetlands include willow oak and sweet gum. Common understory species include spicebush, sweetbay, and possumhaw. Typical herbaceous vegetation includes woolgrass, black bugbane, and Canadian woodnettle. Ferns such as netted chainfern and cinnamon fern are also characteristic of low-lying areas. (NatureServe 2015, Weakley et al. 2012, VDCR 2013).

Table 3-10: Ecological Systems Occurring in Aquatic, Riparian, and Wetland Environments of the Piedmont

Ecological System Name	CHOH	GWMP	MANA	MONO	PRWI	ROCR	WOTR
Central Appalachian River Floodplain	X	X	X	X			
Central Appalachian Stream and Riparian	X	X	X			X	X
Northern Atlantic Coastal Plain Basin Swamp and Wet Hardwood Forest	X	X		X			
Northern Atlantic Coastal Plain Fresh and Oligohaline Tidal Marsh		X					
Northern Atlantic Coastal Plain Stream and River					X		
Northern Atlantic Coastal Plain Tidal Swamp		X					
Piedmont Upland Depression Swamp	X	X	X		X		

3.1.2.4 Coastal Plain Vegetation

GREE, NACE, PISC, and portions of CHOH, GWMP, and ROCR are within the Coastal Plain physiographic province. As shown in Table 3-11, six ecological systems occur within aquatic, riparian, and wetland environments of the Coastal Plain. Wetlands make up nearly 18 percent of the Coastal Plain region. Wetlands are more prominent on the NCR land in this province because of the parks associated with the Potomac and Anacostia rivers. Wetlands in the Coastal Plain and NCR include tidal estuaries, riverine and riparian habitat, forested swamps, seasonally flooded ponds and depressions, seepage slope wetlands, and various tidal and non-tidal aquatic habitats. Floodplain forests in the province consist of willow oak, red maple, sycamore, pin oaks, and sweetgums. Species characteristic of forest swamps include blackgum, green ash, red maple, pin oaks, and willow oaks. Marsh and estuarine areas along the Potomac and Anacostia rivers are likely to be characterized by narrowleaf cattail, common threesquare, arrow arum, pickerelweed, sweetflag, and wild rice (Weakley et al. 2012, VDCR 2013).

Table 3-11: Ecological Systems Occurring in Aquatic, Riparian, and Wetland Environments of the Coastal Plain

Ecological System Name	CHOH	GWMP	GREE	NACE	PISC	ROCR
Central Appalachian River Floodplain	X	X	X	X	X	
Northern Atlantic Coastal Plain Basin Swamp and Wet Hardwood Forest		X	X		X	
Northern Atlantic Coastal Plain Fresh and Oligohaline Tidal Marsh		X	X	X	X	
Northern Atlantic Coastal Plain Pitch Pine Lowland			X			
Northern Atlantic Coastal Plain Stream and River	X	X	X	X	X	
Northern Atlantic Coastal Plain Tidal Swamp		X	X	X	X	
Note: 1. ROCR does not have any ecological systems denoted as Aquatic, Riparian, and Wetland environments mapped within NPS boundaries for the Coastal Plain physiographic province.						

3.2 Wildlife and Habitat

The NCR is home to a wide range of animal species, including mammals, amphibians, birds, fish, insects, mollusks, arthropods, annelids, and freshwater sponges. Wildlife species listed in this section are presented as representative examples of those commonly occurring in the region and are not intended to provide a comprehensive listing of wildlife in the NCR. As previously noted, “common” denotes species that are generally considered to be abundant and are not protected under federal, state, or District of Columbia legislation. However, given the wide variations in climate, topography, and other factors across the NCR, the distribution or abundance of the wildlife species addressed in this section may vary widely throughout the region.

Habitat for wildlife is species dependent. Every species requires a general environment in which to live that includes cover (shelter), food, water, and space within which to obtain food and water and to reproduce. Some species that are specialized require a narrow range of environmental conditions or are dependent on a specific diet. The selection of habitat is a specialized process that has taken species many generations to develop. Broad habitat types include forests, farmlands, grasslands, wetlands, streams, rivers, marshes, and even developed areas such as cities and suburbs. Edge habitat refers to the boundary between two habitat types and often has larger diversity and concentrations of species than other habitats. Given the wide variations in climate, topography, and other factors across the NCR, the presence or abundance of habitat types varies from park to park.

3.2.1 Upland Environment Wildlife and Habitat

Representative examples of common wildlife species known to occur in upland environments in the NCR are listed in Table 3-12. These are species generally likely to be encountered in NCR parks, though actual occurrences would depend on each park’s location, size, and general environment. The white-tailed deer is one species that is actively managed by NPS in the NCR due to its over-abundance in some locations (NPS 2011). Common habitat types in uplands include forests, grasslands, agriculture fields, and rocky outcrops.

Table 3-12: Common Wildlife Species Occurring in Upland Environments of the NCR

Type of Animal	Common Name
Mammals	gray squirrel
	little brown bat
	raccoon
	red fox
	white-tailed deer
Birds	American robin
	Carolina chickadee
	American crow
	northern cardinal
	red-headed woodpecker
	red-tailed hawk
	turkey vulture
	wild turkey
Reptiles and Amphibians	eastern garter snake
	eastern rat snake

3.2.2 Aquatic, Riparian, and Wetland Environment Wildlife and Habitat

Table 3-13 lists representative examples of common wildlife species known to occur in aquatic, riparian, and wetland environments of the NCR. As with upland species, although these species are generally found across the NCR, their actual presence in individual parks depends on park location, size, and general environment. The Canada goose is a species that NPS actively manages in the NCR due to its overabundance at some locations (NPS 2011). Common habitat types in aquatic, riparian, and wetland environments include streams, rivers, bogs, swamps, marshes, and floodplain forests.

Table 3-13: Common Wildlife Species Occurring in Aquatic, Riparian, and Wetland Environments of the NCR

Type of Animal	Common Name
Mammals	beaver
	meadow vole
	muskrat
	raccoon
	river otter
	white-tailed deer
Birds	Canada goose
	green-winged teal
	mallard
	osprey
	red winged blackbird
	red-shouldered hawk
	solitary sandpiper
Reptiles and Amphibians	eastern newt
	eastern painted turtle
	northern red backed salamander
	northern water snake
	spring peeper
Fish, Shellfish and Crustaceans	burrowing crayfish
	common grass shrimp
	largemouth bass
	white crappie

3.3 Cultural Resources

Cultural resources in NCR parks encompass more than 13,000 years of human history. As of 2015, there are more than 1,178 historic and prehistoric archaeological sites, 70 cultural landscapes, and 3,305 historic and prehistoric structures included in the List of Classified Structures within the NCR parks. Museum objects also are cultural resources but they are not likely be affected by the proposed action; therefore, they are not considered further in the EA.

Cultural resources within the NCR that have the potential to be affected by the actions considered in the EA include cultural landscapes (consisting of historic sites, historic designed landscapes, historic

vernacular landscapes, and ethnographic landscapes), memorials, cemeteries, monuments and other commemorative works, buildings and structures, historic districts, and vistas and viewsheds.

Native vegetation is an important contributing element of nearly every outdoor cultural landscape in the 15 NCR parks. In some cases, non-native invasive plants are part of a cultural resource, for instance an historic design landscape such as a garden, and as such may need to be kept in place to maintain the original appearance of the landscape. Such uses are carefully managed by the NPS in accordance with *Management Policies*, Section 4.4.4. In other cases the presence of non-native invasive plants is not by design or is maintained only because it has not been possible to replace them with native plants. This may diminish the integrity of the resource. Examples include invasive shrubs obscuring a significant topographic feature in a historic landscape or a battlefield; or a visually attractive but mortar-damaging vine covering a historic brick structure. In these instances, it is the intent of the NPS to remove non-native invasive plants and inhibit their reestablishment through the most effective method available while avoiding adverse effects on the cultural resource.

In an effort to address potential impacts on cultural resources resulting from the implementation of the proposed undertaking, the NPS is conducting consultation with the SHPOs of Virginia, West Virginia, Maryland, and the District of Columbia. The NPS has also initiated consultation with federally recognized American Indian tribes in accordance with 36 CFR 800.3, Section 106 of the National Historic Preservation Act, 54 U.S.C. 306108. Copies of NPS correspondence to the Advisory Council on Historic Preservation (ACHP), SHPOs and federally recognized tribes as well as responses received to date are included in Appendix C. Consultation with the SHPOs and federally recognized tribes will be ongoing throughout the EA process.

The NPS is developing an assessment of effects (AOE) separately from this EA; the boundaries of the 15 NCR parks constitute the boundaries of the Area of Potential Effect (APE) for the proposed activities.

3.4 Visitor Use and Experience

The Organic Act of 1916 created the NPS to conserve park resources and “provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for future generations.” As set forth in *Management Policies, 2006*, the NPS would advance visitor use and enjoyment by “providing memorable educational and recreational experiences that would (1) help the public understand the meaning and relevance of park resources, and (2) foster development of a sense of stewardship.” To the extent possible, park staff are expected to ensure that visitors have a safe, meaningful, and satisfying park experience. Visitor experiences vary at each park and are dependent on the resources the park has to offer; however, all parks in the NCR generally share the following intended outcomes (NPS 2013):

- Visitors understand and appreciate park values and resources and have the information necessary to adapt to park environments. Visitors are provided with opportunities to enjoy the parks in ways that leave park resources unimpaired for future generations.
- Regulated recreational uses are promoted and basic visitor needs are met in keeping with park purposes.
- NPS facilities, programs, and services are accessible to and usable by all people, including those with disabilities.

Parks in the NCR receive between 40 and 45 million visitors annually. The majority of visitations occur during the warmer spring and summer months (i.e., April through September), although the wide range of activities offered by NCR parks provide recreation opportunities throughout the calendar year (NPS 2012).

3.4.1 Upland Environment Use and Experience

NCR parks include 43,000 acres of forested land and 717 miles of trails in areas of upland environments. These upland resources provide visitors with opportunities for camping, picnicking, hiking, jogging, cycling, and observing wildlife, among other activities. Other recreational opportunities in NCR parks include golfing at three NPS-owned golf courses, visiting memorial and commemorative sites or more than 3,000 Civil War-era structures, and attending concerts and other cultural productions. A number of parks also provide children's playgrounds and areas for active recreation such as baseball/softball and soccer fields and volleyball and basketball courts (NPS 2012).

3.4.2 Aquatic, Riparian, and Wetland Environment Use and Experience

Parks in the NCR include 250 miles of riverfront in addition to lakes, ponds, and other water bodies in areas of aquatic, riparian, and wetland environments. Recreational opportunities for visitors in aquatic, riparian, and wetland areas of NCR parks include fishing, boating, and observing wildlife.

3.5 Park Operations and Management

Park operating hours and seasons vary throughout the NCR. Parks are generally open for visitors during daylight and early evening hours on weekends and most weekdays. NCR parks are generally open to visitors year-round.

Generally, the management of parks in the NCR is led by a Park Superintendent. In addition to supervising the Administrative Division and division chiefs within the park, the Park Superintendent serves as the park's representative to external partners and may serve as the park information officer. The number of full-time and part-time staff in each division varies widely by park (NPS 2014). Divisions at each park can include the following:

- **Administration:** The Administration Division's responsibilities may include human resource management, budget, procurement and contracting, property management, operations, travel management, payroll and benefits programs, business services, excess/surplus property program, and utility program management.
- **Interpretation, Resource Education, and Visitor Services:** The responsibilities of the Interpretation, Resource Education, and Visitor Services Division may include interpretive planning and operations, visitor services, education program operations, curatorial services research, library management, collections management, contract management, living history program coordination, and volunteer program oversight. Interpretation, Resource Education and Visitor Services staff may also develop brochures, displays, educational materials, news releases, and other public outreach information.
- **Resource Management:** Responsibilities of the Resource Management Division may include NHPA, NEPA and NPS cultural resources compliance activities; vegetation and wildlife management; historic structure management; visual resource protection; agricultural lease programs; preservation and restoration; and trail management and construction.
 - **Non-native Invasive Plant Management:** Within the Resources Management Division, non-native invasive plants are typically managed under vegetation management programs. In some cases, especially in more developed portions of the park, these duties may also be implemented by the staff of the Facilities and Maintenance Division personnel. Responsibilities may include identification of target species, monitoring populations, establishing threshold/action levels, implementing treatments, evaluation of treatment

effectiveness, and conducting education programs regarding non-native plant identification and prevention. The treatment methods and BMPs described herein the IPMP would generally be implemented by the Resource Management Division staff at the park level.

- **Facilities and Maintenance:** The responsibilities of the Facilities and Maintenance Division may include general operational maintenance, preservation maintenance, contract management, fleet management and maintenance, turf management, landscape restoration, historic structure preservation and restoration, national cemetery maintenance and burials, fencing program oversight and operations, general and custodial services, and support for special events.
- **Visitor and Resource Protection:** This division's responsibilities may include enforcing existing wildlife, fishing, traffic, and other laws within park boundaries; protecting and preserving cultural and natural resources; managing the structural and wildland fire protection and prevention programs; providing emergency medical services; responding to and managing developing emergencies; and providing "on-the-ground" customer service, such as providing answers and information in response to general questions from park visitors (NPS 2016).

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4 ENVIRONMENTAL CONSEQUENCES

This chapter analyzes both beneficial and adverse impacts that would result from implementing either of the alternatives considered in this EA. Included in this chapter are discussions of impact topics, factors relating to cumulative impacts, definitions of impact thresholds (e.g., negligible, minor, moderate, and major), methods used to analyze impacts, and the analysis methods used for determining cumulative impacts. As required by CEQ regulations for implementing the NEPA, a summary of the environmental consequences for each alternative is provided in Table 2-5 (in Chapter 2, *Alternatives*). The resource topics presented in this chapter, and the organization of the topics, generally correspond to the resource discussions contained in Chapter 3, *Affected Environment*.

4.1 Key Definitions (Impacts, Impact Thresholds, and Cumulative Impacts)

4.1.1 Impact

This EA includes analyses of short-term, long-term, direct, indirect and cumulative impacts on each impact topic. Unless otherwise noted in Chapter 4, these terms are applied to the description of impacts as described below:

- **Short-term impact:** An effect that occurs within a short period of time (generally, 1 to 5 years) and would no longer be detectable, as the resource is returned to its pre-disturbance condition or appearance³.
- **Long-term impact:** A change in a resource or its condition that does not return the resource to its pre-disturbance condition or appearance and that for all practical purposes is considered permanent (i.e., persists beyond 5 years).
- **Direct impact:** An effect that is caused by an action and occurs in the same time and place. Direct impacts may occur in the short term or the long term.
- **Indirect impact:** An effect that is caused by an action but occurs later in time or is farther removed in distance, but is still reasonably foreseeable. Indirect impacts may occur in the short term or the long term.

4.1.2 Impact Thresholds

The intensity of impacts on a particular resource is described in the IPMP/EA using the following terms: no effect (or impact), negligible, minor, moderate, or major. A numerical value is assigned to each descriptor to provide a means of quantifying the intensity of the impact. General impact thresholds for impact topics analyzed in this IPMP/EA are described below:

- **No Effect:** Implementation of the alternatives and invasive plant management options would have no effect on the impact topic or the impact topic is not relevant in the park.
- **Negligible:** Implementation of the alternatives and invasive plant management options would have a highly localized, short-term, and/or non-measurable effect on the impact topic.
- **Minor:** Implementation of the alternatives and invasive plant management options would have a localized, short-term, and/or measurable but not readily noticeable effect on the impact topic.

³ Unless otherwise noted, short-term impacts described in this EA are those resulting from or otherwise associated with the technique(s) or process(es) used to implement a particular treatment method (e.g., soil disturbance from shovels, heavy equipment, or UTVs).

- **Moderate:** Implementation of the alternatives and invasive plant management options would have a regional, long-term, measurable, noticeable, and/or large-scale effect on the impact topic.
- **Major:** Implementation of the alternatives and invasive plant management options would have a substantial, regional, long-term, highly noticeable, and/or permanent effect on the impact topic.

Resource-specific impact thresholds were developed for each impact topic and are discussed further under each resource subsection in Chapter 4.

4.1.3 Cumulative Impacts

Cumulative impacts are "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts can result from individually minor, but collectively substantial, actions undertaken over time by various agencies (federal, state, and local) or private parties. CEQ regulations for implementing NEPA require an assessment of cumulative effects in the decision-making process for federal actions. Analyses of cumulative impacts applicable to each impact topic are included Chapter 4.

4.2 Methods for Establishing Impact Thresholds and Measuring Effects by Resource

The following elements were used in the general approach for establishing impact thresholds and measuring the effects of the alternatives on each resource:

- General analysis methods as described in guiding regulations, including the context and duration of environmental effects.
- 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 impacts of each alternative and their incremental impact when added to external actions regardless of agency (NPS, other federal or non-federal).

The above elements are described in the following sections.

4.2.1 General Analysis Methods

The analysis of impacts follows CEQ guidelines and DO-12 procedures and is based on the underlying goal of controlling, eliminating, and/or substantially reducing the number of non-native invasive plants in NCR parks. This analysis incorporates the best available scientific literature applicable to the region and setting, the species being evaluated, and the actions being considered in the alternatives.

As described in Chapter 1, the NPS created an interdisciplinary team to provide relevant input to the impact analysis. The applicable analysis methods are discussed for each resource topic addressed in Chapter 4, including assumptions and impact intensity thresholds.

4.2.2 Area of Analysis

Consistent with the intended use of the IPMP/EA as a programmatic document, the area of analysis for the impacts described in this chapter is the NCR. Individual jurisdictions comprising portions of the NCR and the parks located within each are presented in Table 4-1.

Table 4-1: Jurisdictions and Parks within the NCR

State or State-Level Jurisdiction	Local Jurisdiction ¹	Parks
Washington, DC	<i>Not applicable</i>	CHOH NACE NAMA ROCR WHHO
Maryland	Allegheny	CHOH
	Anne Arundel	GREE
	Frederick	CATO CHOH HAFE MONO
	Montgomery	CHOH
	Prince George's	GREE NACE PISC
	Washington	ANTI CHOH
Virginia	Arlington	GWMP
	City of Alexandria	GWMP
	Fairfax	GWMP WOTR
	Loudon	HAFE
	Prince William	MANA PRWI
West Virginia	Jefferson	HAFE
Note: 1. Local jurisdictions are counties unless otherwise specified.		

For some impact topics and cumulative impact assessments, the area of analysis may extend beyond the NCR. When applicable, the specific area of analysis for each impact topic is defined at the beginning of each topic discussion.

4.2.3 Impact Thresholds

Determining impact thresholds is a key component in applying NPS Management Policies and DO-12. These thresholds provide the reader and key decision makers with an idea of the intensity of a given impact on a specific topic. The impact threshold is determined primarily by comparing the effect to a relevant standard based on applicable or relevant/appropriate regulations or guidance, 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. Intensity definitions are provided throughout the analysis for negligible, minor, moderate, and major impacts. In all cases, the impact thresholds are defined for adverse impacts. Beneficial impacts are addressed qualitatively.

Potential impacts of all alternatives are described in terms of type (beneficial or adverse); context; duration (short- or long-term); and intensity (negligible, minor, moderate, major). Definitions of these descriptors include:

Beneficial: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.

Adverse: A change that declines, degrades, and/or moves the resource away from a desired condition or detracts from its appearance or condition.

Context: The affected environment within which an impact would occur, such as local, park-wide, regional, global, affected interests, society as whole, or any combination of these. Context is variable and depends on the circumstances involved with each impact topic. As such, the impact analysis determines the context, not vice versa.

Duration: The time frame during which impacts would occur. In this IPMP/EA, the duration of the impact is described as short-term or long-term. Unless otherwise noted for a particular impact topic, short-term impacts are those that would occur during or result from the proposed treatment activities and would end following the completion of such activities. Long-term impacts would occur or continue following the completion of the proposed treatment activities.

Intensity: The severity of the impact. Because definitions of impact intensity (negligible, minor, moderate, and major) vary by impact topic, intensity definitions are provided separately for each impact topic analyzed.

4.2.4 Cumulative Impacts Analysis Method

The CEQ regulations for implementing 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, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) 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 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 was necessary to identify other ongoing or reasonably foreseeable future projects and plans in the NCR and, if applicable, the surrounding area. Table 4-2 summarizes the actions that could affect resources in the NCR.

The analysis of cumulative impacts was accomplished using four steps:

Step 1 — Identify Resources Affected – Fully identify resources affected by any of the alternatives. These include the resources addressed as impact topics in Chapters 3 and 4.

Step 2 — Set Boundaries – Identify an appropriate spatial and temporal boundary for each resource. The geographic boundary for each resource topic is listed under each topic.

Step 3 — Identify Cumulative Action Scenario – Determine which past, present, and reasonably foreseeable future actions to include with each resource. Reasonably foreseeable projects are generally those anticipated to be fully or partially implemented in a 3- to 5-year period. These are listed in Table 4-2 and described below.

Step 4 — Cumulative Impact Analysis – Summarize the impacts of these other actions (x) plus impacts of the proposed action (y), to arrive at the total cumulative impact (z). This analysis is included for each resource in Chapter 4.

Table 4-2: Summary of NCR Cumulative Impact Projects

Project	Location	Description	Affected Resource Areas ¹	Status
Rock Creek Park Multi-Use Trail Rehabilitation Project	ROCR	The proposed action includes resurfacing, trail widening where environmentally feasible, modifications to the trail alignments and road crossings, directional and interpretive signage, and connections to and from the trails to other pedestrian and bicycle facilities.	Vegetation Wildlife and habitat Cultural resources Visitor use and experience Park operations and management	Future
White-tailed Deer Management Plan	ROCR	The NPS is implementing a deer management strategy that supports the long-term protection, preservation, and restoration of native vegetation and other natural and cultural resources in Rock Creek Park.	Vegetation Wildlife and habitat Cultural resources Visitor use and experience Park operations and management	Ongoing
White-tailed Deer Management Plan	CHOH HAFE	The NPS is developing a deer management plan and EA that will support the long-term protection, preservation, and restoration of native vegetation and other natural and cultural resources and landscapes at CHOH and HAFE.	Vegetation Wildlife and habitat Cultural resources Visitor use and experience	Ongoing / Future
Klinge Valley Trail Project	ROCR	The Federal Highway Administration (FHWA) in conjunction with the District Department of Transportation (DDOT) and in cooperation with the NPS is constructing a multi-use trail facility on a deteriorated, barricaded section of Klinge Road, NW. The project includes stream stabilization/ rehabilitation of Klinge Creek and will enable access to the Rock Creek Park multi-use trail from the Klinge Valley Trail.	Vegetation Wildlife and habitat Cultural resources Visitor use and experience Park operations and management	Ongoing
White-Tailed Deer Management Plan	ANTI MONO MANA (Virginia and Maryland)	The NPS is implementing a deer management strategy to protect, preserve, and restore cultural and natural resources in these NPS parks.	Vegetation Wildlife and habitat Cultural resources Visitor use and experience Park operations and management	Ongoing
Metropolitan Branch Trail	ROCR	When complete, the project will connect the Metropolitan Branch Trail system and provide a trail segment of the Fort Circle Parks Trail System proposed in the Fort Circle Parks Management Plan. The project will ensure the protection of natural and cultural resources.	Vegetation Wildlife and habitat Cultural resources Visitor use and experience	Ongoing
DC Water, Sewer, and Rehabilitation Projects ¹	Soapstone Valley Park (ROCR)	This project will evaluate and upgrade, replace or reroute 75- to 100-year-old sewer pipes running under Soapstone Valley Park	Vegetation Wildlife and habitat Cultural resources Visitor use and experience	Future

Project	Location	Description	Affected Resource Areas ¹	Status
	Glover Archbold Park (ROCR)	This project will evaluate and upgrade, replace or reroute a 75- to 100-year-old trunk sewer main running under Glover Archbold Park	Park operations and management	Future
	Sewer lining and manhole rehabilitation projects (ROCR)	These projects involve repairs/upgrades to sewer linings and manholes along Fenwick Branch, Pinehurst Creek, and Sherrill Drive, NW		Ongoing/Future
Rehabilitation of Oregon Avenue, NW	ROCR	DDOT and the FHWA will rehabilitate the 1.7-mile segment of Oregon Avenue, NW, between Military Road and Western Avenue to satisfy operational and safety needs in a manner sensitive to the project area's context and setting.	Vegetation Wildlife and habitat Cultural resources	Future
Rehabilitation of Broad Branch Road, NW	ROCR	DDOT and the FHWA will rehabilitate Broad Branch Road between Linnean Avenue and Beach Drive to satisfy operational and safety needs in a manner sensitive to the project area's context and setting.	Vegetation Wildlife and habitat Cultural resources	Future
White-Tailed Deer Management Plan	CATO	The NPS is implementing a deer management plan that promotes forest regeneration and protects, conserves, and restores native species and cultural landscapes.	Vegetation Wildlife and habitat Cultural resources Visitor use and experience Park operations and management	Ongoing
Restoration of Canal Operations at Hancock, milepost (MP) 122.12 to 124.59	CHOH (Maryland)	The NPS would rehabilitate and restore historic structures of the Chesapeake and Ohio Canal National Historical Park at Hancock, Maryland.	Vegetation Cultural resources Visitor use and experience Park operations and management	Ongoing
Proposed Offshore Submerged Channel Intake	CHOH (Maryland)	Washington Suburban Sanitary Commission (WSSC) would construct an offshore submerged channel intake for water supply at the Potomac Water Filtration Plant.	Vegetation Wildlife and habitat Cultural Resources Park operations and management	Future
Roadway and Drainage Improvements	GREE (Maryland)	The NPS is rehabilitating multiple interior park roads to improve the safety of motorists, cyclists, and pedestrians and to improve the visitor experience.	Vegetation Wildlife and habitat Visitor use and experience Park operations and management	Past/Ongoing
Dyke Marsh Wetland Restoration and Long-Term Management Plan	GWMP (Virginia)	The NPS would implement actions for restoration and long-term management of the tidal freshwater marsh and other associated wetland habitats that have been lost or impacted in Dyke Marsh.	Vegetation Wildlife and habitat Cultural resources Visitor use and experience Park operations and management	Future
Fort Hunt Park Site Development Plan	GWMP (Virginia)	The NPS would implement a site development plan for Fort Hunt Park to enhance visitor experiences and connections with park resources, to protect park resources, and to create a balance of park use that optimizes	Vegetation Wildlife and habitat Cultural resources Visitor use and experience	Future

Project	Location	Description	Affected Resource Areas ¹	Status
		recreation and resource protection.		
Langley Fork Park Land Exchange	GWMP (Virginia)	The Fairfax County Park Authority (FCPA) has proposed that the NPS transfer an approximately 53-acre parcel of NPS Tract 114-005 known as Langley Fork Park, within the GWMP adjacent to Langley Oaks Park in Fairfax County, to the FCPA in exchange for an acreage of equivalent value from Langley Oaks Park. Langley Fork Park is administered by the NPS and has been maintained and operated by the FCPA since 1980 under a special use permit.	Vegetation Wildlife and habitat Cultural resources Visitor use and experience Park operations and management	Future
Potomac Yard Metrorail Station	GWMP (Virginia)	The Federal Transit Administration in cooperation with the City of Alexandria and the Washington Metropolitan Area Transit Authority would build a Metrorail station adjacent to the GWMP in the Potomac Yard area of Alexandria.	Vegetation Wildlife and habitat Cultural resources	Future
Monocacy National Battlefield Public Access Plan	MONO	The NPS is developing a Public Access Plan and Environmental Assessment for Monocacy National Battlefield to look comprehensively at the battlefield's public access to park areas and resources.	Vegetation Wildlife Cultural resources Visitor use and experience Park operations and management	Future
Wetlands and Resident Canada Goose Management Plan	NACE (District of Columbia)	The NPS is preparing a plan to guide and direct the management of wetlands and resident (non-migratory) Canada geese at Anacostia Park. The NPS has been working to restore nearly 100 acres of tidal wetlands along the Anacostia River. This restoration effort has become jeopardized by the increasing number of grazing resident Canada geese that inhabit the park.	Vegetation Wildlife and habitat Visitor use and experience Park operations and management	Future
Construction Projects (general) ²	NCR (outside NPS parks)	Construction and development projects involving the demolition, maintenance, expansion, or construction of new and existing roads and buildings, and similar activities, are an ongoing occurrence throughout the NCR. To varying degrees, such projects frequently involve activities that include soil disturbance, the removal of existing vegetation, the planting of new vegetation for ornamental purposes and/or to minimize soil erosion, and/or the creation of new or removal of an existing impervious surface. Construction and development projects in the NCR may occur for periods spanning a single day to months or years, and may affect areas of land less than 1 acre to hundreds or thousands of acres. Proponents of construction and development projects in the NCR include federal, state, and	Vegetation Wildlife and habitat Species of concern Cultural resources Visitor use and experience Park operations and management	Past/Ongoing/ Future

Project	Location	Description	Affected Resource Areas ¹	Status
		local governments as well as private property owners.		
Landscape Projects (general) ²	NCR (outside NPS parks)	Landscape projects are an ongoing occurrence in the NCR and include activities that involve the removal of existing and/or planting of new vegetation and that are not otherwise associated with building or road construction and development projects. Such activities include farming, timber harvesting and forestry operations, landscape/grounds management, and wetlands restoration. Landscape projects in the NCR may occur over periods spanning a single day to multiple months or years, and may affect areas of land from less than 1 acre to hundreds or thousands of acres in size. Landscape project proponents include private property owners as well as federal, state, and local government agencies.	Vegetation Wildlife and habitat Cultural resources Visitor use and experience Park operations and management	Past/Ongoing /Future

Note:

¹ Only the impact topics that are also addressed in this IPMP/EA are listed.

² Affected resource areas listed for these projects are anticipated based on the general character of the projects; compliance documentation is not available.

4.3 Vegetation

4.3.1 Methods and Assumptions

Impacts on vegetation are based on the general vegetation conditions described in Section 3.1, Vegetation, and consideration of the encroachment and/or removal of vegetation that would result from the implementation of the proposed alternatives.

4.3.2 Study Area

The study area for vegetation impacts is the 15 NCR parks.

4.3.3 Impact Thresholds

Negligible: No native vegetation would be affected or some individual native plants could be affected as a result of the alternative, but there would be no effect on native species populations. Effects would generally occur on a small scale.

Minor: The alternative would affect some individual native plants and would also affect a relatively minor portion of those species' populations. Mitigation to offset adverse effects, such as on-site replacement of all trees removed over 6 inches diameter at breast height (DBH), could be required and would be effective.

Moderate: The alternative would affect some individual native plants and would also affect a sizeable segment of the species' population over a relatively large area. Mitigation to offset adverse effects could be extensive but would likely be successful. The loss of trees over 6 inches DBH would be mitigated on site.

Major: The alternative would have a considerable effect on native plant populations and affect a relatively large area in and out of the park. Mitigation measures to offset the adverse effects would be required and extensive, and success of the mitigation measures would not be guaranteed. The loss of trees over 6 inches DBH would be mitigated on site.

4.3.4 Impacts of the No Action Alternative

Under the No Action Alternative, the 15 NCR parks would continue to use the treatment methods and associated techniques they use now to manage non-native invasive plants. As previously noted, aerial spraying, biological treatments, and prescribed fire are not included in the No Action Alternative.

Impacts on vegetation in upland and aquatic, riparian, and wetland areas of the 15 NCR parks resulting from the use of treatment methods under the No Action Alternative would be as follows:

- **Chemical treatment methods:** Chemical treatment methods would include foliar spraying, cut surface, basal bark, glove applications, and/or hand wicking as described in Section 2.3.3. Short-term impacts on vegetation resulting from chemical treatment methods would include overspray of or absorption by non-targeted native plants, which would have the potential to damage or destroy native plants. To minimize such risks from chemicals applied at ground level, the NPS would identify non-targeted native species adjacent to targeted non-native invasive plant species prior to the application of chemicals and/or would use techniques to apply chemicals directly to targeted non-native species. Any adverse impacts on non-targeted native species would occur at the individual rather than population level. Chemical treatments would be handled, mixed and applied in accordance with manufacturer label instructions and applicable safety data sheets (SDS), further minimizing adverse impacts. Thus, adverse short-term impacts on non-targeted native vegetation resulting from chemical treatment methods conducted under the No Action Alternative would remain negligible.

Chemical treatment methods would not pose a long-term risk to native vegetation because chemicals would be absorbed by the targeted non-native plants and/or chemical molecules would bind to soil, and would have a low potential to migrate to non-targeted native species. Generally, chemical treatments would eliminate or substantially reduce non-native invasive plant species and enable individual specimens as well as communities of native plants to thrive. Individual specimens of native vegetation inadvertently targeted by chemical treatment methods would be replaced by new specimens that would be replanted or would regenerate naturally in their place following the completion of treatment activities. Thus, chemical treatment methods conducted under the No Action Alternative would have no long-term adverse impacts on native vegetation.

- **Manual treatment methods:** As discussed in Section 2.3.5, manual treatment methods would include hand pulling and non-motorized tools such as hand-held pruners and clippers. By their nature, manual treatment methods would be small in scale and would target specific non-native specimens singly or in small groups, leaving adjacent native vegetation undamaged. Thus, manual treatment methods would have no short-term or long-term adverse impacts on individual specimens or communities of native vegetation.
- **Mechanical treatment methods:** Mechanical treatment methods include digging tools such as shovels and trowels; gasoline-powered mowers, trimmers, or chainsaws; and bulldozers, tillers, and/or heavy loaders, as discussed in 2.3.6. Similar to manual treatment methods, mechanical methods would be used to target specific individual specimens or discrete groups of non-native invasive plants. Such precision would leave adjacent native vegetation undamaged. For this

reason, mechanical treatment methods would have no short-term or long-term adverse impacts on native vegetation in the 15 NCR parks.

- **Physical treatment methods:** As described in Section 2.3.7, physical treatment methods include smothering and solar sterilization. Such methods would be used in discrete areas where non-native invasive plants dominate. While some native vegetation may also be destroyed within these areas, such impacts would occur at the individual rather than population level and would remain negligible. The effects of physical treatment methods would cease upon the completion of the technique and the removal of the smothering material, and effects would not persist. Native vegetation would ultimately regrow or regenerate in the treated area. Thus, physical treatment methods would have negligible short-term adverse impacts and no long-term adverse impacts on native vegetation.
- **Cultural treatment methods:** Cultural treatment methods would include prevention, seeding/planting, the planting of cover crops and nurse crops, and livestock grazing, as described in Section 2.3.8. The use of cultural treatment methods under the No Action Alternative would promote the planting, growth, and regeneration of individual specimens and communities of native or adapted plants (e.g., cultivars; only cultivars known to be non-invasive would be considered – see BMPs in Section 2.4.7). In turn, such methods would reduce the likelihood of the establishment of non-native invasive plants. For these reasons, the use of cultural treatment methods would have no adverse short-term or long-term impacts on native vegetation in NCR parks.

BMPs such as those described in Section 2.4 would be used as applicable to minimize short-term adverse impacts on native vegetation. Park managers would evaluate the methods described above prior to their application and would comply with additional compliance requirements as necessary if impacts are anticipated to exceed the intensity of those described above.

Generally, the continued use of the methods described above would eliminate or reduce non-native competitors to native plant species in upland and aquatic, riparian, and wetland environments of NCR parks. However, the lack of a structured approach to prioritizing the systematic treatment of non-native invasive plant species in each park under the No Action Alternative might limit the frequency, quantity, and/or spatial extent of applications of existing treatment methods at the individual park level and continue to yield inconsistent results throughout the NCR. Overall, the No Action Alternative would result in beneficial impacts on vegetation.

4.3.4.1 Cumulative Impacts

A number of the projects listed in Table 4-2 would result in a loss of native vegetation as the project sites are cleared to prepare the site for new, improved, or enlarged facilities. This includes the Rock Creek Park Multi-Use Trail Rehabilitation Project, the Klinge Valley Trail Project, the Metropolitan Branch Trail Project, the Rehabilitation of Oregon Avenue, the Rehabilitation of Broad Branch Road, the Restoration of Canal Operations at Hancock, and the Potomac Yard Metro Station project. In general, the affected areas would be minor, with the Potomac Yard Metro Station causing the greatest such impacts for documented projects, with approximately 2 acres cleared. General construction and landscape projects also are likely to cause losses of native vegetation cover. A number of the cumulative projects partially offset these adverse effects by promoting native vegetation recovery, including the white-tailed deer management plans listed in Table 4-2, the Dyke Marsh Wetland Restoration and Long-Term Management Plan, the Roadway and Drainage Improvements projects, and the Wetlands and Resident Canada Goose Management Plan. However, the balance of past, ongoing, and reasonably foreseeable future project impacts on native vegetation is likely to be adverse at the regional level.

As described above, the No Action Alternative would generally have long-term beneficial impacts on native vegetation in upland and aquatic, riparian, and wetland areas of NCR parks. Thus, when considered along with past, present, and reasonably foreseeable future projects in the NCR, the No Action Alternative would not contribute additional adverse cumulative impacts and would have beneficial cumulative impacts on native vegetation.

4.3.4.2 Conclusion

The No Action Alternative would generally have beneficial long-term impacts on native vegetation. It would have no or negligible short-term impacts and beneficial long-term impacts on native vegetation due to the treatment and reduction of non-native invasive plant species in the 15 NCR parks. BMPs would be followed for all treatment methods. Chemical treatments would be applied in accordance with EPA-approved manufacturer label requirements. Due to overall improvements to conditions that support native vegetation, the No Action Alternative would contribute to beneficial cumulative impacts on native vegetation and would have no potential to contribute to adverse cumulative impacts on native vegetation in the NCR, when considered with past, present, and reasonably foreseeable future projects.

4.3.5 Impacts of Alternative 1 – Implement the IPMP

Under Alternative 1, the 15 NCR parks would be able to use all of the treatment methods and associated techniques included in the No Action Alternative as well as aerial spraying (see Section 2.3.3.1), biological treatment methods (see Section 2.3.4), and prescribed fire (see Section 2.3.7.3). Impacts on native vegetation in upland and aquatic, riparian, and wetland areas of the 15 NCR parks resulting from the use of the treatment methods included in Alternative 1 would be as follows:

- **Chemical treatment methods:** Short-term impacts on native vegetation resulting from chemical treatment methods would include overspray of or absorption by non-targeted native plants, which would have the potential to damage or destroy native plants. To minimize such risks from chemicals applied at ground level, the NPS would identify non-targeted native species adjacent to targeted non-native invasive plant species prior to the application of chemicals and/or would use techniques to apply chemicals directly to targeted non-native species.

In the case of aerial spraying, risk of overspray would be minimized by accurately delineating the areas to receive aerial spray treatments, by noting the locations of non-targeted invasive populations in those areas, by accounting for wind and other influential weather conditions, and by incrementally spraying smaller sections of a target area until the entirety of the area or targeted non-native plants have been treated. The use of aerial spraying may have greater impacts than ground level applications due to unexpected wind shifts and an increased potential for over spray. Therefore, aerial spraying may result in minor adverse impacts resulting from unintended spraying of non-target native plants.

For all chemical treatment methods, adverse impacts on non-targeted native species would occur at the individual rather than population level. Chemical treatments would be handled, mixed and applied in accordance with manufacturer label instructions and applicable SDS, further minimizing adverse impacts. Thus, adverse short-term impacts on individual specimens and communities of native vegetation resulting from chemical treatment methods conducted under Alternative 1 would range from negligible to minor, depending on whether aerial spray methods are used.

Chemical treatment methods would not pose a long-term risk to native vegetation because chemicals would be absorbed by the targeted non-native plants and/or chemical molecules would bind to soil, and would have a low potential to migrate to non-targeted native species.

Generally, chemical treatments would eliminate or substantially reduce non-native invasive plant species and enable native vegetation to thrive.

Individual specimens of native vegetation inadvertently targeted by aerial spraying would be replaced by new native specimens that would be replanted or would regenerate naturally in their place following the completion of spraying activities. For these reasons, chemical treatment methods conducted under Alternative 1 would range from negligible to minor long-term adverse impacts on individual specimens and communities of native vegetation.

- **Biological treatment methods:** Biological treatment methods, also known as biological control or biocontrol, involve the importation and release of host-specific natural enemies (or “agents”) to aid in the management of non-native invasive plants. Biological treatment methods would pose low risks to native vegetation because biological treatment agents are highly host-specific and would only affect targeted non-native invasive plants. As described in Section 2.3.4, biological agents are only approved for release if testing indicates a very low likelihood of non-target effects, as determined by the TAG, a group of experts who report to APHIS. Low likelihood of non-target effects is defined as the potential to occur rarely with multiple published references being available in agreement with the same conclusion. Any inadvertent adverse impacts on non-targeted native vegetation would be contained to areas that would be small within the context of the NCR. As such, biological treatment methods would have no or negligible short-term or long-term adverse impacts on individual specimens or communities of native vegetation.
- **Manual treatment methods:** By their nature, manual treatment methods would be small in scale and would target specific specimens of non-native invasive plants singly or in small groups, leaving adjacent native vegetation undamaged. Thus, manual treatment methods would have no short-term or long-term adverse impacts on individual specimens or communities of native vegetation.
- **Mechanical treatment methods:** Similar to manual treatment methods, mechanical methods would be used to target specific individual specimens or small groups of non-native invasive plants. Such precision would leave adjacent native vegetation undamaged. For this reason, mechanical treatment methods would have no short-term or long-term adverse impacts on individual specimens or communities of native vegetation in the 15 NCR parks.
- **Physical treatment methods:** Physical treatment methods, such as smothering or solar sterilization, would be used in discrete areas where non-native invasive plants are predominant. While some native vegetation may also be destroyed within these areas, such impacts would occur at the individual rather than population level and would remain negligible. The effects of physical treatment methods would cease upon the completion of the technique and the removal of the smothering material, and effects would not persist. Native vegetation would ultimately regrow or regenerate in the treated area. Thus, physical treatment methods, not including prescribed fires, would have negligible short-term adverse impacts and no long-term adverse impacts on individual specimens or communities of native vegetation.

Generally, the use of prescribed fire would be all-consuming within the treatment area and in the short term would destroy native vegetation as well as targeted non-native invasive plant species within that area, thereby resulting in short-term adverse impacts on native vegetation. However, such impacts on non-targeted native vegetation would occur at the individual rather than population level and would remain negligible. In the long term, prescribed fire would create conditions in which individual specimens as well as communities of native vegetation

would thrive while making the reestablishment of non-native invasive plant species less probable. The use of prescribed fire would be limited to NCR parks that have prepared fire management plans in accordance with DO-18 that specifically include prescribe fire as a management tool, and those parks would adhere to additional compliance requirements, as applicable, prior to implementing proposed prescribed fire treatment methods. Therefore, the use of prescribed fire in NCR parks under Alternative 1 would have no long-term adverse impacts on individual specimens or communities of native vegetation.

- **Cultural treatment methods:** The use of cultural treatment methods under Alternative 1 would promote the planting, growth, and regeneration of native or adapted vegetation (e.g., cultivars). In turn, such methods would prevent non-native invasive plant species from reestablishing. For these reasons, the use of cultural treatment methods would have no adverse short-term or long-term impacts on individual specimens or communities of native vegetation in NCR parks.

BMPs such as those described in Section 2.4 would be used as applicable to minimize short-term adverse impacts on native vegetation. Park managers would evaluate the treatment methods described above prior to their application and would comply with additional compliance requirements as applicable if impacts are anticipated to exceed the intensity of those previously described.

Generally, the treatment methods described above would have long-term beneficial impacts on individual specimens and communities of native vegetation in upland and aquatic, riparian, and wetland areas of NCR parks by removing or substantially reducing non-native invasive plant species and enabling native vegetation to thrive. Further, the implementation of Alternative 1 would establish a systematic framework for prioritizing the consistent and efficient treatment of non-native invasive plants and would provide the parks with additional tools for the treatment of non-native invasive plants, thereby providing them with greater flexibility based on park-specific conditions. Correspondingly, the quantity and/or frequency of treatments that would be applied as well as the spatial extent of areas receiving treatments would increase, which would ultimately lead to a greater reduction in the number of non-native invasive plants in the 15 NCR parks and enable native vegetation to thrive. For these reasons, Alternative 1 would have a beneficial long-term impact on individual specimens and communities of native vegetation throughout the NCR.

4.3.5.1 Cumulative Impacts

As explained in Section 4.3.4.1, the collective impacts on native vegetation of past, present, and reasonably foreseeable projects in the NCR are generally adverse. Alternative 1 would have long-term beneficial impacts on native vegetation in upland and aquatic, riparian, and wetland areas of NCR parks. Relative to the No Action Alternative, Alternative 1 would have additional long-term beneficial impacts from the use of aerial spraying, biological treatments, and prescribed fire, and from the establishment of a framework for prioritizing the treatment of non-native invasive plant species. Thus, like the No Action Alternative but to a greater extent, Alternative 1 would have beneficial cumulative impacts and would not result in adverse cumulative impacts on native vegetation.

4.3.5.2 Conclusion

Alternative 1 would have negligible short-term adverse impacts and would have beneficial long-term impacts on native vegetation due to the treatment and reduction of non-native invasive plant species in the 15 NCR parks. BMPs would be followed for all treatment methods. Chemical treatments would be applied in accordance with EPA-approved manufacturer label requirements. Biological treatment methods would only be used after proper vetting and approval by the USDA APHIS. Due to overall improvements to conditions that support native vegetation, Alternative 1 would contribute to

cumulatively beneficial impacts on native vegetation when considered with past, present, and reasonably foreseeable actions in the NCR.

4.4 Wildlife and Habitat

4.4.1 Methods and Assumptions

The NPS is dedicated to preserving the natural abundance, diversity, dynamics, distribution, habitat, and behavior of native animal populations and the communities in which they occur. Impacts on wildlife and habitat are based on information obtained from NPS natural resource managers and the professional judgment of the multidisciplinary IPMP/EA team members.

4.4.2 Study Area

The study area for impacts on wildlife consists of the 15 NCR parks.

4.4.3 Impact Thresholds

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

Minor: Impacts on wildlife would be detectable, but they would not be expected to be outside the natural range of variability of native species' populations, their habitats, or the natural processes sustaining them. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: Mortality or interference with activities necessary for survival, such as breeding, migration, and foraging can be expected on an occasional basis, but is not expected to threaten the continued existence of wildlife populations in the park unit. Impacts on native wildlife populations, their habitats, or the natural processes sustaining them would be detectable, and they could be outside the natural range of variability. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.

Major: Impacts on native wildlife populations, their habitats, or the natural processes sustaining them would be detectable, and they would be expected to be outside the natural range of variability. Key ecosystem processes might be disrupted. Loss of habitat might affect the viability of at least some native wildlife populations. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.

4.4.4 Impacts of the No Action Alternative

Under the No Action Alternative, the 15 NCR parks would continue to use the treatment methods and associated techniques that are now used to manage non-native invasive plants. As previously noted, aerial spraying, biological treatments, and prescribed fire are not included in the No Action Alternative.

Impacts on wildlife and habitat in the 15 NCR parks resulting from the use of the treatment methods included under the No Action Alternative would be as follows:

- **Chemical treatment methods:** In the short term, the application of chemical treatments would have the potential to annoy, irritate, and in some cases destroy individual specimens of wildlife using targeted vegetation as habitat. In most cases, it is anticipated that wildlife would be flushed out of the area using Wildlife BMP techniques described in 2.4.5 and as a result temporarily leave the target area during treatment activities. To minimize impacts on wildlife and to the extent practicable, the NPS and/or its contractors would avoid applying treatments

during the breeding season of wildlife present in the target area and/or would dilute chemicals (according to label instructions) to reduce harm to animals while remaining effective against non-native invasive plants. All chemical treatments would be conducted consistent with the EPA-approved label and all concerns about impacts on non-targeted wildlife would be addressed and reviewed in accordance with Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), see Appendix F for further discussion. Chemical treatments would be handled, mixed and applied in accordance with manufacturer label instructions and applicable SDS, further minimizing adverse impacts. As necessary, aquatic-safe surfactants would be used in aquatic settings to minimize impacts on species inhabiting such environments. Any specimens inadvertently destroyed as a result of chemical treatment activities would represent an adverse impact at the individual rather than population level. Generally, the target area would return to a pre-treatment condition following the completion of treatment activities, and displaced wildlife would return to and repopulate the area as native vegetation regenerates. As previously noted, non-targeted vegetation that would be inadvertently damaged or destroyed by the treatments would be replaced or would regrow or regenerate and resume providing habitat. Thus, while short-term impacts on wildlife and habitat would be adverse, they would be minor.

Chemicals would be absorbed by the target plants and immediately surrounding soils and would have a low potential to migrate to non-targeted species; thus, they would pose low risk in the long-term to wildlife or vegetation providing habitat and would have negligible long-term adverse impacts.

- **Manual treatment methods:** Manual treatment methods would be small in scale and would target specific specimens singly or in small groups, leaving adjacent native vegetation providing habitat undamaged. In accordance with wildlife BMP techniques described in 2.4.5, wildlife would be flushed from the area and would temporarily leave while the treatment methods are being conducted to avoid human contact, but would return and resume breeding, nesting, and foraging activities upon the completion of the treatment activities; no individual specimens would be injured or destroyed. Thus, manual treatment methods would have negligible short-term or long-term adverse impacts on wildlife and habitat.
- **Mechanical treatment methods:** Similar to manual treatment methods, mechanical methods would be used to target specific individual specimens or small groups of non-native invasive plants. Such precision would leave adjacent native vegetation providing habitat undamaged. Although some individual specimens could potentially be injured or destroyed, resulting in an adverse impact, it is anticipated that the majority of wildlife would leave the area while the treatment methods are being conducted to avoid human contact. Following the completion of treatment activities, wildlife would return to the area and resume breeding, nesting, and foraging activities. For these reasons, mechanical treatment methods would have negligible or minor short-term adverse impacts and no long-term adverse impacts on wildlife and habitat in the 15 NCR parks.
- **Physical treatment methods:** Smothering or solar sterilization would be used in discrete areas where non-native invasive plants dominate. Some vegetation providing habitat may also be destroyed within these areas, thereby displacing individual specimens of ground- or understory-dwelling species. However, such impacts would occur at the individual rather than population level, and it is unlikely that any specimens would be damaged or destroyed; thus, short-term impacts would remain negligible. The effects of smothering or solar sterilization would cease upon the completion of the technique and the removal of the smothering material, and effects would not persist. Native vegetation providing habitat would ultimately regrow or regenerate in

the treated area, and displaced specimens of wildlife would return to the revegetated area. Thus, smothering or solar sterilization would have negligible short-term adverse impacts and no long-term impacts on wildlife and habitat.

- **Cultural treatment methods:** The use of cultural treatment methods under the No Action Alternative would promote the planting, growth, and regeneration of native or adapted vegetation (e.g., cultivars). In turn, such methods would prevent non-native invasive plant species from reestablishing. Although new vegetation would not necessarily provide the same habitat characteristics for wildlife, fruits, seeds, flowers, roots, and shoots of new plants could provide forage for some species. For these reasons, the use of cultural treatment methods would have no adverse short-term or long-term impacts on wildlife and habitat in NCR parks.

BMPs such as those described in Section 2.4 would be used as applicable to minimize short-term adverse impacts. Park managers would evaluate the treatment methods described above prior to their application and would comply with additional compliance requirements as applicable if impacts are anticipated to exceed the intensity of those described above.

Generally, the implementation of the treatment methods described above would have the potential to remove food and/or shelter provided by non-native plant species to which individual specimens or populations of native wildlife have adapted. In the short term, this would likely result in the displacement or destruction of individual specimens of wildlife and thus, an adverse impact.

In the long term, the elimination or reduction of non-native invasive plant species through the continued application of treatment methods included in the No Action Alternative would enable native vegetation that has historically provided food and habitat for native wildlife to thrive. In time, native wildlife would repopulate the treated areas as native vegetation regenerates. Thus, the No Action Alternative would have a long-term beneficial impact on wildlife and habitat in the NCR.

4.4.4.1 Cumulative Impacts

A number of the projects listed in Table 4-2 would have an adverse impact on wildlife, generally associated from a loss of habitat through vegetation clearing. This includes the Rock Creek Park Multi-Use Trail Rehabilitation Project, the Klingle Valley Trail Project, the Metropolitan Branch Trail Project, the Rehabilitation of Oregon Avenue, the Rehabilitation of Broad Branch Road, and the Potomac Yard Metro Station project. In general, the amount of lost habitat would be small or of limited quality, as it is located within or adjacent to developed areas. General construction and landscape projects also are likely to cause losses of habitat and adverse impacts on wildlife. A number of cumulative projects partially offset these adverse effects by promoting habitat recovery and controlling certain species of wildlife, including the white-tailed deer management plans, the Dyke Marsh Wetland Restoration and Long-Term Management Plan, the Roadways and Drainage Improvements projects, and the Wetlands and Resident Canada Goose Management Plan. However, the balance of past, ongoing, and reasonably foreseeable future project impacts on wildlife is likely to be negative at the regional level.

The No Action Alternative would generally have long-term beneficial impacts on wildlife by eliminating or substantially reducing non-native invasive plant species and enabling native plant species that provide habitat for native wildlife to thrive. Therefore, when considered with other past, present, and reasonably foreseeable future projects, the No Action Alternative would have cumulatively beneficial impacts on wildlife in the NCR and would not result in adverse cumulative impacts.

4.4.4.2 Conclusion

The No Action Alternative would have no, negligible or minor adverse short-term impacts and generally beneficial long-term impacts on wildlife and habitat due to the treatment and reduction of non-native

invasive plant species in the 15 NCR parks. BMPs would be followed for all treatment methods. Chemical treatments would be applied in accordance with EPA-approved manufacturer label requirements. The No Action Alternative would have cumulatively beneficial impacts on wildlife due to the potential to improve and rehabilitate native habitat.

4.4.5 Impacts of Alternative 1 – Implement the IPMP

Under Alternative 1, the 15 NCR parks would be able to use all of the treatment methods and associated techniques included in the No Action Alternative, as well as aerial spraying (see Section 2.3.3.1), biological treatment methods (see Section 2.3.4), and prescribed fire (see Section 2.3.7.3). Impacts on wildlife and habitat in upland and aquatic, riparian and wetland areas of the 15 NCR parks resulting from the use of these methods would be as follows:

- **Chemical treatment methods:** In the short term, spraying would have the potential to annoy, irritate and in some cases destroy individual specimens of wildlife using targeted vegetation as habitat, as well as damage or destroy non-target vegetation providing habitat. In most cases it is anticipated that wildlife would experience annoyance and as a result temporarily leave the target area during spraying activities. To minimize impacts on wildlife and to the extent practicable, the NPS and/or its contractors would avoid applying treatments during the breeding season of wildlife present in the target area, and/or would dilute chemicals (according to label instructions) to reduce harm to animals while remaining effective against non-native invasive plants.

All chemical treatments would be approved for use by the EPA and will have all concerns addressed about impacts on non-target wildlife reviewed in accordance with FIFRA. Chemical treatments would be handled, mixed and applied in accordance with manufacturer label instructions and applicable SDS, further minimizing adverse impacts. As necessary, aquatic-safe surfactants would be used in aquatic settings to minimize impacts on species inhabiting such environments. Any specimens inadvertently destroyed as a result of spraying activities would represent an adverse impact at the individual rather than population level. Generally, the target area would return to a pre-treatment condition following the completion of spraying activities, and displaced wildlife would return to and repopulate the area as native vegetation regenerates. As previously noted, non-targeted vegetation that would be inadvertently damaged or destroyed by the treatments would be replaced, or would regrow or regenerate and resume providing habitat. Thus, while short-term impacts on wildlife and habitat would be adverse, they would remain minor.

In the case of aerial spraying, risk of overspray would be minimized by accurately delineating the areas to receive aerial spray treatments, by noting the locations of non-targeted invasive populations in those areas, by accounting for wind and other influential weather conditions, and by incrementally spraying smaller sections of a target area until the entirety of the area or targeted non-native plants have been treated. The use of aerial spraying may have greater impacts than ground level applications due to unexpected wind shifts and an increased potential for over spray. Therefore, aerial spraying may result in minor adverse impacts resulting from unintended spraying of wildlife.

Chemicals would be absorbed by the target plants and immediately surrounding soils and would have a low potential to migrate to non-targeted species; thus, they would not pose a long-term risk to wildlife or vegetation providing habitat and would have negligible to minor adverse impacts.

- **Biological treatment methods:** Biological treatment methods would pose low risks to wildlife or habitat because biological agents are highly host specific and would only affect targeted non-native invasive plants. Biological agents are only approved for release if testing indicates a very low likelihood of non-target effects, as determined by TAG, a group of experts who report to APHIS (see Appendix F for more information). As such, biological treatment methods would have no short-term or long-term adverse impacts on wildlife and habitat.
- **Manual treatment methods:** Manual treatment methods would be small in scale and would target specific specimens singly or in small groups, leaving adjacent native vegetation providing habitat undamaged. It is anticipated that wildlife would temporarily leave the area while the treatment methods are being conducted to avoid human contact but would return and resume breeding, nesting, and foraging activities upon the completion of the treatment activities; no individual specimens would be injured or destroyed. Thus, manual treatment methods would have no short-term or long-term adverse impacts on wildlife and habitat.
- **Mechanical treatment methods:** Similar to manual treatment methods, mechanical methods would be used to target specific individual specimens or small groups of non-native invasive plants. Such precision would leave adjacent native vegetation providing habitat undamaged. Although some individual specimens could potentially be injured or destroyed, resulting in an adverse impact, it is anticipated that the majority of wildlife would leave the area while the treatment methods are being conducted to avoid human contact. Following the completion of treatment activities, wildlife would return to the area and resume breeding, nesting, and foraging activities. For these reasons, mechanical treatment methods would have negligible or minor short-term adverse impacts and no long-term adverse impacts on wildlife and habitat in the 15 NCR parks.
- **Physical treatment methods:** Physical treatment methods, such as solar sterilization, would be used in discrete areas where non-native invasive plants dominate. Some vegetation providing habitat may also be destroyed within these areas, thereby displacing individual specimens of ground- or understory-dwelling species. However, such impacts would occur at the individual rather than population level, and it is unlikely that any specimens would be damaged or destroyed; thus, short-term impacts would remain negligible. The effects of physical treatment methods would cease upon the completion of the technique and the removal of the smothering material, and effects would not persist. Native vegetation providing habitat would ultimately regrow or regenerate in the treated area, and displaced specimens of wildlife would return to the revegetated area. Thus, physical treatment methods, not including prescribed fires, would have negligible short-term adverse impacts and no long-term impacts on wildlife and habitat.

The use of prescribed fire would be indiscriminate within the treatment area and in the short term would destroy habitat and displace or potentially destroy wildlife in that area, thereby resulting in short-term adverse impacts on wildlife and habitat. Any such impacts would occur at the individual rather than population level and would remain negligible. To the extent practicable, the NPS and/or its contractors would further minimize these impacts by conducting prescribed fire activities outside the breeding season of wildlife in the target area. In the long term, prescribed fire would create conditions in which native vegetation providing habitat would thrive while making the re-establishment of non-native invasive plant species untenable. Displaced wildlife would return to the target area as suitable habitat regenerates. The use of prescribed fire would be limited to NCR parks that have prepared fire management plans, and those parks would adhere to additional compliance requirements as applicable prior to implementing proposed prescribed fire treatment methods. For these reasons, the use of

prescribed fire in NCR parks under Alternative 1 would have no long-term adverse impacts on wildlife and habitat.

- **Cultural treatment methods:** The use of cultural treatment methods under Alternative 1 would promote the planting, growth, and regeneration of native or adapted vegetation (e.g., cultivars). In turn, such methods would prevent non-native invasive plant species from reestablishing. Although new vegetation would not necessarily provide the same habitat characteristics for wildlife, fruits, seeds, flowers, roots, and shoots of new plants could provide forage for some species. For these reasons, the use of cultural treatment methods would have no adverse short-term or long-term impacts on vegetation in NCR parks.

BMPs such as those described in Section 2.4 would be used as applicable to minimize short-term adverse impacts. Park managers would evaluate the treatment methods described above prior to their application and would comply with additional compliance requirements as applicable if impacts are anticipated to exceed the intensity of those described above.

Generally, the implementation of the treatment methods described above would have the potential to remove food and/or shelter provided by non-native plant species to which individual specimens and populations of native wildlife have adapted. In the short term, this would likely result in the displacement or destruction of individual specimens of wildlife and thus, an adverse impact. However, the elimination or substantial reduction of non-native invasive plant species would ultimately enable native vegetation that has historically provided food and habitat for native populations of wildlife to thrive. In time, native wildlife would repopulate the treated areas as native vegetation regenerates. Thus, Alternative 1 would have a long-term beneficial impact on wildlife and habitat in the NCR.

The implementation of Alternative 1 would establish a systematic framework for prioritizing the consistent and efficient treatment of non-native invasive plants and would provide the parks with additional tools for the treatment of such plants, thereby providing them with greater flexibility based on park-specific conditions. Correspondingly, the quantity and/or frequency of treatments that would be applied as well as the spatial extent of areas receiving treatments would increase, which would ultimately lead to a greater reduction in the number of non-native invasive plants in the 15 NCR parks and enable native vegetation providing habitat for native wildlife to thrive. For these reasons, Alternative 1 would have a beneficial long-term impact on wildlife and habitat throughout the NCR.

4.4.5.1 Cumulative Impacts

As explained in Section 4.4.4.1, the collective impacts on wildlife of past, present, and reasonably foreseeable projects in the NCR are generally adverse. Alternative 1 would have long-term beneficial impacts on wildlife in upland and aquatic, riparian, and wetland areas of NCR parks. Relative to the No Action Alternative, Alternative 1 would have additional long-term beneficial impacts from the use of aerial spraying, biological treatments, and prescribed fire, and from the establishment of a framework for prioritizing the treatment of non-native invasive plant species. Thus, like the No Action Alternative but to a greater extent, Alternative 1 would have beneficial cumulative impacts. Like the No Action Alternative, it would not contribute to adverse cumulative impacts on wildlife in the NCR.

4.4.5.2 Conclusion

Alternative 1 would have no or negligible short-term impacts and beneficial long-term impacts on wildlife and habitat due to the treatment and reduction of non-native invasive plant species in the 15 NCR parks. BMPs would be followed for all treatment methods. Chemical treatments would be applied in accordance with EPA-approved manufacturer label requirements. Biological treatment methods

would only be used after proper vetting and approval by APHIS. Alternative 1 would have cumulatively beneficial impacts on wildlife due to the potential to improve and rehabilitate native habitat.

4.5 Cultural Resources

4.5.1 Guiding Regulations and Policies

The NHPA governs federal agencies in their handling of historic properties. Section 106 of the NHPA requires that federal agencies take into account the effects of their actions on historic properties. Historic properties, as defined by the implementing regulations of the NHPA (36 CFR 800), are any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). This term includes artifacts, records, and the remains that are related to and located within such properties, as well as traditional and culturally significant Native American sites and historic landscapes. Agencies must consult with the SHPO and the ACHP as required, and with other interested parties in an effort to avoid, minimize, or mitigate adverse effects. In addition to the NHPA, protection and management of cultural resources held by the NPS is governed by DO-28, *Cultural Resources Management Guidelines*, and NPS Management Policies 2006.

4.5.2 Methods and Assumptions

Under the provisions of Section 106, the NPS must evaluate effects on historic properties listed in or eligible for listing in the NRHP. The NPS categorizes its historic properties as archeological resources, cultural landscapes, historic structures and districts, museum objects, and ethnographic resources. Potential impacts on historic structures and districts, cultural landscapes, and archeological resources are of concern for the proposed activities. There would be no impacts on museum collections or ethnographic resources.

For the purposes of this IPMP/EA, “cultural resource” and “historic property” are considered synonymous. The analyses of effects on cultural resources that are presented in this section respond only to the requirements of NEPA. In this IPMP/EA, impacts on cultural resources are considered in terms of type, context, duration, and intensity, which is consistent with CEQ regulations for implementing NEPA. A separate AOE for Section 106 of the NHPA will be prepared in parallel with this IPMP/EA.

The NPS guide for evaluating impacts, DO-12, requires that impact assessment be scientific, accurate, and quantified to the extent possible. For cultural resources, it is rarely possible to measure impacts in quantifiable terms; therefore, impact thresholds must rely on the professional judgment of resource experts.

4.5.3 Area of Potential Effect

The boundaries of the 15 NCR parks constitute the APE for the proposed activities.

4.5.4 Impact Thresholds

For a resource to be eligible for listing or listed in the NRHP, it must possess historic significance and the features that convey its significance must have integrity. For purposes of evaluating potential impacts on historic structures and districts, the thresholds of change are defined as follows:

Negligible: The impact is at the lowest level of detection with neither adverse nor beneficial consequences.

Minor: Alteration of the patterns or features of a historic property would not diminish the integrity of the character-defining features or the overall integrity of the historic property.

Moderate: The project would alter the character-defining features of the historic property and diminish the integrity of the features of the historic property.

Major: The project would alter the character-defining features of the historic property and severely diminish the integrity of the features and the overall integrity of the historic property.

4.5.5 Impacts of the No Action Alternative

Under the No Action Alternative, the 15 NCR parks would continue to use the treatment methods and associated techniques that are used now to manage non-native invasive plants. As previously noted, aerial spraying, biological treatments, and prescribed fire are not included in the No Action Alternative.

The potential impacts on cultural resources in the 15 NCR parks resulting from the treatment methods included in the No Action Alternative are as follows:

- **All methods:** In cases where one or more invasive species are a component of the significance of a historic property (e.g., a historic designed landscape), removing these species could diminish the historic integrity of the affected property and result in an adverse effect. However, in such cases, the NPS carefully manages the relevant plants in accordance with *Management Policies*, Section 4.4.4, and removal treatment methods would generally not be applied. The following method-specific analyses pertain only to situations where the targeted invasive species are not a component of a resource's historic significance.
- **Chemical treatment methods:** The primary adverse effect on cultural resources potentially resulting from chemical treatment methods conducted under the No Action Alternative would be overspray. Overspray could affect the integrity of cultural resources by damaging or destroying native vegetation in cultural landscapes, or staining, discoloring, or otherwise damaging the structural or aesthetic integrity of a built resource or archeological material at the ground surface (i.e., material that is not buried). The NPS and/or contractors would minimize the potential for such effects by delineating cultural resources that could be affected prior to conducting chemical treatments and/or applying chemical treatments directly to target species. Chemical treatments would be handled, mixed and applied in accordance with manufacturer label instructions and applicable SDS, further minimizing the potential for adverse impacts.
- **Manual treatment methods:** Manual treatment methods would be small in scale and would target specific specimens of non-native invasive plants singly or in small groups, leaving any adjacent elements contributing to the integrity of a cultural resource undamaged. Ground-disturbing activities would be limited as much as possible, and the potential for below-ground resources would be reviewed prior to the implementation of manual treatment methods. Any resources present would be avoided, for instance by adopting an alternative treatment method that would not disturb the resources. Thus, manual treatment methods would have no potential to affect cultural resources.
- **Mechanical treatment methods:** Similar to manual treatment methods, mechanical methods would be used to target specific individual specimens or small groups of non-native invasive plants. Such precision would leave any adjacent contributing resources undamaged or unaltered. In cases where motorized and/or heavy equipment is used, the boundaries of treatment areas would be clearly delineated with high-visibility fencing or other markers to prevent damage to or the destruction of adjacent contributing elements. All temporary fencing and markers would be removed following the completion of treatment activities and cultural resources would be returned to a pre-treatment condition. Ground-disturbing activities would be limited as much as possible, and the potential for below-ground resources would be

reviewed prior to the implementation of mechanical treatment methods. Any resources present would be avoided, for instance by adopting an alternative treatment method that would not disturb the resources. For these reasons, the potential for mechanical treatment to have an adverse impact on cultural resources in the 15 NCR parks would be minimal.

- **Physical treatment methods:** Physical treatment methods, such as smothering or solar sterilization, would be used in discrete areas where non-native invasive plants dominate. While some native vegetation contributing to the integrity of a cultural resource may also be destroyed within these areas, such vegetation would be restored in the entirety of the treated area following the completion of the treatment and would resume contributing to the resource's integrity. Ground-disturbing activities would be limited as much as possible, and the potential for below-ground resources would be reviewed prior to the implementation of mechanical treatment methods. Any resources present would be avoided, for instance by adopting an alternative treatment method that would not disturb the resources. The effects of physical treatment methods would cease upon the completion of the treatment method and the removal of the smothering material, and effects would not persist. Thus, physical treatment methods would have minimal potential to result in adverse effects on cultural resources in the 15 NCR parks.
- **Cultural treatment methods:** The use of cultural treatment methods under the No Action Alternative would promote the planting, growth, and regeneration of native or adapted vegetation (e.g., cultivars) that contribute to cultural resources such as cultural landscapes and historic sites. In turn, such methods would prevent non-native invasive plant species that diminish the integrity of cultural resources from reestablishing. Thus, the use of cultural treatment methods would have no potential to result in adverse effects on cultural resources in the 15 NCR parks.

Thus, the potential for the No Action Alternative to result in adverse impacts on cultural resources would be minimal. Furthermore, regardless of the treatment method, the actions to be conducted under the No Action Alternative would be covered under the Programmatic Agreement executed on November 14, 2008 among the NPS, the Advisory Council on Historic Preservation (ACHP), and the National Conference of State Historic Preservation Officers (NCSHPO) (2008 PA). The 2008 PA established a program for Section 106 compliance for the operation, management, and administration of the National Park System. The PA establishes two processes for Section 106 review: a "streamlined" review processes for designated undertakings that meet established criteria and a "standard" review process for all other undertakings.

A majority of the actions to be conducted under the No Action Alternative would meet the conditions for streamlined review under the criteria defined in Section III.C.5 – Routine Grounds Maintenance and Section III.C.6 – Battlefield Preservation and Management of the 2008 PA. Those actions that do not meet the PA's criteria for streamlined review would be subject to the standard Section 106 review process as stated in the 2008 PA. Compliance with Section 106 in accordance with the 2008 PA would ensure that any potential adverse effects are identified, avoided, minimized, or mitigated as part of the action planning.

Given the low potential for adverse impacts, as described above, and the case-by-case review to be conducted for each action in accordance with Section 106 and the 2008 PA, the No Action Alternative would have no impacts on cultural resources.

To the contrary, the continued use of the treatment methods included in the No Action Alternative would generally have beneficial long-term impacts on cultural resources by eliminating or reducing non-

native invasive plant species that threaten the integrity of those resources. However, the lack of a structured approach to prioritizing the treatment of non-native invasive plant species in each park under the No Action Alternative could affect the frequency, quantity, efficiency, or spatial extent of applications of existing treatment methods in a manner that, ultimately, would yield inconsistent results throughout the NCR.

4.5.5.1 Cumulative Impacts

Impacts on cultural resources from the projects listed in Table 4-2 would generally be short-term, resulting from temporary construction activities, and have no durable, long-term impacts on those resources. The Rehabilitation of Broad Branch Road might affect archaeological resources, but these impacts would be limited in scope. Other projects, such as the wildlife management plans and the Dyke Marsh Wetland Restoration and Long-Term Management Plan, would have beneficial impacts through better land management. General construction and landscape projects have the potential to affect historic and archaeological sites, known and unknown, but these adverse impacts generally would be minimized through compliance with applicable state and federal laws and regulations. Overall, if taken together, projects in the NCR would likely have generally beneficial and minimally adverse effects on cultural resources.

Because, as explained above, the No Action Alternative would generally result in long-term beneficial impacts on cultural resources at the 15 NCR parks, when considered with other past, present, and reasonably foreseeable future actions, it would have no potential to contribute to cumulatively adverse impacts on such resources.

4.5.5.2 Conclusion

The No Action Alternative would have beneficial impacts on cultural resources in the 15 NCR parks by eliminating or reducing non-native invasive plant species that threaten the integrity of those resources. The No Action Alternative would generally result in long-term beneficial impacts on cultural resources and would not contribute to cumulatively adverse impacts on cultural resources in the NCR when considered with other past, present, and reasonably foreseeable future actions.

4.5.6 Impacts of Alternative 1 – Implement the IPMP

Under Alternative 1, the 15 NCR parks would be able to use all of the treatment methods and associated techniques included in the No Action Alternative as well as aerial spraying (see Section 2.3.3.1), biological treatment methods (see Section 2.3.4), and prescribed fire (see Section 2.3.7.3). Therefore, the potential impacts of Alternative 1 on cultural resources would be the same as under the No Action Alternative (see Section 1.1.5) plus those associated with the treatment methods specific to Alternative 1, which are described below:

- **Chemical treatment methods, including aerial spraying:** The potential impacts of chemical treatment methods, including aerial spraying, would be the same as under the No Action Alternative and would primarily be associated with the risk of overspray. This risk would potentially be greater when using aerial spraying. In addition to the measures described in Section 2.3.3.1, aerial spraying would not be used in areas where the risk of affecting cultural resources is determined to be too great, minimizing the potential for adverse impacts.

In the case of aerial spraying, risk of overspray would be minimized by accurately delineating the areas to receive aerial spray treatments, by noting the locations of non-targeted invasive populations in those areas, by accounting for wind and other influential weather conditions, and by incrementally spraying smaller sections of a target area until the entirety of the area or

targeted non-native plants have been treated. The use of aerial spraying may have greater impacts than ground level applications due to unexpected wind shifts and an increased potential for over spray. Therefore, aerial spraying may result in minor adverse impacts resulting from unintended spraying of cultural resources

- **Biological treatment methods:** Biological treatment methods would pose low risks to cultural resources, such as cultural landscapes, because biological agents are highly host-specific and would only affect targeted non-native invasive plants. As described in Section 2.3.4, biological agents are only approved for release if testing indicates a very low likelihood of non-target effects, as determined by the TAG, a group of experts who report to APHIS. As such, biological treatment methods have minimal potential for adverse impacts on cultural resources.
- **Physical treatment methods, including prescribed fire:** The potential effects of physical treatment methods under Alternative 1 would be the same as under the No Action Alternative (see Section 4.5.5) plus those specifically associated with prescribe fire. Generally, the use of prescribed fire would be all-consuming within the treatment area and in the short term would destroy any culturally meaningful vegetation in that area as well as targeted non-native invasive plant species, thereby resulting in potential short-term adverse impacts. However, any such impacts on non-targeted vegetation would be temporary. In the long term, prescribed fire would create conditions in which contributing vegetation would thrive while making the reestablishment of non-native invasive plant species untenable. The use of prescribed fire would be limited to NCR parks that have prepared fire management plans, and those parks would adhere to additional compliance requirements, as applicable, prior to implementing proposed prescribed fire treatment methods. Prescribed fire would not be used in any areas where it could result in damage to or the destruction of physical resources such as structures, monuments, and memorials. Therefore, physical treatment methods, including the use of prescribed fire, in NCR parks under Alternative 1 have minimal potential to result in adverse impacts on cultural resources.

Generally, the use of prescribed fire would be all-consuming within the treatment area and in the short term could adversely impact unknown cultural resources, thereby resulting in long-term adverse impacts.

Thus, the potential for Alternative 1 to result in adverse impacts on cultural resources would be minimal. Furthermore, as under the No Action Alternative and regardless of the treatment method, the actions to be conducted under Alternative 1 would be covered under the 2008 PA. It is anticipated that a majority of the actions to be conducted under Alternative 1 would meet the conditions for streamlined review under the criteria defined in Section III.C.5 – Routine Grounds Maintenance, Section III.C.6 – Battlefield Preservation and Management, and Section III.C.7 - Hazardous Fuel and Fire Management of the 2008 PA. Those actions that do not meet the PA's criteria for streamlined review would be subject to the standard Section 106 review process as stated in the 2008 PA. Compliance with Section 106 in accordance with the 2008 PA would ensure that any potential adverse effects are identified, avoided, minimized, or mitigated as part of the action planning.

Given the low potential for adverse impacts, as described above, and the case-by-case review to be conducted for each action in accordance with Section 106 and the 2008 PA, Alternative 1 would have negligible impacts on cultural resources.

The implementation of Alternative 1 would establish a systematic framework for prioritizing the consistent and efficient treatment of non-native invasive plants and would provide the parks with additional tools for the treatment of such plants, thereby giving each park greater flexibility based on

park-specific conditions. The quantity, frequency, and efficiency of treatments as well as the spatial extent of areas receiving treatments could increase, which would ultimately lead to a greater reduction in the number of non-native invasive plants in the 15 NCR parks. Generally, this would have a beneficial effect on cultural resources in the 15 NCR parks by removing or substantially reducing non-native invasive plant species that threaten the integrity of such resources.

4.5.6.1 Cumulative Impacts

Impacts on cultural resources from the projects listed in Table 4-2 would generally be short-term, resulting from temporary construction activities, and have no durable, long-term impacts on those resources. The Rehabilitation of Broad Branch Road might affect archaeological resources, but these impacts would be limited in scope. Other projects, such as the wildlife management plans and the Dyke Marsh Wetland Restoration and Long-Term Management Plan, would have beneficial impacts through better land management. General construction and landscape projects have the potential to affect historic and archaeological sites, known and unknown, but these adverse impacts generally would be minimized through compliance with applicable state and federal laws and regulations. Overall, if taken together, projects in the NCR would likely have generally beneficial and minimally adverse impacts on cultural resources.

Because, as explained above, Alternative 1 would generally result in long-term beneficial impacts on cultural resources at the 15 NCR parks, when considered with other past, present, and reasonably foreseeable future actions, it would have no potential to contribute to cumulatively adverse impacts on such resources.

4.5.6.2 Conclusion

Alternative 1 would have beneficial effects on cultural resources in the 15 NCR parks by eliminating or reducing non-native invasive plant species that threaten the integrity of those resources. Alternative 1 would generally result in long-term beneficial effects on cultural resources and would not contribute to cumulatively adverse impacts on cultural resources in the NCR when considered with other past, present, and reasonably foreseeable future actions.

4.6 Visitor Use and Experience

4.6.1 Methods and Assumptions

NPS Management Policies 2006 state 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. The 15 NCR parks provide a diversity of recreational opportunities and the potential for change in visitor experience was evaluated.

4.6.2 Study Area

The study area for the analysis of impacts on visitor use and experience consists of the 15 NCR parks.

4.6.3 Impact Thresholds

Thresholds for the intensity of impacts on visitor use and experience are defined as follows:

Negligible: Changes in visitor use and recreation resources would be barely perceptible. The visitor would not likely be aware of the effects associated with the action.

Minor: The visitor might be aware of the effects associated with the action, but would likely not express an opinion about it.

Moderate: Changes in visitor experience and recreation resources would be readily apparent. The visitor would be aware of the effects associated with the action and would likely express an opinion about the changes.

Major: Changes in visitor experience and recreation resources would be readily apparent and severely adverse. The visitor would be aware of the effects associated with the action and would likely express a strong opinion about the changes.

4.6.4 Impacts of the No Action Alternative

Under the No Action Alternative, the 15 NCR parks would continue to use the treatment methods and associated techniques that are used now to manage non-native invasive plants. As previously noted, aerial spraying, biological treatments, and prescribed fire are not included in the No Action Alternative.

To varying degrees, the use of the treatment methods included in the No Action Alternative in upland and aquatic, riparian, and wetland areas of the 15 NCR parks would restrict visitor access to areas actively undergoing treatment. Methods used to bar visitor access would include but would not be limited to verbal instructions from NPS staff and/or contractors, signage, caution tape, fencing, or other temporary physical barriers. Although restricting visitor access to such areas would potentially diminish the experience of visitors to the parks, such restrictions would be in the interest of protecting the health and safety of visitors.

Depending on the type of treatment used, access to the treated areas could continue to be restricted until safety conditions in those areas are restored to pre-treatment conditions (or better). However, any such adverse impacts on visitor use and experience would be temporary, as visitor access to and use of the treated areas would ultimately resume. The intensity of these impacts would vary widely throughout the 15 NCR parks and would range from being unnoticeable or barely noticeable (e.g., treatments being conducted in areas of parks not normally accessible to visitors; small areas undergoing chemical treatments or physical treatments such as solar sterilization or smothering) to being highly noticeable and displeasing (e.g., denuded areas that have been cleared of vegetation; popular areas such as playgrounds or hiking trails where visitor access is restricted due to ongoing treatments). It is not anticipated that any of the treatment methods included in the No Action Alternative would permanently prohibit visitor access to areas of the 15 NCR parks. The removal or substantial reduction of non-native invasive plant species in NCR parks would ultimately enhance visitor use and experience by restoring the parks to conditions more closely resembling those that were present at the time the parks were established or the events they commemorate occurred.

Although an intent of the treatment methods is to improve the quality of visitor use and experience, some park visitors may be displeased by or object to the use of some methods – particularly chemical and mechanical methods – in the short term due to personal ideology or an overall concern for human and animal health. However, it is likely that the intensity of displeasure would vary widely by park and could subside upon completion of the treatment activities. As previously noted, chemical treatments would be handled, mixed and applied in accordance with manufacturer label instructions and applicable SDS, further minimizing adverse impacts.

For these reasons, the No Action Alternative could have no, negligible, minor, or moderate short-term adverse impacts, depending on the park and the area affected, and beneficial long-term impacts on visitor use and experience in the 15 NCR parks.

Park managers would evaluate the methods included in the No Action Alternative prior to their application and would adhere to additional compliance requirements as necessary if impacts are anticipated to exceed the intensity of those described above. BMPs such as those described in Section 2.4 would be used as applicable to minimize short-term and long-term adverse impacts.

The continued use of the treatment methods included in the No Action Alternative would eliminate or reduce non-native plant species in upland and aquatic, riparian, and wetland environments of NCR parks and would restore the parks to conditions more closely resembling target conditions. However, the lack of a structured approach to prioritizing the treatment of non-native invasive plant species in each park under the No Action Alternative might limit the frequency, quantity, and/or spatial extent of applications of existing treatment methods and ultimately yield inconsistent results throughout the NCR. Overall, the No Action Alternative would result in beneficial long-term impacts on visitor use and experience.

4.6.4.1 Cumulative Impacts

The projects listed in Table 4-2 that are projects in parks would generally have short-term adverse impacts on visitors during construction or implementation activities. These adverse impacts include access restrictions or disturbance due to noise or construction activities nearby affecting the visitors' enjoyment of the park. Such impacts, however, are by definition temporary and as they do not take place at the same time in the affected parks, do not cumulatively contribute to a deterioration of visitor experience. In the long term, park projects are intended to improve the parks and thus the quality of the visitor experience, resulting in beneficial impacts. A partial exception is those visitors who might object to wildlife management measures, such as those defined in the white-tailed deer management plans or the Wetlands and Resident Canada Goose Management Plan. But such impacts would most likely be offset by the enhanced experience of other visitors who would enjoy the improvements to landscape and other park elements resulting from better management of certain species of wildlife. Non-park general construction and landscape projects near parks could potentially adversely affect visitor experience through increased development, noise, or visual clutter, but such impacts generally can be addressed and minimized through applicable environmental and land use policies and regulations at the federal, state, or local level. Overall, taken together, the projects in Table 4-2 are more likely to result in beneficial impacts to visitor use and experience of the NCR parks than in adverse impacts.

Any adverse impacts the No Action Alternative would have on visitor use and experience would be localized and limited in time and space. Long-term impacts would be beneficial. Thus, the No Action Alternative, when considered with other past, present, and reasonably foreseeable future projects, would not contribute to adverse cumulative impacts and would generally result in beneficial cumulative impacts on visitor use and experience.

4.6.4.2 Conclusion

The No Action Alternative would have no additional long-term adverse impacts and generally beneficial long-term impacts on visitor use and experience at the 15 NCR parks by restoring and rehabilitating park ecosystems closer to native conditions. BMPs would be followed for all treatment methods. Impacts on visitor use and experience would be localized and limited in time and space with long-term beneficial impacts. Thus, the No Action Alternative would not contribute to cumulatively adverse impacts on visitor use and experience when considered with past, present, and reasonably foreseeable future projects in the NCR.

4.6.5 Impacts of Alternative 1 – Implement the IPMP

Under Alternative 1, the 15 NCR parks would be able to use all of the treatment methods and associated techniques included in the No Action Alternative, as well as aerial spraying (see Section 2.3.3.1), biological treatment methods (see Section 2.3.4), and prescribed fire (see Section 2.3.7.3). To varying degrees, the use of the methods included in Alternative 1 in upland and aquatic, riparian and wetland areas of the 15 NCR parks would restrict visitor access to areas actively undergoing treatment. Methods used to bar visitor access would include but would not be limited to verbal instructions from NPS staff and/or contractors, signage, caution tape, fencing or other temporary physical barriers. Although restricting visitor access to such areas would potentially diminish the experience of visitors to the parks, such restrictions would be in the interest of protecting the health and safety of visitors.

Depending on the type of treatment used, access to the treated areas could continue to be restricted until safety conditions in those areas are restored to pre-treatment conditions (or better). However, any such adverse impacts on visitor use and experience would be temporary, as visitor access to and enjoyment of the treated areas would ultimately resume. The intensity of these impacts would vary widely throughout the 15 NCR parks and would range from being unnoticeable or barely noticeable (e.g., treatments being conducted in areas of parks not normally accessible to visitors; small areas undergoing chemical treatments or physical treatments such as solar sterilization or smothering) to being highly noticeable and displeasing (e.g., denuded areas that have been cleared of vegetation; popular areas such as playgrounds or hiking trails where visitor access is restricted due to ongoing treatments). It is not anticipated that any of the treatment methods included in Alternative 1 would permanently prohibit visitor access to areas of the 15 NCR parks. The removal or substantial reduction of non-native invasive plant species in NCR parks would ultimately enhance visitor use and experience by restoring the parks to target conditions.

Although one intent of the treatment methods is to improve the quality of visitor use and experience, some park visitors maybe be displeased by or object to the use of some methods – particularly chemical and mechanical methods – in the short term due to personal ideology or an overall concern for human and animal health. However, it is likely that the intensity of displeasure would vary widely by park and could subside upon completion of the treatment activities. As noted above, chemical treatments would be handled, mixed and applied in accordance with manufacturer label instructions and applicable SDS, further minimizing adverse impacts.

For these reasons, Alternative 1 could have no, negligible, minor or moderate short-term adverse impacts, depending on the park and the area affected, and beneficial long-term impacts on visitor use and experience in the 15 NCR parks.

Park managers would evaluate the methods included in Alternative 1 prior to their application and would adhere to additional compliance requirements as necessary if impacts are anticipated to exceed the intensity of those described above. BMPs such as those described in Section 2.4 would be used as applicable to minimize short-term and long-term adverse impacts.

The implementation of Alternative 1 would establish a systematic framework for prioritizing the consistent and efficient treatment of non-native invasive plants and would provide the parks with additional tools for the treatment of such plants, thereby providing them with greater flexibility based on park-specific conditions. The quantity, frequency, and efficiency of treatments as well as the spatial extent of areas receiving treatments could increase, which would ultimately lead to a greater reduction in the number of non-native invasive plants in the 15 NCR parks. Generally, this would have a beneficial effect on visitor use and experience by removing or substantially reducing non-native invasive plant species that diminish the quality and value of resources.

4.6.5.1 Cumulative Impacts

The projects listed in Table 4-2 that would fall within park boundaries would generally have short-term adverse impacts on visitors during construction or implementation activities. These adverse impacts include access restrictions or disturbances due to noise or construction activities nearby affecting the visitors' enjoyment of the park. Such impacts, however, are by definition temporary and as they do not take place at the same time in the affected parks, do not cumulatively contribute to a deterioration of visitor experience. In the long term, park projects are intended to improve the parks and, thus, result in beneficial impacts to the quality of the visitor experience. A partial exception is those visitors who might object to wildlife management measures, such as those defined in the white-tailed deer management plans or the Wetlands and Resident Canada Goose Management Plan. But such impacts would most likely be offset by the enhanced experience of other visitors who would enjoy the improvements to landscape and other park elements resulting from better management of nuisance species. Non-park general construction and landscape projects near parks could potentially adversely affect visitor experience through increased development, noise, or visual clutter, but such impacts generally can be addressed and minimized through applicable environmental and land use policies and regulations at the federal, state, or local level. Overall, taken together, the projects in Table 4-2 are more likely to result in beneficial impacts to visitor use and experience of the NCR parks than in adverse impacts.

Any adverse impacts Alternative 1 would have on visitor use and experience would be localized and limited in time and space. Long-term impacts would be beneficial. Thus, Alternative 1, when considered with other past, present, and reasonably foreseeable future projects, would not contribute to adverse cumulative impacts and would generally result in beneficial cumulative impacts on visitor use and experience.

4.6.5.2 Conclusion

Alternative 1 would have no additional short-term or long-term adverse impacts and would have generally beneficial long-term impacts on visitor use and experience at the 15 NCR parks by restoring and rehabilitating parks ecosystems closer to native conditions. BMPs would be followed for all treatment methods. Impacts on visitor use and experience would be localized and limited in time and space with long-term beneficial impacts. Thus, Alternative 1 would not contribute to cumulatively adverse impacts on visitor use and experience when considered with past, present, and reasonably foreseeable future projects in the NCR.

4.7 Park Operations and Management

4.7.1 Methods and Assumptions

Impacts on park operations and management are based on the information presented in Section 3.4, *Park Operations and Management*, and the anticipated effects of the proposed treatment activities included in each alternative.

4.7.2 Study Area

The study area for the analysis of impacts on park operations and management is composed of the 15 NCR parks.

4.7.3 Impact Thresholds

Thresholds for the intensity of impacts on park operations and management are defined as follows:

Negligible: Impacts would be barely detectable and would not have an appreciable effect on park operations.

Minor: The impact would be detectable and would be of a magnitude that would not have an appreciable effect on park operations.

Moderate: The impacts would be readily apparent and result in a substantial change in park operations in a manner noticeable to staff and the public.

Major: The impacts would be readily apparent, result in a substantial change in park operations in a manner noticeable to staff and the public, and be markedly different from existing operations.

4.7.4 Impacts of the No Action Alternative

Under the No Action Alternative, the 15 NCR parks would continue to use the treatment methods and associated techniques that are used now to manage non-native invasive plants. As previously noted, aerial spraying, biological treatments, and prescribed fire are not included in the No Action Alternative.

The treatment methods included in the No Action Alternative would have similar impacts on park operations and management in the 15 NCR parks. When feasible, the application of the various treatment methods would be conducted by NPS staff employed at the park or at the regional level. In cases where specialized expertise is required (e.g., licensed applicators for chemical and/or biological treatments, operators of heavy equipment), the NPS may hire additional full-time or part-time staff, or use contractors. Chemical treatments would be handled, mixed and applied in accordance with manufacturer label instructions and SDS, thereby ensuring that chemical concentrations would meet appropriate human exposure levels. The parks could use volunteers for low-risk treatments when the labor necessary to apply those treatments exceeds the capabilities of the existing park staff. The hiring of additional staff and the use of private contractors and/or volunteers would be conducted within the limitations of budget and administrative constraints. The level of effort required to treat non-native invasive plant species would vary from park to park but generally would not be expected to disrupt ongoing park operations and management procedures at the 15 NCR parks.

The lack of a structured approach to prioritizing the treatment of non-native invasive plant species in each park under the No Action Alternative could affect the frequency, quantity, efficiency, or spatial extent of applications of existing treatment methods in a manner that, ultimately, would yield inconsistent results throughout the NCR. However, this would not affect park operations and management in the 15 NCR parks.

Thus, the No Action Alternative would have no short-term or long-term impacts on park operations and management.

4.7.4.1 Cumulative Impacts

Because the No Action Alternative would have no short-term or long-term impacts on park operations and management, it has no potential to result in cumulative impacts when considered along with the past, present, and reasonably foreseeable future projects listed in Table 4-2. The No Action Alternative would not result in any cumulative impacts on park operations and management in the NCR.

4.7.4.2 Conclusion

The No Action Alternative would have no short-term or long-term impacts on park operations and management due to the treatment and reduction of non-native invasive plant species in the 15 NCR parks. BMPs would be followed for all treatment methods. Chemical treatments would be applied in accordance with EPA-approved manufacturer label requirements. The No Action Alternative would not

contribute any cumulative impacts on park operations and management in the NCR when considered with past, present, and reasonably foreseeable future actions.

4.7.5 Impacts of Alternative 1 – Implement the IPMP

Under Alternative 1, the 15 NCR parks would be able to use all of the treatment methods and associated techniques included in the No Action Alternative as well as aerial spraying (see Section 2.3.3.1), biological treatment methods (see Section 2.3.4), and prescribed fire (see Section 2.3.7.3). To varying degrees, the treatment methods included in Alternative 1 would have similar impacts on park operations and management in the 15 NCR parks. When feasible, the application of the various treatment methods would be conducted by NPS staff employed at the park or at the regional level. In cases where specialized expertise is required (e.g., licensed applicators for chemical and/or biological treatments and operators of heavy equipment), the NPS may hire additional full-time or part-time staff, or use contractors. Chemical treatments would be handled, mixed and applied in accordance with manufacturer label instructions and SDS, thereby ensuring that chemical concentrations would meet appropriate human exposure levels. The parks could use volunteers for low-risk treatments when the labor necessary to apply those treatments exceeds the capabilities of the existing park staff. The hiring of additional staff and the use of private contractors and/or volunteers would be conducted within the limitations of budget and administrative constraints. The level of effort required to treat non-native invasive plant species would vary from park to park but generally would not be expected to disrupt ongoing park operations and management procedures at the 15 NCR parks. Thus, Alternative 1 would have no short-term or long-term adverse impacts on park operations and management.

The implementation of Alternative 1 would establish a systematic framework for prioritizing the consistent and efficient treatment of non-native invasive plants and would provide the parks with additional tools for the treatment of such plants, thereby providing them with greater flexibility based on park-specific conditions. The use of such a framework and access to additional treatment options would generally have a beneficial long-term impact on park operations and management.

4.7.5.1 Cumulative Impacts

The park projects listed in Table 4-2 generally would have an adverse impact on park operations and management because of the need for park personnel to manage, monitor, or execute the projects, which would increase the demand on the park staff's time. Most of those adverse impacts are short-term and either decrease or disappear in the long term. For instance the Rock Creek Park Multi-Use Trail Rehabilitation will reduce the need for maintenance when completed. Management plans, such as the white-tailed deer management plans listed in Table 4-2, would allow park staff to focus on other park management issues once implemented. Non-park projects, such as the rehabilitation of Broad Branch Road, will require ROCR to open certain roads that may be closed to vehicle traffic. As such, non-park projects would potentially have no, minor or moderate adverse impacts on park operations and management.

Alternative 1 would have beneficial long-term impacts on park operations and management. When considered with other past, present, and reasonably foreseeable future actions, therefore, Alternative 1 would result in long-term beneficial cumulative impacts on park operations and management in the NCR.

4.7.5.2 Conclusion

Alternative 1 would have no short-term or long-term impacts on park operations and management due to the treatment and reduction of non-native invasive plant species in the 15 NCR parks. BMPs would be followed for all treatment methods. Chemical treatments would be applied in accordance with EPA-

approved manufacturer label requirements. Alternative 1 would have beneficial cumulative impacts on park operations and management in the NCR when considered with past, present, and reasonably foreseeable future actions.

5 CONSULTATION AND COORDINATION

5.1 Endangered Species Act Section 7 Coordination

The NPS is conducting inquiries for Threatened and Endangered species under Section 7 of the ESA using the USFWS's Environmental Conservation Online System (ECOS) search tool. Inquiries are being conducted on a quarterly basis, with the first inquiries conducted in January 2015. In each quarter, separate inquiries are conducted for counties of the three states – Virginia, West Virginia and Maryland – and the District of Columbia in which the 15 NCR parks are located. Results from these inquiries are reviewed against current NPS information regarding species of special concern in the 15 NCR parks and incorporated into the IPMP/EA as applicable.

Based on the results of the first inquiry conducted in January 2015 for species of special concern in West Virginia, the NPS submitted a letter with additional information describing the IPMP/EA to the West Virginia Field Office of the USFWS. A copy of this letter is included in Appendix D. In a letter dated April 14, 2015, the West Virginia Field Office responded that the project is not likely to adversely affect federally listed endangered or threatened species, and that no biological assessments or further Section 7 consultation is required. A copy of the USFWS response is included in Appendix D.

Informal consultation correspondence was sent by the NPS on March 17, 2016 to the Virginia Field Office and the Chesapeake Bay Field Office for Maryland and the District of Columbia. On April 4, 2016 the Virginia Field Office responded with new instructions for environmental review using their website. A follow up Self Certification Letter was submitted by the NPS on May 2, 2016 per the instructions on the Virginia Field Office's website. A copy of this correspondence is included in Appendix D.

To date, no further requests for additional information or responses have been received from USFWS field offices with jurisdiction in the NCR.

5.2 National Historic Preservation Act, Section 106 Coordination

In accordance with 36 CFR 800.3 of the regulations implementing Section 106 of the National Historic Preservation Act, the NPS sent letters initiating formal consultation to the State Historic Preservation Officers (SHPO) for Maryland, Virginia, West Virginia and the District of Columbia. A letter was also sent to the Advisory Council on Historic Preservation (ACHP) informing them of the project. Copies of these letters are included in Appendix C.

In a letter dated April 28, 2015, the Virginia Department of Historic Resources expressed support for the plan's objectives and provided a point of contact for additional requests or inquiries. A copy of this response is included in Appendix C.

On April 7, 2016 the NPS sent letters to the SHPOs for Maryland, Virginia, West Virginia, and the District of Columbia with a programmatic assessment of the effects of the proposed plan on historic properties and a statement that future park-level actions under the plan would be further reviewed under the terms of the 2008 PA. In a letter dated April 27, 2016 the District of Columbia's SHPO Office concurred with the finding of No Adverse Effect and the use of the streamlined review process under the 2008 PA for appropriate projects. A copy of this response is included in Appendix C. To date, no other responses have been received.

5.2.1 Tribal Coordination

In accordance with 36 CFR 800.3 of the regulations implementing Section 106 of the National Historic Preservation Act and 54 USC 306108, the NPS sent letters to federally-recognized Native American tribes

with a potentially interest in the project (copies in Appendix B). In a response dated September 23, 2015, the Delaware Nation stated that they have no concerns with the project (a copy of this response is included in Appendix C.) To date, no other responses have been received.

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7 Glossary of Terms

Action alternative — An alternative that proposes a new or different management action or actions than that used now to address the purpose, need, and objectives of the proposed activities assessed in the IPMP/EA; an action alternative proposes changes to the current management of invasive plants. Alternative 1 is the action alternative in the planning process analyzed in this IPMP/EA. See also *No Action Alternative*.

Active ingredient — The chemical or chemicals in a pesticide or herbicide responsible for killing, poisoning, or repelling a pest. Active ingredients are listed separately in the ingredient statement on the label of the pesticide's or herbicide's container.

Adjuvant (also referred to as additive) — A substance added to a pesticide to improve its effectiveness or safety.

Affected environment — The existing conditions in a given area that may be altered or impacted by the alternatives being considered.

Alien species⁴ (also referred to as exotic species, non-indigenous species, non-native species, or noxious weeds) — A species that has not evolved in concert with the species native to a place and is not a natural component of the natural ecosystem at that place.

Biological treatment method (also referred to as biological control agent[s], bio-control agent[s] or bioengineered product[s]) — The use of living organisms (such as insects or microbes) to manage targeted populations of pests. In the context of the IPMP/EA, the use of biological treatment methods is proposed only for the management of non-native invasive plants.

Brand name — The name or designation under which a specific pesticide or herbicide product or device made by a manufacturer or formulator is sold or marketed. A common example is Roundup®.

Certified applicator (also referred to as a registered or licensed applicator) — An individual who is approved by the state or other responsible jurisdiction to use or supervise the use of regulated pesticides and/or herbicides.

Community — The different populations of animal or plant species that exist together in an ecosystem.

Concentration — The amount of active ingredient in a given volume or weight of formulated product.

Cultural landscape — A geographic area (including both cultural and natural resources and the wildlife or domestic animals therein) associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values.

Cultural resource — The physical evidence of a place of past human activity. Cultural resources may include sites, objects, landscapes, structures, or natural features of significance to a group of people traditionally associated with them.

Cumulative impact — Effect on the environment that result from the incremental effect of the action when added to the past, present, and reasonable foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time and can be adverse or beneficial (40 CFR 1508.7).

Defoliant — A chemical that removes the leaves from trees and plants.

⁴ In the context of this IPMP/EA, the term "alien species" refers exclusively to species of non-native invasive plants.

Desiccant – A type of herbicide that draws moisture or fluid from a plant, causing it to die.

Ecosystem – An ecological system in which the interaction of living organisms with the nonliving environment produces an exchange of materials and energy between the living and nonliving.

Ecological System – Community of living organisms influenced by similar physical environments and natural processes are described as ecological systems. Forests, shrublands, grasslands, wetlands, and sparsely vegetated lands describe the majority of terrestrial classifications. Aquatic classifications generally consist of rivers, streams, lakes, estuaries, and oceans.

Environmental Assessment (EA) — An environmental analysis prepared pursuant to the National Environmental Policy Act that discusses the purposes and need for an action and provides sufficient evidence and analysis of impacts to determine whether to prepare an Environmental Impact Statement or Finding of No Significant Impact.

Exotic species – See *alien species*.

Fee boundary – The boundary of a national park that has been legislated by Congress.

Finding of No Significant Impact (FONSI) — A document prepared by a federal agency explaining why a proposed action would not have a significant impact on the environment and would not require the preparation of an Environmental Impact Statement (EIS). A FONSI is based on the analyses presented in an Environmental Assessment.

Habitat – The environment in which a plant or animal lives (includes vegetation, soil, water, and other factors).

Herbicide – A pesticide used to kill or inhibit plant growth.

Integrated pest⁵ management (IPM) – The coordinated use of accurate and relevant information with available management methods to prevent unacceptable levels of pest damage by the most economical means and with the least possible hazard to people and the environment. IPM includes reducing pests to a tolerable level. The application of pesticides (or herbicides in the context of the IPMP/EA) is not the primary management method, but is an element of IPM, as are cultural and structural alterations. IPM programs stress communication, monitoring, inspection, and evaluation (keeping and using records).

Invasive species – A non-native species whose introduction causes or is likely to cause economic or environmental harm or harm to human health (GSA 1999). In the IPMP/EA, this term refers exclusively to non-native species of plants that have been determined by the NPS to be invasive.

Microbial biodegradation – The alteration or breakdown of the chemical structure of a substance resulting in the loss of undesirable properties of the compound.

Mitigation — Modification of a proposal to lessen the intensity of its impact on a particular resource.

National Register of Historic Places (National Register) — A register of districts, sites, buildings, structures, and objects important in American history, architecture, archaeology, and culture that is maintained by the Secretary of the Interior under authority of Section 2(b) of the Historic Sites Act of 1935 and Section 101(a)(1) of the National Historic Preservation Act of 1966, as amended.

Native species – Species that have occurred, now occur, or may occur as a result of natural processes and that have evolved in concert with each other in a particular place.

⁵ In the context of this IPMP/EA, the term “pest” refers exclusively to species of non-native invasive plants.

No Action Alternative — The alternative in which baseline conditions and trends are projected into the future without any substantive changes in management (40 CFR 1502.14(d)).

Non-indigenous species – See *alien species*.

Non-native species – See *alien species*.

Noxious weed – See *alien species*.

Pesticide – Any substance or mixture that is used in any manner to destroy, repel, or control the growth of any viral, microbial, plant, or animal pest. In the context of the IPMP/EA, this term refers exclusively to herbicides.

Physiographic province - a geographic region in which climate and geology have given rise to an array of landforms different from those of surrounding regions.

Population – A group of individual plants or animals that have common characteristics and interbreed among themselves and not with other similar groups.

Proposed action – The activities that would be implemented by the project proponent and the impacts potentially resulting from the activities' implementation that are analyzed in the IPMP/EA. In the context of the IPMP/EA, the proposed action includes both the action alternative and the No Action Alternative.

Resource Manager – An employee of the National Park Service who is responsible for controlling, administering, and making decisions about cultural and/or natural resources.

Scoping — An early and open process for determining the extent and variety of issues to be addressed and for identifying the significant issues related to a proposed action (40 CFR 1501.7).

Section 106 compliance — Section 106 of the National Historic Preservation Act of 1966 requires federal agencies to take into account the effects of their proposed undertakings on properties included or eligible for inclusion in the National Register of Historic Places. Federal agencies are also required under Section 106 to provide the Advisory Council on Historic Preservation a reasonable opportunity to comment on the proposed undertakings. The Section 106 review process seeks ways to avoid, minimize, or mitigate any adverse effects on historic properties.

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