National Park Service
U.S. Department of the Interior

ROCK CREEK PARK
WASHINGTON, DC

DEER MANAGEMENT PLAN AND ENVIRONMENTAL IMPACT STATEMENT

FINAL INTERNAL SCOPING REPORT

ROCK CREEK PARK

NATIONAL PARK SERVICE

November 28, 2005

Printed on recycled paper

National Park Service
U.S. Department of the Interior

ROCK CREEK PARK
WASHINGTON, DC

DEER MANAGEMENT PLAN AND ENVIRONMENTAL IMPACT STATEMENT

FINAL INTERNAL SCOPING REPORT

ROCK CREEK PARK

November 28, 2005

Prepared for the National Park Service, U.S. Department of the Interior

by

The Louis Berger Group, Inc.

Washington, D.C.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDIXES

[This page intentionally left blank.]

PURPOSE OF AND NEED FOR ACTION

As an administrative unit of the national park system, Rock Creek Park comprises 99 separate areas, known as reservations, located in the District of Columbia. The largest of the 99 reservations, Rock Creek Park (Reservation 339), was established by Congress on September 27, 1890, and consists of 1,754 acres of Rock Creek and the surrounding valley from the Maryland state line south to the National Zoo. Beyond Reservation 339, Rock Creek administers areas such as the Rock Creek and Potomac Parkway (Reservation 360), Glover-Archbold Park (Reservations 351 and 450), and the Fort Circle Parks to name but a few. These different units have different purposes and needs, ranging from highly designed cultural landscapes to natural forested areas. Throughout this document, references to Rock Creek Park or the park include all administered units, descriptions of specific units will be referenced as such.

For more than 20 years, Rock Creek Park has collected data on the park's white-tailed deer (*Odocoileus virginianus*) population that has shown that the rising number of deer may be adversely impacting plant communities and other vegetative resources in the park. The National Park Service (NPS) conducted an internal scoping meeting, July 13-15, 2005, to discuss the management of white-tailed deer as part of the healthy and functioning ecosystem of Rock Creek Park, including all administered units. The goal of the meeting was to determine the purpose, need, objectives, and preliminary alternatives for white-tailed deer management within the park-administered units, as well as to identify issues and concerns associated with the current white-tailed deer population and its management. Representatives from the Maryland National Capital Park and Planning Commission, Montgomery County Department of Park and Planning and the District of Columbia Department of Health, Environmental Health Administration, Fisheries and Wildlife Division were present to discuss deer management practices within their respective agencies.

White-tailed deer occur throughout the contiguous United States with the exception of portions of the Southwest (Coffey 1999). Before European settlement, North American white-tailed deer populations are estimated to have been between 23 and 24 million, or about 8 to 11 deer per square mile (McCabe and McCabe 1984). These deer population numbers declined dramatically in the eastern U.S. after European settlement. Although no information exists on the history of the deer population in Washington, D.C., data do exist for the surrounding area of Maryland. Overall, the state of Maryland has seen a resurgence of white-tailed deer during recent years. Rare at the turn of the twentieth century, deer populations in Maryland have not only rebounded, but now number more than at any time in history. Maryland's white-tailed deer is an adaptable animal that has been favorably exploiting changes in habitat brought about by agricultural changes and the land use patterns associated with suburban development (MDNR 1998).

Deer thrive on habitat conditions created by suburban development as new roads, housing and related enterprises fragment forests and farms. These "edge" habitats provide plenty of food and ample shelter for deer. Fragmentation of the landscape has reduced suitable hunting opportunities, particularly in Maryland's growing suburban areas, some of which are adjacent to the District of Columbia (MDNR 1998).

Improved habitat conditions resulting in increased reproduction, coupled with low mortality rates, have resulted in growing deer numbers to an estimated current statewide population in excess of 250,000 animals. This population growth has resulted in many more opportunities to see or hunt deer. High deer numbers also result in increased deer/vehicle collisions, damage to agricultural crops and ornamental vegetation, increased transmission of Lyme disease, and degradation of natural ecosystems (MDNR 1998). Data do not exist for the District of Columbia but, because deer populations can and do cross these political boundaries, the District of Columbia is assumed to face the same issues as the neighboring Maryland suburbs.

Although there are no historic records of the deer population specific to Rock Creek Park, deer herds throughout the eastern United States were heavily exploited after the arrival of Europeans around 1600. By 1790, populations were low wherever Europeans had settled. Recent research indicates that European settlements were established in the Rock Creek valley area in the 17th century. Deer populations in the Piedmont were probably extirpated by the late 1800s. According to park observation records, sightings of deer in Reservation 339 of Rock Creek Park began in the 1960s, where there were four sightings. Although still relatively few in number, deer sightings increased to 19 by the 1970s. The deer population continued to increase and, in 1984, the first deer sighting in Glover-Archbold Park occurred. In the late 1980s (1987 to 1989) there were 39 deer sightings. By the early 1990s, deer sightings were so prevalent that observation cards were no longer completed. Until the early 1990s, observation cards served as the only method for tracking deer in Rock Creek Park.

PURPOSE OF AND NEED FOR ACTION

As defined in the DO-12 Handbook, section 2.2:

Purpose is a broad statement of goals and objectives that NPS intends to fulfill by taking action . . . Objectives are a more specific statement of purpose, i.e., what must be accomplished, in large part, for the action to be considered a success.

Need is a discussion of existing conditions that need to be changed, problems that need to be remedied, decisions that need to be made, and policies or mandates that need to be implemented . . . Need is why action is being taken at this time.

The National Park Service seeks to address deer management at Rock Creek Park by completing a plan and environmental impact statement (EIS). NPS and Rock Creek Park policies, as well as the National Environmental Policy Act (NEPA) and other related requirements will guide the plan/EIS. The NPS will also address concerns voiced by the public and other agencies.

PURPOSE OF ACTION

The purpose of this plan and environmental impact statement is to develop a deer management plan that supports long-term protection, preservation, and restoration of native vegetation and other natural and cultural resources within the park.

NEED FOR ACTION

A deer management plan is needed at this time to address:

- The potential of deer becoming the dominant force in the park's ecosystem, and adversely impacting native vegetation and other wildlife.
- Excessive deer browse causing a decline in forest tree regeneration of Rock Creek Park.
- Excessive deer browse impacting the existing shrubs and herbaceous species.
- Deer impacts on the character of the park's cultural landscapes.

- Opportunities to coordinate with other jurisdictional entities currently implementing deer management actions beneficial to the protection of park resource and values.

OBJECTIVES IN TAKING ACTION

Any plan the park develops must be consistent with the laws, policies, and regulations that guide the National Park Service. Objectives are "what must be achieved to a large degree for the action to be considered a success" (*Director's Order 12*, NPS 2001a). All alternatives selected for detailed analysis must meet all objectives to a large degree, and resolve the purpose and need for action. Objectives for managing deer populations must be grounded in the park's enabling legislation, purpose, significance, and mission goals, and be compatible with direction and guidance provided by each park unit's general management plan, strategic plan, and/or other management guidance. Rock Creek Park is made up of 99 individual units, some with their own enabling legislation, purpose, significance, and mission goals. The following are the objectives related to deer management derived at the internal scoping meeting.

VEGETATION

- Develop and implement informed, scientifically-based vegetation impact levels and corresponding measures of deer population size that would serve as a threshold for taking prescribed management actions within the park.

- Protect the natural abundance, distribution, and diversity of native plant species within the applicable park units by reducing excessive deer browsing, trampling, and non-native seed dispersal.

- Maintain, restore, and promote a mix of native plant species and reduce the spread of non-native plant species through effective deer management.

WILDLIFE AND WILDLIFE HABITAT

- Allow for a white-tailed deer population within the park while protecting other park resources.

- Protect the natural abundance, distribution, and diversity of native animal species within the park by reducing excessive deer browsing, trampling, and non-native seed dispersal.

- Protect lower canopy and ground nesting bird habitat from adverse effects of deer browsing.

THREATENED, ENDANGERED, AND SPECIES OF SPECIAL CONCERN

- Protect habitat of rare plant and animal species from adverse effects of deer.

CULTURAL RESOURCES

- Protect the integrity of the cultural landscapes by reducing excessive deer browsing, trampling, and non-native seed dispersal.

VISITOR SAFETY

- Reduce the potential for deer and visitor safety conflicts.

VISITOR USE AND EXPERIENCE

- Share information with the public regarding the deer population and the forest regeneration process and diversity, including the role of deer as part of a functioning park ecosystem, not the primary driving force within it.
- Initiate cooperative efforts to address deer effects on the park and surrounding communities.

PARK MANAGEMENT AND OPERATIONS

- Share information with park staff and other regional parks regarding the deer population and management strategies.

STUDY AREA AND SCOPE OF THE ANALYSIS

The focus of the analysis is to develop management strategies for the white-tailed deer population in and around the 99 units administered by Rock Creek Park. While all units are being considered, those which have the available land to support a deer population, provide travel corridors between viable habitat and/or where deer are currently known to occur, would be the primary focus of the plan. Table 1 provides a listing of all administered units of Rock Creek Park. Reservations not specifically addressed in the plan are highlighted in gray. Triangle parks, traffic circles, and parks less than one acre in size were removed from site specific evaluation. Park units less than one acre in size that are not highlighted in gray are included in the study area because of their proximity to Reservation 339 and their potential as a wildlife corridor to that reservation.

Table 1. Rock Creek Park Named Administered Units

Unit Name	Reservation Number	Approx. Acreage	Enabling Legislation
Rock Creek Park and tributary park extensions Pinehurst Parkway Klingle Valley Soapstone Valley Park Normanstone Parkway North Portal Parkway Beach Parkway	339 545 356, 635, 563 402 514 433 432	1,822	26 Stat 492 September 27, 1890 Purchased by NCPC 4/30/1926 and Capper-Cramton Act, transfer from District of Columbia
Rock Creek and Potomac Parkway	360	171	Public Buildings Act of March 4, 1913
Fort Circle Parks Fort Reno Fort Stevens Battery Kemble Fort Bayard Fort Slocum Fort Totten Fort Bunker Hill	 470, 515, 542 358, 494, 499 521, 530 359 435 497, 544, 451 443	 62 24 57 4 18 129 6	Capper-Cramton Act, May 29, 1930
Potomac Palisades Parkway – Key Bridge to DC Line, NW	404 Section 3	232	Capper-Cramton Act, May 29, 1930 Transfer of jurisdiction from District of Columbia
Barnard Hill	520, 528	29	Capper-Cramton Act, May 29, 1930
Dumbarton Oaks Park	637	27	Deeded to government from private donors
Meridian Hill Park	327	12	36 Stat 1310 March 4, 1911
Montrose Park	324	16	1911 District appropriations act provision (36 Stat 1005), transfer of jurisdiction from District of Columbia or other
Glover-Archbold Park, Glover Parkway & Children's Playground	351 (A-K), 450 (A-B), 451, 641	287	Land donations, authorized June 6, 1924 (43 Stat 464) and February 25, 1925 (43 Stat 978)
Triangle Parks (irregular parcels)	302-303, 303B, 309 (A-B, G), 312 (A, I), 313B, 330 (B-C), 345-346, 397, 436, 438, 447-448, 468, 565, 573, 587, 614, 643, 667, 686	5.07	Transfer of jurisdiction from District of Columbia or other
Traffic Circles Grant Circle Chevy Chase Circle Sherman Circle Tenley Circle Westmoreland Circle Ward Circle	303A 312 335A 369 398, 399 559 572	0.16 1.84 0.71 2.32 0.16 0.76 0.69	Transfer of jurisdiction from District of Columbia or other
Curb Parking – Ashmeade Pl between Connecticut Ave & Kalorama Rd NW, Jenifer & 41st Sts at Belt Rd NW, Western Ave & Patterson St NW	303D, 326C, 335, 361	0.44	Transfer of jurisdiction from District of Columbia or other
Center Parking – Tilden St & Linnean Ave NW, Rock Creek Dr between Edgevale Terr & Normanstone Dr NW	308A, 338	1.20	Transfer of jurisdiction from District of Columbia or other
Rabaut Park	309C	0.57	Transfer of jurisdiction from District of Columbia or other
Whitehaven Parkway	357	51.25	--

Unit Name	Reservation Number	Approx. Acreage	Enabling Legislation
Dalecarlia Parkway – Massachusetts Ave & Loughboro Rd NW	478	0.16	Transfer of jurisdiction from District of Columbia or other (Part Trans to DC 12/14/72)
National Zoological Park Entrance – Harvard St NW	516	1.0	Capper-Cramton Act, May 29, 1930
Park – Garfield St, between Fulton St & Foxhall Rd NW	529	14.0	Capper-Cramton Act, May 29, 1930
Piney Branch Portal	531	0.77	Transfer of jurisdiction from District of Columbia or other
Park – north side of National Zoological Park & Adams Mill Rd NW	563	1.77	Transfer of jurisdiction from District of Columbia or other U.S. agency
Battleground National Cemetery	568	1	Transfer from U.S. agencies
Melvin C. Hazen Park	630	43	Capper-Cramton Act, May 29, 1930
Woodley Park	635	3	Capper-Cramton Act, May 29, 1930 and transfer from District of Columbia or other
Francis G. Newlands Park (Little Forest)	668	9	Dedication/donation from private party
Park – Pennsylvania Ave btw 28th & M Sts NW	691	0.07	Transfer of jurisdiction from District of Columbia or other
Old Stone House	693	0.42	Purchased by DOI, NPS, or NCR, legislation approved September 25, 1950
Bryce Park	700	0.58	Capper-Cramton Act, May 29, 1930

Parklands not covered by specific legislation were established under the general authority of the National Capital Park Commission, approved June 6, 1924 (43 Stat 463). Source: NPS 2002a.

BACKGROUND

NPS units were established by Congress to fulfill specified purposes, based on the park's unique and significant resources. A park's purpose, as established by Congress, is the fundamental building block for its decisions to conserve resources while providing for "enjoyment of future generations."

The following were explored with the park during internal scoping: why each unit was established as a park; what resources Congress recognized as needing NPS protection; and what purpose, mission, and objectives must be fulfilled by the park.

Rock Creek Park's Strategic Plan and General Management Plan summarize its authorizing legislation, its purpose and significance, as well as broad mission goals for the future. These statements were reviewed at the internal scoping meeting and are presented in this section. Other park units, identified during the internal scoping meeting, were discussed and applicable enabling legislation reviewed.

ROCK CREEK PARK LEGISLATION AND PLANNING DOCUMENTS

Rock Creek Park, as an administrative unit of the national park system, is composed of 99 separate areas, known as reservations, located throughout the northeast and northwest of the District of Columbia. Since its inception, Rock Creek has increased in size through the addition of tributary parks and boundary expansions for the purpose of preserving the watershed, forest, and natural scenery in Washington as well the preservation of a diversity of monuments and historic sites (NPS 2003a). These additions to the park have occurred through an equally diverse number of administrative actions, mandates, and acquisitions (see Table 1). The park legislation and planning documents vary for each unit of the park.

The following provides the enabling legislation for three large units managed by Rock Creek Park—Rock Creek Park (Reservation 339), Rock Creek and Potomac Parkway, and the Fort Circle Parks.

PURPOSE AND SIGNIFICANCE OF ROCK CREEK PARK UNITS

Rock Creek Park and Associated Tributary Parks (Reservation 339) and the Rock Creek and Potomac Parkway (Reservation 360)

Establishment — Congress established Rock Creek Park, one of the first national park areas, on September 27, 1890 as a unique natural park containing significant historic and archeological resources, and providing a variety of recreational opportunities for visitors and residents of the District of Columbia metropolitan area (Pub. L. 51-297, 26 Stat. 482).

Rock Creek Park is linked to the Potomac River and the monuments in downtown Washington, D.C. by the Rock Creek and Potomac Parkway. Congress established the parkway through the Public Buildings Act of March 4, 1913. The parkway corridor is managed contiguously with Rock Creek Park.

Purpose — The 1890 enabling legislation for Rock Creek Park states that:

> The area is to be "perpetually dedicated and set apart as a public park or pleasure ground for the benefit and enjoyment of the people of the United States."

> The park is to "provide for the preservation from injury or spoliation of all timber, animals, or curiosities within said park, and their retention in their natural condition, as nearly as possible."

Based on NPS's interpretation of this legislation, as presented in the Rock Creek Park and the Rock Creek and Potomac Parkway General Management Plan, Rock Creek Park exists to:

> Preserve and perpetuate for this and future generations the ecological resources of the Rock Creek valley within the park in as natural a condition as possible, the archeological and historic resources in the park, and the scenic beauty of the park.
>
> Provide opportunities for the public to experience, understand, and appreciate the park in a manner appropriate to the preservation of its natural and cultural resources.
>
> Provide opportunities for recreation appropriate to the park's natural and cultural resources.

The purpose of the tributary parks adjacent to Rock Creek Park includes the preservation of forests and natural scenery in and around the District of Columbia (NPS 2002b).

Rock Creek and Potomac Parkway exists to connect Rock Creek Park and the National Zoological Park (National Zoo) to Potomac Park with a scenic road; and prevent pollution and obstruction of Rock Creek.

Significance — Park significance statements capture the essence of the park's importance to the nation's natural and cultural heritage. Understanding park significance helps managers make decisions that preserve the resources and values necessary to the park's purpose. The following significance statements, as detailed in the Rock Creek Park and the Rock Creek and Potomac Parkway General Management Plan, recognize the important features of the park.

> Rock Creek Park is one of the oldest and largest naturally managed urban parks in the United States (NPS 2002a).
>
> The park and parkway contains approximately 2,100 acres of valuable plant and wildlife habitat, providing protection for a variety of native species within a heavily urbanized area (NPS 2003a).
>
> Rock Creek Park encompasses a rugged stream valley of exceptional scenic beauty with forested, natural landscapes and intimate natural details, in contrast to the surrounding cityscape of the District of Columbia (NPS 2002a).
>
> Rock Creek Park's forests and open spaces help define the character of the nation's capital (NPS 2002a).
>
> Rock Creek valley was important in the early history of the region and in the development of the nation's capital and the park's cultural resources are among the few tangible remains of the area's past (NPS 2002a).
>
> Rock Creek Park is an oasis for urban dwellers, offering respite from the bustle of the city (NPS 2003a).
>
> Rock Creek Park is a historic designed landscape incorporating early twentieth century picturesque and rustic features designed to enhance the visitors' experience of the naturalistic park scenery (NPS 2002a).

> Located in the heart of a densely populated cosmopolitan area, Rock Creek Park serves as an ambassador for the national park idea, providing outstanding opportunities for education, interpretation, and recreation to foster stewardship of natural and cultural resources (NPS 2002a).

The following significance statement recognizes the important features of the parkway.

> The Rock Creek and Potomac Parkway provides a scenic gateway to the city's downtown area, known as the monumental core (NPS 2002a).

Fort Circle Parks

The Fort Circle Parks managed by Rock Creek Park are Battery Kemble, Fort Bayard, Fort Reno, Fort DeRussy, Fort Stevens, Fort Slocum, Fort Totten, and Fort Bunker Hill, as stated in the *Fort Circle Parks Management Plan/Environmental Assessment* (NPS 2004b).

Establishment — The monies used by the NPS to acquire the Fort Circle Parks were appropriated by the Capper-Cramton Act of 1930. This act appropriated funds for the further acquisition of "…such lands in the District of Columbia as are necessary and desirable for the suitable development of the National Capital Park, parkway, and playground system…"

Purpose — The *Fort Circle Parks Draft Management Plan/Environmental Assessment* states that the purpose of the Fort Circle Parks is to (NPS 2003b):

> Preserve and interpret historical resources related to the Civil War defenses of Washington.
>
> Conserve this linkage or urban green space that contributes to the natural character and scenic values of the nation's capital.
>
> Provide recreational opportunities compatible with historic and natural resource values.
>
> Protect the forests and natural scenery and prevent the pollution of park waterways.

Significance — The *Fort Circle Parks Draft Management Plan/Environmental Assessment* states that the significance of the Fort Circle Parks is (NPS 2003b):

> The park sites contain remains of the defense sites (e.g., forts, batteries, rifle trenches) that effectively deterred the invasion of the nation's capital during the Civil War.
>
> The Fort Circle Parks include the remains of forts that were engaged in the Battle of Fort Stevens in July 1864 – the only Civil War battle in the District of Columbia and the only time a sitting U.S. president has come under enemy fire in warfare.
>
> The pattern (greenbelt) of public space of Fort Circle Parks represents an element of one of the earliest urban planning efforts for public recreation in the United States (as first suggested in the 1902 *Improvement of the Park System of the District of Columbia* and the 1926–1927 *National Capital Planning Commission Plan)*. Today it enhances the aesthetics of the capital city and the quality of life for its citizens.
>
> The Fort Circle Parks preserve significant natural features, including substantial acreage of mature native hardwood forests, geologic and aquatic resources, and a diversity of important habitat for

indigenous flora and fauna that are unusual in an urban setting and that contribute to the uniqueness of the nation's capital.

ROCK CREEK PARK AND ADMINISTERED UNITS PLANNING DOCUMENTS

The purpose, need, and objectives need to be, to a significant degree, consistent with park planning documents. These documents include the 2002 *Rock Creek Park and the Rock Creek and Potomac Parkway Draft General Management Plan/Environmental Impact Statement,* the 2004 *Fort Circle Parks Management Plan/Environmental Assessment,* the 1996 *Natural Resources Management Plan Rock Creek Park,* and various cultural and natural resource management documents.

Rock Creek Park and Rock Creek and Potomac Parkway Draft General Management Plan/Environmental Impact Statement (2003)

The NPS released a draft *General Management Plan/Environmental Impact Statement* (GMP/EIS) for Rock Creek Park (Reservation 339) and Rock Creek Park and Potomac Parkway for public review and comment in March 2003. This management plan is in its final draft stages of completion. The final plan will be the first comprehensive plan prepared for Rock Creek Park. The central issue for management planning in Rock Creek Park is how to meet the often conflicting purposes of protecting the scenic, natural, and cultural resources of the park, while concurrently providing for appropriate public use of these resources.

The Draft *General Management Plan/EIS* identifies what must be done at Rock Creek Park and the Rock Creek and Potomac Parkway to comply with federal laws and with the policies of the National Park Service. These are measures that the National Park Service must strive to meet. The following desired conditions for Rock Creek Park and the Rock Creek and Potomac Parkway that relate to deer management outline how the park will meet those resource requirements:

Natural Resource Management Requirements

Native species populations that have been severely reduced or extirpated are restored where feasible and sustainable.

Invasive species are reduced in number and area, or eliminated from natural areas of the park.

Federal- and District-listed threatened or endangered species and their habitats are protected and sustained.

Native plant and animal species function in as natural a condition as possible, except where special management considerations are allowable under policy.

Surface waters and groundwater are protected or restored such that water quality as a minimum meets all applicable District of Columbia water quality standards.

Cultural Resource Management Requirements

Archeological sites are protected in an undisturbed condition unless it is determined through formal processes that disturbance or natural deterioration is unavoidable.

Visitor Experience and Park Use Requirements

Visitor and employee safety and health are protected.

Visitors have opportunities to enjoy the park in ways that leave park resources unimpaired for future generations.

Visitors understand and appreciate park values and resources and have the information necessary to adapt to the park's environments.

Special Use Management Requirements

Resources outside of the park are managed in such a way that the park will be safeguarded.

The NPS works cooperatively with others to anticipate, avoid, and resolve potential conflicts and address mutual interests.

All alternatives considered for the development of a White-tailed Deer Management Plan will be developed within the framework of the park's GMP/EIS.

Rock Creek Park Environmental Commitment Statement (2004a)

In July 2004, Rock Creek Park issued a statement that summarizes a commitment to manage park resources and the multiple sites in the District of Columbia under park jurisdiction as outlined by the principles and practices described in the Organic Act of 1916, which state "we are to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

Fort Circle Parks Management Plan/Environmental Assessment (2004b)

The Fort Circle Parks Management Plan, finalized in September 2004, provides a unifying management concept for significant historic resources associated with the Civil War defenses of Washington that would allow these resources to be preserved for future generations, and interpreted in a coherent, easily understandable manner. This plan sets forth a series of desired visitor experience and resource condition statements to guide the management of these units for the next 10 to 15 years.

Natural Resources Management Plan Rock Creek Park (1996)

The Natural Resources Management Plan for Rock Creek Park provides specific management objectives for Rock Creek Park based on the park's Statement for Management. The Natural Resources Management Plan is slated for update as a Resource Stewardship Plan when NPS issues guidelines for the updated plan. Resource related management objectives in the existing plan require that the park:

Seek information, through research or other means, on the natural processes of the park's natural areas in order to perpetuate park resources and to enhance opportunities for resource-compatible public use and enjoyment.

Preserve and perpetuate the park's plant and wildlife resources in as natural a condition as possible, and reduce the adverse effects of human activities and exotic species on the natural environment.

Identify, protect, and perpetuate the park's historic resources, including mills, Civil War fortifications, and archeological sites.

Monitor and evaluate current recreational uses of the park lands and redirect these activities in order to reduce adverse impacts.

Foster understanding and appreciation of the park's natural and cultural values through interpretive and educational programs focusing on Rock Creek's biological, geological, historic, and prehistoric resources.

Provide for public use and enjoyment of the park through the provisions of varied facilities, services, and programs that are compatible with perpetuating the park's natural and cultural values.

Establish contact and cooperation with citizens' associations, governmental agencies, and other groups or individuals that surround and have direct effects on or interests in the welfare of the park.

The Natural Resources Management Plan is a strategic planning document and a key element in good management and resource preservation. These management objectives are addressed in a series of project statements which consider natural and cultural resource problems, activities, or issues. The plan does not directly address deer management at the park.

Cultural Landscape Report: Dumbarton Oaks Park, Rock Creek Park (2000)

The Dumbarton Oaks cultural landscape report documents the history and existing condition of this park unit, and analyzes and evaluates the landscape resources. The need to document the Dumbarton Oaks Park historic landscape became apparent in 1985 when the NPS recognized that the garden was being managed as a natural, rather than a cultural resource. The landscape report was created to provide guidance for stabilizing existing resources such as focal points and waterway features. This effort led to the 1997 *Preservation Maintenance Plan for Dumbarton Oaks Park*, which details how the cultural landscape will be maintained. The results and recommendations of these reports will be taken into consideration when developing a white-tailed deer management plan for Rock Creek Park.

Cultural Landscapes Inventory: Peirce Mill Rock Creek Park (2003)

In 1997, the Peirce Mill landscape was identified as a component landscape of Rock Creek Park (Reservation 339). The Peirce Mill landscape is identified as the property owned by Peirce Shoemaker that was transferred to the federal government after the creation of the park in 1890. The Peirce Mill landscape is distinctive from the rest of Reservation 339 because of the physical history of the site and the character of the area. Deer management activities would occur in this section of Rock Creek Park and the cultural landscape component would be considered.

Cultural Landscapes Inventory: Linnaean Hill Rock Creek Park (2003)

In 1997, the Linnaean Hill landscape was identified as a component landscape of Rock Creek Park (Reservation 339). The Linnaean Hill landscape is identified as the property of Joshua Peirce Klingle that was transferred to the federal government after the creation of the park in 1890. The Linnean Hill landscape is distinctive from the rest of Reservation 339 because of the physical history of the site and the character of the area. Deer management activities would occur in this section of Rock Creek Park and the cultural landscape component would be considered.

Rock Creek Park Long Range Interpretive Plan (draft, 2003)

The Rock Creek Park Long Range Interpretive Plan (NPS 2003c) provides an assessment of current conditions in the interpretation and educational program for Rock Creek Park, establishes goals for the future direction and development of that program, and establishes priorities necessary to get there.

Invasive Exotic Plant Management Plan (draft, 2004c)

The purpose of this plan is to describe the principles under which exotic plant management will be prioritized and undertaken for all the natural areas within Rock Creek Park. The plan details methods to be used, with the understanding that methods will be adapted as more effective and efficient methods are developed and/or monitoring indicates that current methods are ineffective. The NEPA process has not yet begun for this project. Elements of the plan fall into four broad categories:

1. Prioritizing Exotics Control

   Prioritize all natural areas of Rock Creek Park in terms of their ecological value, sensitivity, and presence of rare, threatened, or endangered species.

   Evaluate known exotic species in terms of the threat each poses and their feasibility of control, and use this information to identify which and how imminently species require active treatment.

   Identify techniques for controlling exotics, including preventing their introduction and spread.

2. Executing Control Tactics

   Implement control projects, using information gathered while prioritizing exotics control and following the priority list of areas in which to direct exotic plant control efforts. Priorities will be based on the ecological importance of the area and the threat from the exotics present. An important factor in this prioritization will be whether the exotic species present are so invasive and destructive that they need to be controlled in any area where they are found.

3. Monitoring and Evaluation

   Continue to document and map the density of populations of exotics throughout Rock Creek Park.

   Identify new potentially damaging exotics and monitor the populations of existing exotics.

   Monitor the effectiveness of control efforts and the regeneration of native communities.

   Identify needs for and conduct further research.

4. Outreach

   Educate the public, especially adjacent neighbors, about the exotics problems in Rock Creek Park and how they can help mitigate the problem.

   Enlist the aid of other agencies through cooperative efforts.

LEGISLATION, REGULATIONS, AND POLICIES

The following laws, policies, and plans by the NPS, the District of Columbia government, or agencies with neighboring land or relevant management authority are described in this section to show the constraints this plan/EIS will need to operate under and the goals and policies that it must meet.

NPS ORGANIC ACT AND MANAGEMENT POLICIES

By enacting the National Park Service Organic Act of 1916 (Organic Act), Congress directed the U.S. Department of the Interior and the NPS to manage units "to conserve the scenery and the natural and historic objects and wild life therein and to provide for the enjoyment of the same in such a manner and by such a means as will leave them unimpaired for the enjoyment of future generations" (16 USC 1). The *Redwood National Park Expansion Act of 1978* reiterates this mandate by stating that the NPS must conduct its actions in a manner that will ensure no "derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress" (16 USC 1a-1).

Despite these mandates, the *Organic Act* and its amendments afford the National Park Service latitude when making resource decisions. By these acts Congress "empowered [the National Park Service] with the authority to determine what uses of park resources are proper and what proportion of the parks resources are available for each use" (*Bicycle Trails Council of Marin v. Babbitt,* 82 F.3d 1445, 1453 (9th Cir. 1996)).

Nevertheless, courts have consistently interpreted the Organic Act and its amendments to elevate resource conservation above visitor recreation. The *Michigan United Conservation Clubs* v. *Lujan,* 949 F.2d 202, 206 (6th Cir. 1991) decision states, "Congress placed specific emphasis on conservation." The *National Rifle Ass'n of America* v. *Potter,* 628 F.Supp. 903, 909 (D.D.C. 1986) decision states, "In the Organic Act Congress speaks of but a single purpose, namely, conservation." The NPS *Management Policies,* which state the conditions or processes that must be undertaken, considered, or followed before taking a management action in any unit of the national park system, also recognize that resource conservation takes precedence over visitor recreation. "When there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to be predominant" (NPS *Management Policies 2001,* sec. 1.4.3).

Because conservation remains predominant, the National Park Service seeks to avoid or to minimize adverse impacts on park resources and values. The NPS Organic Act does give the Secretary of the Interior discretion to provide "for the destruction of such animal and of such plant life as may be detrimental to the use of any of said parks, monuments, or reservations" (16 USC 3), and the *Management Policies* give the Park Service discretion to allow negative impacts when necessary (sec. 1.4.3). However, while some actions and activities cause impacts, the National Park Service cannot allow an adverse impact that constitutes resource impairment (NPS *Management Policies 2001*, sec. 1.4.3). The Organic Act prohibits actions that impair park resources unless a law directly and specifically allows for such actions (16 USC 1 a-1). An action constitutes an impairment when its effects "harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values" (NPS *Management Policies 2001*, sec. 1.4.4). To determine impairment, the Park Service must evaluate "the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts" (NPS *Management Policies 2001*, sec. 1.4.4).

Because park units vary based on enabling legislation, natural resources, cultural resources, and missions, management activities appropriate for each unit and for areas within each unit vary as well. An action appropriate in one unit could impair resources in another unit. Thus, this environmental impact statement will analyze the context, duration, and intensity of impacts related to deer management within Rock Creek Park, as well as the potential for resource impairment, as required by *Director's Order #12: Conservation Planning, Environmental Impact Analysis and Decision-making* (NPS 2001a).

OTHER NATIONAL LEGISLATION, COMPLIANCE, AND NPS POLICY

The National Park Service is governed by laws, regulations, and other policies before, during, and following any management action related to the developed NEPA document.

Redwood Amendment to the General Authorities Act

Reasserting the system-wide standard of protection established by Congress in the original *Organic Act*, the Redwood Amendment stated:

> The authorization of activities shall be construed and the protection, management, and administration of these areas shall be conducted in light of the high public value and integrity of the National Park System and shall not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress (P.L. 95-250, USC Sec 1a-1).

Congress intended the language of the Redwood Amendment to the General Authorities Act to reiterate the provisions of the Organic Act, not to create a substantively different management standard. The House committee report described the Redwood amendment as a "declaration by Congress" that the promotion and regulation of the national park system is to be consistent with the Organic Act. The Senate committee report stated that under the Redwood amendment, "The Secretary has an absolute duty, which is not to be compromised, to fulfill the mandate of the 1916 Act to take whatever actions and seek whatever relief as will safeguard the units of the national park system." Although the Organic Act and the General Authorities Act, as amended by the Redwood amendment, use different wording ("unimpaired" and "derogation") to describe what the National Park Service must avoid, they define a single standard for the management of the national park system—not two different standards. For simplicity, Management Policies uses "impairment," not both statutory phrases, to refer to that single standard.

National Environmental Policy Act of 1969, as Amended

NEPA section 102(2)(c) requires that an environmental impact statement be prepared for proposed major federal actions that may significantly affect the quality of the human environment.

Endangered Species Act of 1973, as Amended

The Endangered Species Act requires all federal agencies to consult with the Secretary of the Interior on all projects and proposals having potential impact on federally endangered or threatened plants and animals.

Fish and Wildlife Coordination Act of 1934, as Amended

The act authorizes the Secretaries of Agriculture and Commerce to provide assistance to and cooperate with federal and state agencies to protect, rear, stock, and increase the supply of game and fur-bearing animals, as well as to study the effects of domestic sewage, trade wastes, and other polluting substances on wildlife. The 1958 amendments added provisions to recognize the vital contribution of wildlife resources to the nation and to require equal consideration and coordination of wildlife conservation with other water resources development programs, and authorized the Secretary of the Interior to provide public fishing areas and accept donations of lands and funds (16 USC 661-667e).

Federal Noxious Weed Act, 1975

The Federal Noxious Weed Act (7 USC 2801-2814, January 3, 1975, as amended 1988 and 1994) provides for the control and management of nonindigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health.

The National Historic Preservation Act of 1966, as Amended

Section 106 of the National Historic Preservation Act requires federal agencies to consider the effects of their undertakings on properties listed on or potentially eligible for listing on the National Register of Historic Places. All actions affecting the parks' cultural resources must comply with this legislation.

Historic Sites, Buildings, and Antiquities Act, 1935

The Historic Sites, Buildings, and Antiquities Act establishes "national policy to preserve for public use historic sites, buildings and objects of national significance." It gives the Secretary of the Interior broad powers to protect these properties, including the authority to establish and acquire nationally significant historic sites.

Title 36, Code of Federal Regulations

Title 36 provides the regulations "for the proper use, management, government, and protection of persons, property, and natural and cultural resources within areas under the jurisdiction of the National Park Service" (36 CFR 1.1(a)).

Executive Order 11990, "Protection of Wetlands"

Executive Order 11990 directs federal agencies to avoid to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

Executive Order 11988, "Floodplain Management"

This executive order directs federal agencies to avoid, to the extent possible, long- and short-term impacts associated with occupying and modifying floodplains through development, where a practicable alternative exists.

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations"

The National Park Service must address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities, including planning projects, on minority populations and low-income populations.

Executive Order 13112, "Invasive Species"

This executive order requires the National Park Service to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

Executive Order 13186, "Responsibilities of Federal Agencies to Protect Migratory Birds"

Executive Order 13186 was established on the premise that migratory birds contribute to biological diversity, bring enjoyment to millions of Americans, and are of great ecological and economic value to this county and to other countries. Under this order, federal agencies taking actions that have, or are likely to have, a measurable negative effect on the migratory bird population are directed to develop and implement a Memorandum of Understanding with the U.S. Fish and Wildlife Service that promotes the conservation of migratory bird populations. This executive order also requires that the environmental analysis of federal actions required by NPS or other established environmental review processes evaluate the effects of the action and agency plans on migratory birds, with an emphasis on species of concern.

NPS-77: Natural Resources Management Guideline (1991)

The *Natural Resources Management Guideline* provides guidance to park managers for all planned and ongoing natural resource management activities. Managers must follow all federal laws, regulations, and policies. This document provides the guidance for park management to design, implement, and evaluate a comprehensive natural resource management program.

Director's Order #28: Cultural Resource Management (1998)

This Director's Order sets forth the guidelines for management of cultural resources, including cultural landscapes, archeological resources, historic and prehistoric structures, museum objects, and ethnographic resources. This order calls for the NPS to protect and manage cultural resources in its custody through effective research, planning, and stewardship in accordance with the policies and principals contained in the NPS *Management Policies*.

Animal Welfare Act, as Amended (7 USC, 2131-2159)

The Animal Welfare Act requires that minimum standards of care and treatment be provided for certain animals bred for commercial sale, used in research, transported commercially, or exhibited to the public. Individuals who operate facilities in these categories must provide their animals with adequate care and treatment in the areas of housing, handling, sanitation, nutrition, water, veterinary care, and protection from extreme weather and temperatures. Although federal requirements establish acceptable standards, they are not ideal. Regulated businesses are encouraged to exceed the specified minimum standards. Deer management alternatives with a research component would be regulated by this act.

STATE AND LOCAL LAWS, REGULATIONS, AND POLICIES

Maryland Guide to Hunting and Trapping and Deer Regulations

The Maryland Department of Natural Resources Wildlife Division has the legal mandate and legislated authority to manage deer populations throughout the state of Maryland. As part of this function they set the goals and regulations for deer management in the state. The long-term goal of the state is to ensure the present and future well-being of deer and their habitat; to maintain deer populations at levels necessary to ensure compatibility with human land uses and natural communities; to encourage and promote the recreational use and enjoyment of the deer resource; and to inform and educate Maryland citizens about deer biology, management options, and the effects that deer have on landscapes and people.

Deer regulations in the state of Maryland cover hunting hours, licensing and stamp requirements, daily limits, legal hunting devices, and the use of dogs in hunting. These regulations are explained in the yearly *Guide to Hunting & Trapping in Maryland*, along with any new regulations or updates to existing regulations.

Comprehensive Management Plan for White-tailed Deer in Montgomery County (1995a, updated 2004)

The Maryland National Capital Park and Planning Commission (MNCPPC), which oversees the Montgomery County Department of Park and Planning, created a comprehensive management plan for white-tailed deer on the premise that deer are an important and valued part of the county's natural heritage; however, deer are an opportunistic species that can, in the absence of checks and balances, become abundant enough to conflict with human interests. The plan, developed to be open-ended and adaptable, acknowledges that deer-human conflicts vary and one single management prescription may not be appropriate. The *Comprehensive Management Plan for White-tailed Deer in Montgomery County* establishes goals and objectives for managing deer in the county, develops a plan of action for each of the problem issues identified, and sets a timetable for implementation of these actions. The management plan is composed of four components:

> Part I addresses the collection, centralization, and use of accurate data on white-tailed deer and their effects on Montgomery County, and forms the foundation on which sound management decisions must be based.
>
> Part II outlines the implementation of a comprehensive public awareness and public education program to better inform citizens about deer-human conflicts and how to prevent them.
>
> Part III describes the various management alternatives that are available to reduce the deer effects and outlines the implementation of population management alternatives to reduce deer populations in areas where this is deemed necessary.
>
> Part IV outlines the current status of the plan's implementation and the work program for the current fiscal year—this component of the plan is updated annually.

District of Columbia Firearm Regulations

District of Columbia firearm regulations state that the transport of firearms can occur for "any non resident of the District participating in any lawful recreational firearm related activity in the District, or on his way to or from such activity in another jurisdiction:

Provided, that such a person, whenever in possession of a firearm, shall upon demand of any member of the Metropolitan Police Department, or other bona fide law enforcement officer, exhibit proof that he is on his way to or from such an activity, and that his possession or control of such a firearm is lawful in the jurisdiction in which he resides.

Provided further, that such a weapon shall be unloaded, securely wrapped, and carried in open view" (1973 Ed., 6-1811; September 24, 1976, D.C. Law I-85, Title II, 201, 23 DCR 2464).

This page intentionally left blank.]

DEER MANAGEMENT SUMMARY AND RESEARCH OVERVIEW

To provide more context for the plan, general deer management issues at national parks are summarized below, followed by an overview of deer management at Rock Creek Park.

SUMMARY OF DEER MANAGEMENT ISSUES AT NATIONAL PARKS

Within eastern national parks, such as Rock Creek Park, landscapes have been managed to allow for the preservation and rehabilitation of scenic and historic lands. The result is a mixture of forest, shrub, and grassland, which constitutes excellent habitat for white-tailed deer. Since deer harvest has not been part of management activities in the majority of parks, the population of deer has greatly increased. Today in many areas, the density of deer exceeds 40 deer/square kilometer (100 deer/square mile) (Porter 1991), and it has been established that deer densities this high can have negative effects on plant and animal species (Alverson 1988; Anderson 1994; Augustine and Frelich 1998; DeCalesta 1994; McShea 2000; McShea and Rappole 2000).

Other national park units have been involved in deer management planning efforts. Gettysburg National Military Park and Eisenhower National Historic Site completed an environmental impact statement and white-tailed deer management plan in 1995, and approved management strategies are now being implemented. Deer management planning and environmental review efforts are also being undertaken at Indiana Dunes National Lakeshore, Indiana; Cuyahoga Valley National Park, Ohio; and Catoctin Mountain Park, Maryland. Fire Island National Seashore in New York is researching immunocontraception as a means of population control for deer.

The issues surrounding resource management, including that of deer, are complex. Park managers are challenged to establish vegetation goals, such as abundance, diversity and habitat, and achieve those goals in light of other environmental influences and the important role deer play in a balanced ecosystem. In addition, determining and monitoring the effects of deer and then deciding how and when to take appropriate action must be based on best available science and professional judgment. Finally, the human component of this issue is important because many people have different views of wildlife management in units of the National Park Service. Hunting is not permitted in most national parks, unless it is explicitly stated in the park's legislation or allowed under other laws (i.e., Alaska's subsistence hunting laws for native populations).

As in other eastern national parks, white-tailed deer at Rock Creek Park have no significant natural predators. The park provides an island of habitat in an urban environment and there is no hunting in national parks (36 CFR 2.2). The combination of these factors has facilitated the growth of the deer population at Rock Creek Park. To determine the extent of deer-related impacts at Rock Creek Park, some studies on the deer population and on deer impacts to other park resources have been implemented.

The following sections summarize the history of deer monitoring in Rock Creek Park in a chronology of deer-related studies completed by the park. This summary is followed by an overview of deer management activities occurring in neighboring jurisdictions.

HISTORY OF DEER MONITORING AND RESEARCH AT ROCK CREEK PARK

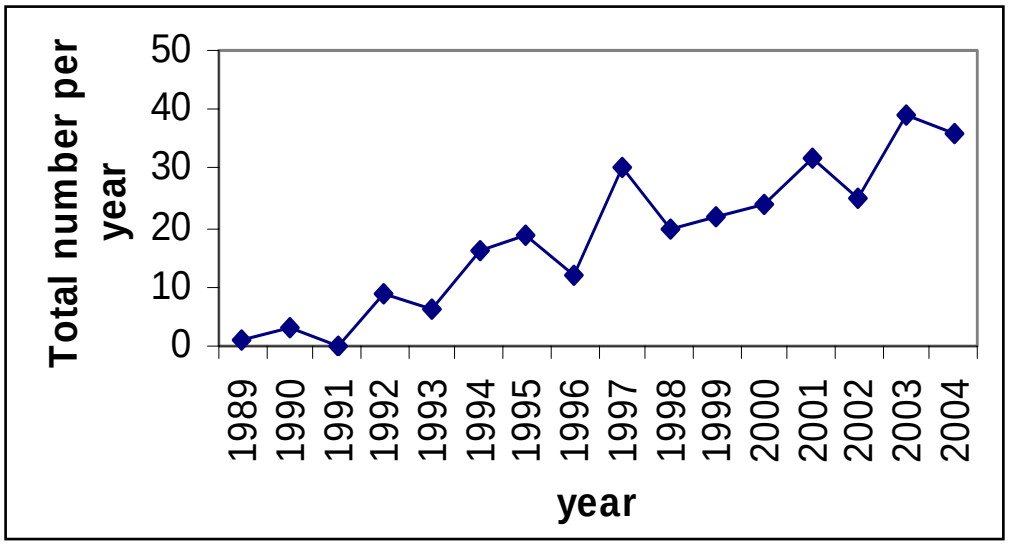
Deer population growth and density at Rock Creek have been measured through roadside spotlight surveys and distance sampling, limited Forward Looking Infrared Surveys (FLIR), and dead deer surveys. Deer monitoring and research started in Rock Creek Park when deer were first spotted in Reservation 339 the 1960s. From the first deer sighting in 1962 to the early 1990s, deer observation cards were collected to document sightings. By the early 1990s, deer sightings were so prevalent that observation cards were no longer completed. Until the early 1990s, observation cards served as the only method for tracking deer in Rock Creek Park.

DEAD DEER SURVEYS (1989 - PRESENT)

Rock Creek Park has surveyed dead deer since the early 1980s and, in 1989, recorded the first deer struck and killed by a vehicle. Data collected included sex, age, and the presence or absence of parasites. The park now records roadkill in a Geographic Information System (GIS) layer. Data on the number of dead deer throughout all units of Rock Creek Park indicate an upward trend between 1989 and 2004. In 2003, 39 were reported. The number dropped in 2004 with 36 reports and is on a similar track in 2005 with 18 kills reported through July (Figure 1). Areas of high roadkill include Military Road, Oregon Avenue, and Beach Drive.

The cost of dead deer surveys vary annually based on the number of dead deer recorded. The estimated average annual cost of the dead deer survey is approximately $3,580. This estimate accounts for the average number of deer roadkill for the last 10 years, which was 28, and multiplies it by two hours needed to find, move, and potentially bury each animal. Two people at the GS-9 Step 8 level are required for these activities. This estimate includes time for database entry.

Figure 1: Reported Annual Roadkill Deer in Rock Creek Park, 1989–2004

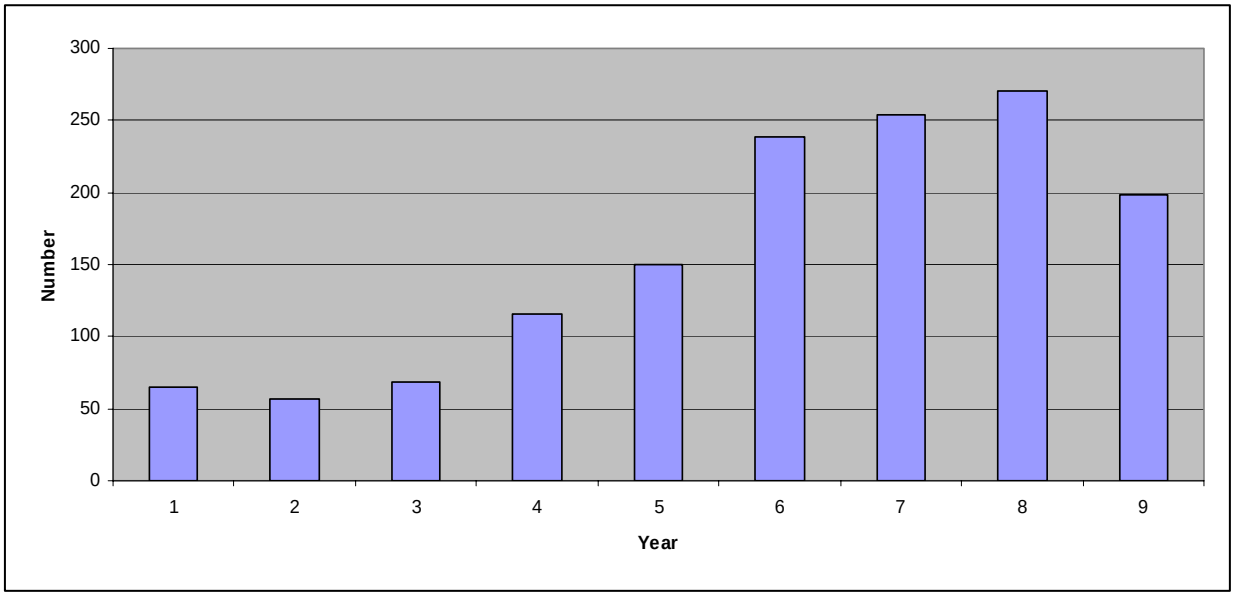


SPOTLIGHT SURVEYS (1996 - PRESENT)

Since 1996, Rock Creek Park has conducted annual spotlight surveys to monitor the deer population at Rock Creek Park. The surveys are conducted the same time each year over a four night period following the same 22-mile route covering the majority of Rock Creek Park (Reservation 339). The deer counts are based on visual sightings using eye shine from a spotlight. The numbers from the four nights are averaged each year. Where possible, sex and age determinations were recorded. The data provide population trends and a baseline for density estimates. Spotlight surveys indicate that the deer population increased steadily from 1997 to 2003, with a decrease in 2004 (Figure 2).

Cost estimates for the spotlight survey include three hours for three people to monitor four nights; with follow-up analysis of the data, this totals approximately $1,300 in labor.

Figure 2: Spotlight Counts, 1996–2004



FORWARD LOOKING INFRARED SURVEYS (FLIR) (1997–1999)

In March 1997, the park contracted for Forward Looking Infrared Surveys (FLIR), a nighttime survey conducted from a helicopter to estimate the total number of deer in the park. In the first two years of the survey, Reservation 339, Glover-Archbold Park, and Battery Kemble Park were surveyed. In 1999 (year 3), only Reservation 339 was surveyed, to allow a more intensive survey in one location to obtain more accurate results. In Reservation 339 the survey recorded: 1997, 87 deer; 1998, 80 deer; and 1999, 90 deer in the park. The company conducting the survey stated the results were 75% accurate or better; however, due to some inconsistencies in the analysis, the park did not use FLIR after 1999.

The total cost of the FLIR surveys over three years was $27,400. This included $8,900 in 1997 and $8,000 in 1998 for the survey of Glover Archbold, Battery Kembel, and Reservation 339 and $10,500 in 1999 for just Reservation 339.

No other national park units that are implementing deer management plans have used FLIR. Indiana Dunes National Lakeshore conducted aerial infrared surveys from 1998 to 2002 in conjunction with some

neighboring communities, but this technique is no longer being used. The surveys covered only part of the East Unit of the park and were conducted at different times of the year to accommodate the timing of surveys planned by park neighbors.

DISTANCE SAMPLING (2000 – PRESENT)

In 2000, the National Capital Region contracted with Dr. Brian Underwood of the U.S. Geological Survey to teach distance sampling to estimate population numbers. Rock Creek Park staff participated in the training and, in November 2000, conducted the first distance sampling, estimating 59 deer per square mile within the park. Since 2000, distance sampling is duplicated annually for three to four nights each year. In 2004, 75 deer per square mile were surveyed, a decrease from 98 deer per square mile in 2003.

Cost estimates for the distance sampling include 2.5 hours for three people to monitor three nights; with follow-up analysis of the data, this totals approximately $1,100 in labor.

Other national park units that have used distance sampling include Catoctin Mountain Park in Maryland and Cuyahoga Valley National Park in Ohio. Catoctin began spotlight surveys in 1989, and then modified these to incorporate the distance sampling technique beginning in 2002. The surveys are conducted on three consecutive nights in late October. Results from 2002 through 2004 indicated deer densities of 104 to 194 deer per square mile. At Cuyahoga, distance sampling was initiated in 1998 and was performed over a five night period in November. Results from 1998 and 1999 indicated a deer density of 40 to 100 per square mile in 1998, and 53-130 per square mile in 1999. Indiana Dunes National Lakeshore has conducted spotlight surveys since 1991, but to date has not modeled the survey results to develop a population density estimate using the distance sampling technique.

RADIO TELEMETRY SURVEYS (1999 – PRESENT)

The park performs limited radio telemetry surveys. Since 1999, park staff have collared five does with a radio transmitters recording their movements. Data collected from these does include recording the movements in and out of the park and calculating the percent of time that the doe is inside or outside of the park. Initial results of preliminary data from the study indicate that average annual deer movements vary between ¼ to ½ mile to approximately 1½ mile. Time spent within and outside of the park varied considerably among the does in different areas of the park.

Cost estimates for the radio telemetry surveys include tracking two deer over a year. In 2004, park staff conducted surveys of one hour each approximately 42 times. With analysis, radio telemetry surveying totals approximately $1,700 in labor.

ROCK CREEK PARK IMPACT STUDIES

In addition to determining abundance and distribution of deer at Rock Creek Park, the park is also conducting studies to determine the impacts of deer on other natural resources. Studies conducted to date include open plot monitoring and exclosure studies of deer browse on forest.

VEGETATION IMPACTS

Intense deer browsing on vegetation is a concern for park managers. Impacts could include loss of plant species that may change diversity and structure of plant communities and potential impacts to dependent

wildlife. Biological diversity in eastern forests has declined as deer seek out and consume highly preferred plant species. Large-flowered trillium (*Trillium grandiflorum*) is common to the region and is favored by deer. High deer densities can skew trillium populations toward small plants and can lead to extirpation of sensitive forbs such as trillium (Augustine and Frelich 1998). Population density as low as 8 deer/km^2 (21 deer/mi^2) may be too high to maintain the diversity of all plants and animal species in northern hardwood forests (Alverson 1988). Densities as low as 4 deer/km^2 (10 deer/mi^2) may prevent regeneration of woody species such as white cedar (*Thuja occidentalis*) and some herbaceous species in northern Wisconsin, as an example (Alverson 1988). At high deer densities, if deer browsing activities are not controlled, browse availability for deer declines to the point that feeding by deer becomes much less selective (Hazel 1995). At that point, browse impacts become apparent in the form of a "browse line" from the ground up to 2 meters in height. All herbaceous species and most shrub species are eliminated (Rhoads, n.d.)

Long-term Open Vegetation Plots

Figure 3: Browsed Vegetation

In 1990, long-term open vegetation plots were randomly located throughout the park to capture general changes in vegetation over time. There were not many deer documented in the park at that time, providing a good baseline of vegetation characteristics. Read every four years, data from the open plots indicate that in 1991, 2.9% of the stems in the plots were browsed, compared to 28% in 2003. During this time, shrub cover decreased 73% and tree seedlings in the open plots decreased from 8/m^2 to 5/m^2. These data, weighted by height class, indicate that stocking rates, as defined by Susan Stout of the U.S. Forest Service, are below recommended vegetative stocking rates for regeneration. Figure 3 shows an example of deer browse in one of the open vegetation plots. The long-term plots are scheduled to be measured again in 2007.

Cost estimates for monitoring the 27 plots assume four park staff require four hours per plot during each monitoring event. This requires approximately $9,000 per event in 2004 dollars. A one time data analysis fee is assumed at $12,000.

Exclosure Plots

In 2000, fenced plots were erected and paired with open plots in Reservation 339 (Figure 4). Twenty paired plots were randomly erected throughout the park and are measured annually. Since establishment of these plots in 2000, two of the exclosure plots have been abandoned and are no longer monitored. Rock Creek Park staff collected data from these plots from 2001 to 2004. Plant densities outside the exclosure decreased compared to the density of plants inside the exclosure. Specifically, the plant densities in the

open plots for plants less than 30 centimeters tall was 82% lower and plants up to 100 centimeters tall was 50% lower. These impacts can be directly attributed to deer browse and indicate deer are affecting the integrity of the understory structure and species composition, diminishing the value of habitat for other wildlife.

Cost estimates for monitoring and maintaining the exclosure plots annually include approximately $4,500 for monitoring, $6,000 for analysis, and less than $200 for maintenance.

Figure 4: Exclosure

ROCK CREEK PARK EDUCATION AND PUBLIC OUTREACH

Other deer management activities currently undertaken by Rock Creek Park include assisting D.C. Animal Control with injured animals (e.g., darting animals, euthanizing injured animals), responding to neighbors' questions about the deer population (e.g., how to keep deer out of yards, preventing browse of landscaping vegetation), and disseminating information about the deer population.

Three urban wildlife kits (deer, turtle, owl), designed for pre-kindergarten through grade 3, are available for loan from the Rock Creek Park Nature Center. Each kit contains a teacher's guide, materials, books, and objects for hands-on lessons focusing on adaptations and habitats (NPS 2003a). The wildlife kits are borrowed an average of four times each year (based on receipts from 1998-2005). Teachers keep the kit for three to five weeks. The Deer Kit has 16 suggested lessons and teachers often create additional activities. Checking the kits in and out requires minimal staff time. Each teacher may teach as many as 10 to 12 lessons for different classes using the kits (L. Illige, NPS, pers. comm., August 25, 2005).

Park staff are participating in the Wildlife Vehicle Collision Reduction Working Group with the Metropolitan Washington Council of Governments. Approximately 80 hours per year is spent by park staff participating in the work group, including preparation and meeting attendance.

In addition, park staff and the superintendent have spoken at community association meetings and town hall meetings regarding deer issues in the park. Six "Oh Deer" interpretive programs are given during the year.

In 2005, the park spent more than $7,000 on public outreach and education programs related to deer management.

DEER MANAGEMENT BY OTHER FEDERAL, STATE, AND LOCAL AGENCIES IN THE REGION

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services program has been involved in the evaluation and/or implementation of a number of deer management plans on federal properties in eastern United States. Environmental assessments conducted for the states of New Jersey and Virginia concluded that direct reduction, or sharpshooting, of the deer population was the preferred alternative (USDA 2000a, USDA 2000b). In

Pennsylvania, the resulting management plan included a wide range of management options to assist landowners with damage control (USDA 2003).

The Maryland Department of Natural Resources has issued two permits to conduct reproductive control studies, one to the USDA, Wildlife Services program for research on the effectiveness of GonaCon™ Immunocontraceptive Vaccine (GCIV) on female white-tailed deer contained within the White Oak Federal Research Center in White Oak, Maryland, and the second to the Humane Society of the United States (HSUS) to test the effectiveness of different forms of porcine zona pellucida (PZP) on female white-tailed deer within the National Institute of Standards and Technology (NIST) site in Gaithersburg, Maryland.

DEER MANAGEMENT—MARYLAND NATIONAL CAPITAL PARK AND PLANNING COMMISSION

In addition to the District of Columbia, Rock Creek Park shares a border with Montgomery County, Maryland. Along this border, the NPS Rock Creek Park transitions into the Maryland National Capital Park and Planning Commission–managed Rock Creek Park, a portion of the 33,000-acre county park system. Like many parks and areas of green space in the eastern United States, Montgomery County addresses, and continues to address, overpopulation of deer.

Citizen complaints about the effects of deer, including deer/vehicle collisions and damage to landscape vegetation, began to increase in the county around 1992. At that time, the county established a task force to determine if deer overpopulation was a problem and, if so, to discuss solutions for addressing it. The efforts of the task force focused on information relative to conflicts between deer and people in the county and resulted in the April 1994 *Report of the Task Force to Study White-Tailed Deer Management*. The report included a recommendation to the county council to establish a working group to prepare a comprehensive deer management plan. This working group is still active today.

As a result of the working group efforts, in 1995 the *Comprehensive Management Plan for White-tailed Deer in Montgomery County, Maryland* was published. This plan recognized that the type and extent of deer-human conflicts varies throughout the county and addresses deer from a variety of standpoints including public safety issues (Lyme disease, collisions), economic issues (agricultural interests, agricultural preserves), and the maintenance and protection of natural areas. The goal of the deer management plan in Montgomery County is to address the effects of deer. The plan does not provide a density goal to be reached (Montgomery County 1995a).

To develop the plan, the county collected and centralized data on the deer and their impacts so that these data could be used as a foundation for management decisions. Data collected during the initial stages included information on deer/vehicle collisions that was later incorporated into a geographic information system to identify hot spots and target areas, effects on agricultural lands and residential properties, and effects on natural areas. Part of the data collection involved vegetation monitoring where a number of plots were established throughout the county in upland and stream valley parks. The open plot study, concluded in 1999, indicated that county forests experienced degradation, but it did not show to what extent increasing deer densities were responsible.

The county also established twenty paired plots measuring 20 meters by 20 meters. Data from the paired plots showed an average loss of 65 percent net species to deer browse. A qualitative assessment of 1995–2001 paired plot data concluded that 1) deer impacts are reducing height, number, and species diversity of seedlings within county parks, 2) understory density has been dramatically reduced, and 3) the effects appear greatest in parks with higher densities of deer (Montgomery County 2002). In 1995, a report from the Maryland Department of Natural Resources (*Inventory of Rare, Threatened, and Endangered Plant*

Populations and Significant Habitats on Selected Park Lands of M-NCPPC in Montgomery County, Maryland) stated that

> "Every park surveyed during this project had an overpopulation of deer. The severity of this problem varies from one park to another, but it represents a considerable threat to the native vegetation in every park" (Montgomery County 1995b).

The county studied a variety of deer management methods and, in 1996, in areas where immediate attention was required, managed deer hunts were implemented. The first managed hunt occurred in northern Montgomery County on a 400-acre agricultural history farm park. The hunt was considered a success and this type of management has continued to be implemented throughout the county.

The county also considered the use of repellents/scare devices, fencing/physical exclusion, habitat management, supplemental feeding, restoration of predators, modifying legal harvest, agricultural depredation permits, direct reduction through sharpshooting or special or managed hunts, contraception, and trapping and removal/relocation. Although all were considered, not all of these methods have been or will be implemented.

One method implemented throughout the county is sharpshooting. When sharpshooting activities occur, the subject park is closed to public from sunset to sunrise and it is posted at the entrance that the park is closed for sharpshooting activities. MNCPPC Park Police officers perform the sharpshooting, removing deer for approximately five hours per night. Taken deer are processed and donated to the Capital Area Food Bank. The county notes that, while this method is effective, the administration and logistics are difficult. The county estimates the cost of sharpshooting at $150 per animal, which includes approximately $50 for deer processing for donation and the rest for ammunition, staffing, and other needs. The other form of direct reduction, special or managed hunts, involves taking land previously closed to hunting and holding a managed hunt under strict guidelines for limited duration. To participate in the hunts, hunters must pass special training and marksmanship tests.

The county has considered contraception and has worked with the Humane Society and the National Institute of Standards and Technology to implement a study in Wheaton Regional Park. However, the site was determined inappropriate for such an effort as policy in the State of Maryland prefers an enclosed population for research studies.

As part of the management plan, the Montgomery County Deer Management Work Group reviews deer-impact data and presents a list of recommendations for the upcoming year in an annual report. In Fiscal Year (FY) 2003, this report stated that the management options implemented over the previous six years appear to be having an effect. The report also states that, in areas where managed hunts had been held (Little Bennett Regional Park, the Agricultural History Farm Park, and Seneca Creek State Park), the number of deer/vehicle collisions had been reduced and remained at lower levels. The FY 2003 study also identified 19 "hot spots" for deer impacts and listed a combination of lethal and non-lethal methods at each site to manage the deer population (Montgomery County 2002).

DEER MANAGEMENT—DISTRICT OF COLUMBIA FISHERIES AND WILDLIFE

Although there is not a formal deer management plan in the District of Columbia, issues associated with an overpopulation of deer still exist. As issues arise, they are addressed mainly by two divisions in the District of Columbia Department of Health, Fisheries and Wildlife and Animal Control. The District of Columbia's Fisheries and Wildlife Division has four major components: the Aquatic and Wildlife Education Branch, the Fisheries Research and Management Branch, the Grant Coordination and

Licensure Branch, and the Wildlife Management and Research Branch. Collectively these branches monitor the District's aquatic and wildlife resources. Although not currently engaged in deer management, the Fisheries and Wildlife Division is currently seeking funding to peruse these issues further.

The majority of deer related actions in the city are undertaken by the District of Columbia Animal Control, who address injured animals, nuisance animals, and resident complaints. District of Columbia Animal Control provides animal control and animal disease prevention services and assists the public with animal-related problems. Services offered by this agency include, but are not limited to, animal disease control, rabies suspect control, stray animal control, dangerous dog control, licensing, enforcement, sterilization, and adoption. Specific activities related to a deer management plan include: conducting disease surveillance (i.e., Lyme disease); enforcement animal control laws; disposal of animals by redemption to owner, release to the wild, humane intravenous euthanasia; providing education via pamphlets, classroom visits; and assisting District of Columbia agencies, such as the Metropolitan Police Department, as required (DCDOH n.d.).

[This page intentionally left blank.]

IMPACT ISSUES AND TOPICS

Issues associated with implementing a White-tailed Deer Management Plan at Rock Creek Park were identified by park staff during the internal scoping meeting at the park using the NPS Environmental Screening Form (appendix A). The issues identified are discussed below.

SOILS

Deer overpopulation has led to increased deer browsing and a reduction in the understory vegetation in Rock Creek Park, as shown in the data from the open and paired vegetation plots. As the understory cover decreases, soils become more susceptible to erosion, which can lead to sedimentation and degradation of the park's water resources. Similar disturbance results from numerous deer in the same area creating paths in the forest. Once created by the deer, these newly formed paths are then used by other wildlife and once informally established by wildlife use, create social paths that are could be used by park visitors. The magnitude of the impact of these activities to soils has not been quantified and would need further investigation.

Issue Statement: Increased deer browsing and creation of paths by deer movement decreases the amount of vegetation and could lead to increased runoff resulting in erosion of soils.

SOUNDSCAPES

The deer management strategies discussed included the use of sharpshooting and/or contraceptives by dart gun. Firearm noise resulting from such management activities could affect park visitors and wildlife. Rock Creek Park is an urban park and, while the park is located in an area of high ambient noise, residents have expressed concern for noises related to firearms, and this concern would be taken into consideration in the creation of a deer management plan. It is unlikely that firearm discharge noise would have a substantial impact due to the likelihood that noise suppression devices for the firearms would be recommended as part of the management activity. Current sources of ambient noise in the park include a variety of visitor uses (traffic, special events, athletic fields, picnicking, etc.), flight paths over the park including helicopters and military flyovers, landscaping activities both within the park by contractors and on adjoining lands, commuter traffic, emergency service vehicles, and the activities of adjacent property owners (i.e., community events at schools or churches), as well as other noises common to urban areas.

Issue Statement: Certain deer management activities may cause disturbance to park soundscapes.

WATER RESOURCES – SURFACE WATER

Water resource issues related to deer overpopulation stem from the issues discussed under soils. As the deer population increases so does the amount of deer browse and deer trampling of vegetation, reducing ground cover. As the ground cover decreases, the amount of stormwater runoff and erosion could increase. The retention of water in the forest is related to the amount of ground cover. Although a slight increase in erosion may occur, the water quality in the area is heavily influenced by factors outside the park, such as combined sewer overflows, or sewer lines that carry both the sanitary sewer and stormwater during heavy rain events. During these times, regulators on the sewer lines are designed discharge the excess flow, which is a mixture of storm water and sanitary wastes, directly to the Anacostia River, Rock Creek, the Potomac River, or tributary waters, impacting the water quality. In addition, high density development around the park increases stormwater runoff and the level and types of pollutants entering

the regions waterbodies. While deer activities may have an impact to water quality and surface water, it is likely minimal when compared to these other influences.

Issue Statement: The removal of ground vegetation resulting from deer overpopulation and activities (i.e., browsing, trampling, creating paths) can potentially increase erosion and stormwater runoff, degrading water quality.

WATER RESOURCES – FLOODPLAINS AND WETLANDS

Issues related to floodplains and wetlands are similar to those for surface water. As the deer population increases, the amount of deer browse and deer trampling of vegetation increases, thus reducing the amount of ground cover within the forest. As ground cover decreases, stormwater runoff and erosion increase. Water retention in the forest is related to the amount of ground cover. Some of the vegetation in floodplains could be affected and there could be a degradation of wetland habitat from the increased erosion and sedimentation. Although some minor impacts to floodplains and wetlands may be attributed to deer activity, there are other factors from both inside and outside the park that also influence floodplains and wetlands, and contribute to the majority of impacts to these resources. Among these factors are the large amount of impervious surfaces in Washington, DC and the loss of ground cover and trampling of vegetation by park users.

Issue Statement: The removal of ground vegetation as a result of overpopulation of deer and their activities (i.e. browsing, trampling, creating paths) may increase erosion and stormwater runoff and affect floodplains and wetland habitats.

VEGETATION

Vegetation monitoring in Rock Creek Park has demonstrated a decline in shrubs and seedlings since 1990. In 1990, long-term open vegetation plots were randomly located throughout the park. Not many deer were documented in the park at that time, providing a good baseline of vegetation characteristics. Measured every four years, data from the open plots indicate that in 1991, 2.9% of the stems in the plots were browsed, compared to 28% in 2003. During this time, shrub cover decreased 73% and tree seedlings in the open plots decreased from $8/m^2$ to $5/m^2$.

Rock Creek Park staff collected data annually from twenty randomly erected paired plots from 2001 to 2004. Plant densities outside the exclosures decreased compared to the density of plants inside the exclosures. Specifically, the plant densities in the open plots for plants less than 30 centimeters tall was 82% lower and plants up to 100 centimeters tall was 50% lower. These impacts can be directly attributed to deer browse and indicate deer are affecting the integrity of the understory structure and species composition, diminishing the value of habitat for other wildlife. While there is some understory vegetation and the browse line is not prominent at Rock Creek Park, trends indicate that an unmanaged deer population could lead to these problems, as are currently being faced by similar eastern national parks such as Catoctin Mountain Park.

Issue Statement: An overpopulation of deer could possibly alter and affect forest regeneration patterns in the park, as well as the diversity of species within the park, by reducing the understory and affecting the natural diversity of dominant tree species.

The riparian areas located within Rock Creek Park are considered to be rare or unusual vegetation, as defined by the NPS Environmental Screening Form. The level of deer browse in these areas that would be

associated with an overpopulation of deer in Rock Creek Park could prevent regeneration in these areas and negatively affect the riparian areas. Currently, no data exist on deer impacts to riparian areas within the park.

Issue Statement: The excessive browse associated with an overpopulation of deer in Rock Creek Park could adversely affect regeneration of vegetation in riparian areas.

Deer activity, such as browsing, trampling, and seed dispersal through waste, has the potential to increase the number and type of non-native species within the park. As the number of non-native species increases, the native species within the park encounter increased competition and are adversely affected.

Issue Statement: Deer activities can promote non-native species through habitat alteration and seed dispersal. An increase in non-native species could have a negative impact on the park's native plant communities.

WILDLIFE AND WILDLIFE HABITAT

Rock Creek Park has monitored the number and density of the deer population through spotlight counts, forward-looking infrared surveys, and distance sampling. Survey results indicate that population trends are increasing.

Although the District of Columbia does not collect any data on the deer population, the Maryland Department of Natural Resources and other national park system areas (Antietam National Battlefield, Chesapeake and Ohio Canal National Historical Park, Monocacy National Battlefield) conduct an annual update on the status of deer issues and research, as well as communicate concerns and issues. No formal report is produced, but meeting notes are recorded. Parks provide the state with roadkill data using state deer tags. The State of Maryland collects only 'sex of deer' and 'location taken' data from hunter kills.

Studies have linked high deer densities to undesirable effects on other wildlife species, such as migratory birds (DeCalesta 1994; McShea 2000; McShea and Rappole 2000). Park staff are concerned that deer may be affecting other species, including breeding birds. The Audubon Naturalist Society conducted an annual breeding bird census within Rock Creek Park, which will be examined for any data on impacts to the breeding birds and their habitat over time from various sources. Park staff have noted that deer overpopulation may affect the microclimate of the forest floor, resulting in impacts to vegetation and sensitive species.

Issue Statement: At certain levels, deer overpopulation would adversely affect other wildlife and/or habitat by reducing habitat diversity through activities such as browsing, trampling, and seed dispersal.

Issues related to unique or essential fish habitat are similar to those for surface water. As the deer population increases, so does the amount of deer browse and deer trampling of vegetation, reducing the amount of ground cover within the forest. As the ground cover decreases, the amount of stormwater runoff and erosion also increases and could degrade water quality, including unique and essential fish habitat. Efforts are currently underway in the park to improve fish habitat. As a part of the Woodrow Wilson Bridge project mitigation, man-made barriers to fish movement in Rock Creek Park are being removed. This project, which began in December 2003, will remove or bypass several man-made barriers that for generations have prevented herring and other migratory fish from returning to primordial spawning areas located upriver. A total of 23 fish barriers will be removed or modified in several streams that empty into the Potomac River. In Rock Creek National Park, six fish barriers are being removed or modified, while two more are being removed from the adjacent National Zoological Park.

Issue Statement: Changes in water quality from the removal of ground vegetation as a result of overpopulation of deer and their activities (i.e. browsing, trampling, creating paths) have the potential to adversely affect unique and important fish habitats located within Rock Creek Park.

RARE, UNIQUE, THREATENED, OR ENDANGERED SPECIES

The federally listed endangered Hay's Spring amphipod (*Stygobromus hayi*) was discovered in Rock Creek Park in 1998. The Kenk's amphipod (*Stygobromus kenki*), also found in the park, is under consideration for future listing by the U.S. Fish and Wildlife Service. Since both amphipod species live in seeps or springs underground, it is uncertain whether there is a causal relationship between a deer population and their related activities (browsing, trampling, seed dispersal, etc.) and potential impacts on the amphipods. Protection of the amphipods would be considered in the creation of a deer management plan.

Issue Statement: Habitat for federal listed species may be vulnerable to impacts from deer overpopulation and their related activities (i.e., trampling, browsing, seed dispersal, etc.). In particular, these activities may degrade water quality, in turn affecting the amphipod species.

Because the District of Columbia does not currently provide special protection status for rare plant or animal species, the park considers those species listed by Maryland and Virginia as sensitive species requiring protection. At the state level, the Maryland Department of Natural Resources has identified three listed rare or uncommon *Stygobromus* species in or near the park. *Stygobromus* is a blind, unpigmented subterranean amphipod. Maryland also identified three animal species with known occurrences in Rock Creek Park listed as rare or uncommon at the state level including the yellow-crowned night-heron (highly rare), Appalachian spring snail (rare), and gray petaltail dragonfly (possibly rare). The Virginia Department of Conservation has identified 7 highly rare and 21 watch list plant species in Rock Creek Park. While the NPS is not under any legal obligation to protect these plant or animal species, park policy and management actions include maintaining these uncommon native species as part of the park's natural heritage. These species have the potential to be impacted by an overpopulation of deer as a result of habitat alteration as discussed under soils, water resources, and vegetation.

Issue Statement: Habitat for Maryland and Virginia state-listed, or other species considered sensitive by Rock Creek Park, may be vulnerable to high levels of deer browse activity.

VISITOR USE AND EXPERIENCE

Many visitors come to Rock Creek Park units to enjoy the natural areas. For some park visitors, seeing a deer is an important part of the park experience and for others, deer are an unwelcome intrusion. Park staff noted at a recent town hall meeting jointly sponsored by Rock Creek Park and Councilman Adrian Fenty, approximately half of the participants were favorable toward deer in the area and the other half looked upon the presence of deer unfavorably. Furthermore, an overpopulation of deer may have an indirect impact on other park visitors by altering the habitat of other species (i.e., changing the understory so that there are fewer migratory birds) and changing the visitor experience for those visitors that come to see species within that habitat.

Issue Statement: The presence or absence of deer in Rock Creek Park could be an important component of the visitor experience for some park users and alteration of the number of deer through a Deer Management Plan would impact this experience.

Deer management activities have been, and will continue to be, affected by the public perception of deer and other wildlife. In the past five years the park received two reports of deer running through plate glass windows at neighboring residences. These few instances of damage to personal property resulting from deer influence the public perception within the community. Likewise, park staff have reported that public outreach indicates that a portion of the District of Columbia community has a general fear of wildlife, including deer.

Rock Creek Park is one of the largest forested urban parks in the nation, supporting an average of more than two million recreational visitors per year. Another 12 million people use the park annually for nonrecreational purposes such as commuting (NPS 2003c). The park offers a wide variety of natural, historical, and recreational opportunities, including hiking, biking, horseback riding, bird watching and wildlife viewing, picnicking, golf and other sports activities, nature walks, and educational activities. An extensive system of trails and paths cross Rock Creek Park. Others come to Rock Creek Park by car. Beach Drive is used by commuters as a north-south transportation route through the park. There are no entrance fees, although some fees are charged for various activities in the park.

Deer are found in all areas of Rock Creek Park, but park staff note a higher concentration on and in the area of the golf course. The Rock Creek Park golf course is open every day from dawn to dusk and includes a golf school, golf shop, putting green, and snack bar. Visitation records indicate use of the course is slowly decreasing with an annual use of 51,700 in 1997 and an annual use of 33,000 in 2002. The highest use period at the golf course, on average, is April through October.

Issue Statement: Proposed deer management activities may require certain areas of the park to be closed to the general public use during management activities, affecting visitor use and experience.

CULTURAL/HISTORIC RESOURCES

Rock Creek Park consists of many diverse units varying from carefully designed landscapes to natural forested areas. The cultural landscapes at Rock Creek Park reflect the relationship between what is natural and what is man-made. Dumbarton Oaks is an example of a designed landscape within the park. Whether natural or designed, an overpopulation of deer and the resulting deer browse can impact the cultural landscape of an area and affect the historical accuracy of a given site.

Issue Statement: An overpopulation of deer and the resulting deer browse could impact the cultural landscapes within Rock Creek Park.

SOCIOECONOMIC RESOURCES

Current Rock Creek Park deer management activities include communicating with neighboring landowners and addressing questions and concerns. Residents contact the park to complain about deer in the area that may have come from the park, entering private property and eating landscaping, causing aesthetic and economic impacts. The park, in turn, provides advice to the landowners regarding landscape plantings that may be less palatable to deer.

Issue Statement: An overpopulation of deer could lead to increased browse of landscape vegetation on neighboring properties, having a negative economic impact on those landowners.

ENVIRONMENTAL JUSTICE

There are potential beneficial effects to low-income families from the donation of meat should a management plan be implemented that contained lethal action. Based on Montgomery County's experience, it would cost approximately $50 a deer to process meat for donation. Meat resulting from a lethal management method that uses certain kinds of chemical injections cannot be donated and must be discarded.

Issue Statement: The donation of meat from lethal deer management activities would have an impact to local charitable organizations and those they serve.

HEALTH AND SAFETY

According to the U.S. Centers for Disease Control and Prevention, Lyme disease was identified in 1977 when arthritis was observed in a cluster of children in and around Lyme, Connecticut. Other clinical symptoms and environmental conditions suggested this was an infectious disease probably transmitted by an arthropod. Further investigation revealed that Lyme disease is caused by the bacterium, *Borrelia burgdorferi*. These bacteria are transmitted to humans by the bite of infected deer ticks (U.S. Centers for Disease Control and Prevention 2003). Lyme disease is confirmed in the park area, but has not been identified as a problem at Rock Creek Park.

Issue Statement: An overpopulation of deer provides more hosts for Lyme disease and could increase the possibility of the deer in Rock Creek Park becoming a more prevalent source.

According to Virginia's Department of Game and Inland Fisheries, the number of vehicle accidents in Virginia known to involve deer increased by 22 percent between 1990 and 2000. The number of injuries jumped nearly 70 percent. Fairfax County Police 2002 records offer a snapshot of the problem in the District of Columbia region (AAA 2003):

- 47% of car-deer collisions in 2002 occurred between 5:00 and 9:00 PM., and another 20% between 5:00 and 9:00 AM;
- 84% of collisions occurred at speeds of 35 miles per hour or more;
- 67% of deer struck the front of the car, 22% struck the left side, and 11% struck the right side; and
- Average damage to cars was more than $2,200.

More than 60 percent of crashes in the Washington metropolitan area occur from October through January, when deer populations are on the move across busy roads—first during their mating season, and then foraging for food and shelter (AAA 2003).

The Metropolitan Council of Governments completed a case study noting that roadkill has increased but traffic numbers remained comparatively constant between 1995 and 2003. The multi-agency Wildlife Vehicle Collision Avoidance Working Group, of which Rock Creek is a part, will provide draft recommendations in a white paper scheduled for release this fall.

Issue Statement: Regionally, the deer population has resulted in an increase in deer-vehicle accidents. The park is participating in the multi-agency Wildlife Vehicle Collision Avoidance Working Group to assist in developing recommendations to reverse the trend.

ROCK CREEK PARK MANAGEMENT AND OPERATION

Rock Creek Park is an urban park with multiple jurisdictions as neighbors, including the District of Columbia and Montgomery County, Maryland. While the District of Columbia does not actively manage deer, D.C. Animal Control assists Rock Creek Park with responding to deer complaints. The District of Columbia is also seeking a funding increase for deer management efforts; the 2006 budget includes appropriations for a wildlife biologist to address potential deer issues. Rock Creek Park views the District of Columbia as a partner in their deer management efforts and as members of the Metropolitan Washington Council of Government initiative, the city and the park are working on the regional deer management efforts.

The adjacent jurisdiction of Montgomery County, Maryland has had an active deer management program since 1995 as described on page 27. The county and the District of Columbia have stated they would like to be a partner with the park for deer management efforts.

Issue Statement: Deer management activities must take into consideration the deer management actions of adjacent municipalities to enhance deer management success within the park.

ISSUES ELIMINATED FROM FURTHER CONSIDERATION

The following impact topics and/or issues should be removed from consideration:

- Geohazards: A geohazard is an event related to geological features and processes that cause loss of life and severe damage to property and the natural and built environment, such as an earthquake or rock slide. There are no known geohazards within the park that would be affected by the creation or implementation of a white-tailed deer management plan.

- Prime Farmlands: There are no designated prime farmland soils in the park.

- Air Quality: Potential sources of air quality emissions from the implementation of a white-tailed deer management plan include the use of a few vehicles to carry out the prescribed management activities. Although Rock Creek Park is located in an area classified by the U.S. Environmental Protection Agency as severe nonattainment for ozone, it was determined that the increase in air emissions from these activities would be extremely minimal and short-term, resulting in only negligible impacts to the regional air quality.

- Streamflow Characteristics: The proposed action would not occur in any area or involve management actions that would potentially impact streamflow.

- Marine or Estuarine Resources: There are no marine or estuarine resources in any of the Rock Creek Park units.

- Land Use: Implementation of a white-tailed deer management plan would not affect how surrounding land is used including occupancy, income, ownership, or type of use. The

proposed plan would be consistent with surrounding land uses and would not have an effect.

- Unique Ecosystems, Biosphere Reserves, World Heritage Sites: There are no known biosphere reserves, World Heritage sites, or unique ecosystems listed in the park. Rock Creek Park is part of the Chesapeake Bay Watershed; however, actions related to the deer management plan would not affect the watershed.

- Museum Collections: The implementation of a White-tailed Deer Management Plan in Rock Creek Park would mainly occur within the forested areas of the park and would not have any effects on the park's museum collections.

- Historic Structures: Although there are historic structures that are listed or eligible for listing on the National Register of Historic Places, there would be no to negligible impacts on these structures from implementing, or not implementing, a white-tailed deer management plan in Rock Creek Park. Designed landscapes, such as Dumbarton Oaks, would be addressed under cultural landscapes.

- Energy Resources and Resource Conservation: The implementation of a white-tailed deer management plan would not be expected to affect energy resources or resource conservation within the park.

PRELIMINARY ALTERNATIVES

Alternatives must meet objectives to a large degree, while meeting the purpose of and need for action. See Director's Order 12, 2.7; 4.5 (EIS); 5.3 (EA)

The discussion of potential alternatives during the internal scoping meeting focused on the components or potential actions that would meet the plan objectives. Numerous alternative components were identified by the group; this brainstorming session did not proceed into a discussion of how well the potential action would resolve purpose and need and meet objectives to a large degree. Meeting participants grouped the alternative components into potential alternatives. Some ideas were considered, but may not be carried forward into the planning process. These are noted as "alternatives considered, but not carried forward." The preliminary alternatives, as well as those not carried forward, will be reviewed through additional public and agency scoping. After additional scoping is completed, a range of reasonable alternatives will be identified for detailed analyses in the planning process.

PRELIMINARY ALTERNATIVES

ACTIONS COMMON TO ALL ALTERNATIVES

The following actions would be common to all alternatives:

Best available science: The best available science would be used to determine appropriate management actions. The management plan would be adaptive, allowing for incorporation of new information over time to affect management actions.

Threshold development: The scientific monitoring methods currently underway in the park would be used to determine what population thresholds the park is trying to achieve and/or maintain. This would include continuation of monitoring for both vegetation effects and deer population in order to correlate impact levels with deer population numbers.

Small-scale fencing: Small areas of known sensitive resources, such as rare plant populations or single saplings, would be fenced to protect them from deer browsing. Small, fenced areas would be established around rare plants to encourage regeneration.

Repellents: Small areas of known sensitive resources, such as historic landscaping, would be protected through the use of repellents. Repellents reduce the attractiveness and palatability of treated plants to a level lower than that of other available forage. Repellents are more effective on less palatable plant species than highly preferred species (Swihart et al. 1991). Repellent performance may be negatively correlated with deer density, meaning that the higher the abundance of deer, the less likely the repellent would be effective. Success with repellents is measured as a reduction in damage; total elimination of damage should not be expected (Craven and Hygnstrom 1994).

ALTERNATIVE A — EXISTING MANAGEMENT CONTINUED (NO-ACTION ALTERNATIVE)

Section 1502.14(d) of the CEQ regulations for implementing NEPA requires the alternatives analysis in the EIS to "include the alternative of no action." In the case of developing a deer management plan, the no action alternative represents no change from current management direction or level of management intensity.

Under the no-action alternative, Rock Creek Park would continue to conduct deer monitoring, data gathering, and various activities to protect native plant species, as described under the Deer Management Summary and Research Overview section (such as creating and monitoring exclosures, conducting spotlight surveys and distance sampling, performing limited radio telemetry studies, recording roadkill data, etc.). Current inventorying and monitoring efforts would continue to record impacts and deer population numbers within the park. Preventive measures, such as limited fencing around tree plantings and some community garden plots, would continue to be used. Educational and interpretive measures, such as conducting park-sponsored meetings or participating in town hall meetings, would continue to inform the public about deer ecology and park resource issues. The park would continue to work with District of Columbia Animal Control, Montgomery County, other national park units, and the Metropolitan Washington Council of Governments on committees and in an advisory capacity. No additional active deer management activities would take place.

Costs associated with current management activities are approximately $35,000 in those years where monitoring of all vegetation plots and exclosures occur with analysis.

(This alternative would serve as the baseline for analyzing and comparing the effects of the other alternatives.)

ALTERNATIVE B — REPRODUCTIVE CONTROL

Reproductive control can generally be divided into contraception (i.e., preventing conception) and contragestation (i.e., preventing gestation or pregnancy). To implement reproductive control as an alternative, the park would monitor the status of ongoing contraceptive research to determine if other contraceptive options exist. If the advances in technology could benefit the management plan of the park, the park would consider future application of reproductive controls as a research or management level action and develop specific implementation plans at that time.

Contraception

There are no currently available contraceptive reproductive control agents approved by the Food and Drug Administration for animal population management. In the near future there may be a single year reproductive control agent (leuprolide) available for off-label veterinary use[1], or immunocontraceptive agents (PZP (porcine zona pellucida) vaccines, GnRH (Gonadotropin releasing hormone) vaccine) could be available under an Investigational New Animal Drug (INAD) approval by the Food and Drug Administration. Currently several vaccines are available for research with INAD approval; however, these agents require a researcher to define the specific goals and objectives of the proposed application. Some

[1] Off-label veterinary use refers to the administration to a species of animal of a medicine that is not intended for use in that species.

general parameters for using reproductive controls under this alternative are provided for purposes of evaluating potential effects of this alternative.

Actions that the park could take at this time would include research studies on contraceptives. This type of study could be conducted in one of two ways. The first approach would be to fence an area within the park to contain a certain number of deer that would be treated with a reproductive control agent. The general purpose of using a fenced portion of the population may be to test the duration of efficacy of one or more contraceptive agents, or to answer a variety of other research questions. The fenced deer would need to be marked with tags for identification in case they escape. All policies regarding wildlife containment and the Animal Welfare Act would be followed. The second approach involves the treatment of a certain number of deer with a reproductive agent, but in a free-ranging condition (no fence). The general purpose of this free-range application would be to estimate the effort and cost per deer to administer reproductive control within remote areas (steep terrain, limited access roads or trails). The treated animals would be radio collared to assist in locating each treated deer for subsequent treatments and to monitor them to verify the reproductive controls are working. Use of reproductive controls would result in the reduction of the population over time, and would not have an immediate effect on managing the deer population.

Reproductive Control Agents

Several contraceptive products are currently being developed and tested for use in deer population control (Table 2). A final contraceptive agent choice would be determined by cost, efficacy, duration and safety of available products at the time action is implemented. Currently, the most readily available products for female deer contraception are (1) porcine zona pellucida (PZP) (Naugle et al. 2002, Turner et al. 1996, Kilpatrick et al.1992) (2) Uniquely formulated PZP = SpayVac®, (3) Gonadotropin releasing hormone vaccine (Miller et al. 2000, 2001; Curtis et al., 2002) and (4) Leuprolide (Baker et al. 2002, 2004).

Table 2: Reproductive Control Agents

Issue	Standard PZP Vaccine	SpayVac (PZP) (vaccine)	GnRH Vaccine	Leuprolide (GnRH agonist)
Mode of Action	Blocks sperm penetration and fertilization; estrous cycles continue	Blocks sperm penetration and fertilization; estrous cycles continue	Prevents secondary hormone (lutenizing hormone and follicle stimulating hormone) secretion, which stops folliculogenesis and ovulation	Prevents secondary hormone (lutenizing hormone and follicle stimulating hormone) secretion, which stops folliculogenesis and ovulation.
Administered	Injection	Injection	Injection	Injection
Dosage	Twice initially and a yearly booster	Initially a single injection; if and when antibodies decline retreatment would be required	Likely a single injection initially; if and when antibodies decline, retreatment would be required	Current formulation — once per year
Timing	Treat before breeding season and allow sufficient time for antibody development.	Treat before breeding season and allow sufficient time for antibody development.	Treat before breeding season and allow sufficient time for antibody development.	Treat immediately before breeding season on a yearly basis.

The listed contraceptive agents may be administered by direct injection or remote dart application, which ever method is most feasible at the time of implementation. Direct injection would require the capture of deer, which may require bait stations, traps, or tranquilizers. Remote dart application would not require captures, except for the initial marking of the deer before treatment.

Because the FDA has not approved these contraceptive agents, with the exception of Leuporlide, for management use in wild ungulates, currently all deer treated with any of these agents must be individually identified or marked (Rudolph et al. 2000). This is often accomplished using ear tags stating "Not for Human Consumption" and/or by fitting with radio collars. To identify treated deer, each deer must be captured and handled at least once initially and may require additional handling annually for booster applications. Tracking and capturing previously treated deer requires time to locate the animal or to lure it to a trap site for injection. After deer have been handled one or more times, they can become increasingly difficult to capture for subsequent treatments.

While it is correct that no FDA-approved product exists specifically for the purpose of reducing the fertility of white-tailed deer, this is not a requirement for use of such products. There are several products which are FDA-approved for therapeutic (medical) use in either domestic animals or humans (lueprolide). These products can be used with a veterinary prescription under the Animal Drug Use and Clarification Act of 1994 (AMDUCA). The veterinarian, the client (NPS unit) and the animal (deer herd) must develop a strong relationship of understanding regarding how and why the drug will be used in an off-label manner. It is the responsibility of the prescribing veterinarian to give an appropriate meat withdrawal period for food producing animals that may enter the human food chain. The veterinarian may determine there is no meat withholding period for a particular drug. If this is the case, the animal does not need to be marked. If there is a meat withholding period then the animal needs to be appropriately marked. Additionally, many other products such as the immunocontraceptives (PZP vaccines or GnRH vaccine) have been issued Investigational New Animal Drug exemptions by the FDA. The INAD exemption allows the use of these drugs in research settings. A research setting may be a captive (fenced) area within a park or may be free-ranging animals. The important aspect of a research setting is that new information is carefully and systematically being gathered by a researcher regarding the safety and efficacy of the experimental drug.

Technology has been developed to deliver boosters without physically capturing and handling the deer via a remote dart application (biobullet) delivered with a dart-type gun. Factors that need to be considered regarding this technology include the maximum distance to the deer that allows the needed penetration for delivery, consistency in dosage delivered, and accurate documentation of which deer have been treated. Therefore, the application of annual boosters, whether by capturing and handling of deer or by remote delivery, can be time consuming and expensive, and human and animal safety precautions must be addressed.

Capture Methods

Capture and sampling may stress individual deer and result in a small percentage of handling-related mortalities. This mortality rate is applicable to all capture methods, including physical or chemical restraint; both methods should be conducted by skilled professionals (NPS 2004c). The U.S. Department of Agriculture (USDA), Wildlife Services would likely administer reproductive controls. Wildlife Services has personnel qualified to capture deer and apply contraceptive control methods.

Depending on the capture technique used, the park may restrict visitor access in certain areas during the capture and processing period. The areas used for trapping and processing deer would be chosen based on accessibility and limiting visitor inconvenience. Deer could be captured by trap nets or darting with tranquilizers. The capture and treatment of deer would be conducted during off-peak visitor times to the extent possible.

Sterilization of Does

Although contraception is experimental at this time and can only be implemented as a research study, the surgical sterilization of does would not require chemical contraceptives and could be implemented as a management action. This alternative provides the advantage of permanent sterilization of individuals. Under this alternative, female deer would be captured, tagged, and surgically sterilized, usually requiring a licensed veterinarian. They would be released back into the park. The capture and treatment of deer would be conducted during off-peak visitor times to the extent possible.

Although feasible, sterilization disadvantages include capture stress to the doe due to tranquilizers/anesthesia, surgical procedures, and recovery, which could increase mortality rates of sterilized individuals. Additionally, the long-term effects of this alternative on population genetics or behavior have not been well documented. Some researchers suggest that, depending on the type of sterilization used, changes in animal behavior could be expected (Warren and Warnell 2000). According to Know et al. (1988), removal of the ovaries, and thus changing hormone production in the treated animal, can result in altered behavior. With a ligation procedure, normal hormone production would remain; however, this has been shown to result in repeated estrous cycles during the breeding season (Knox et al. 1988), extending the rut by modifying the male response behavior.

Sterilization of bucks is possible, but based on past studies sterilization of does was considered to be more effective. In a study of sterilization of feral horses, sterilizing only dominant harem stallions resulted in relatively modest reductions in population growth. Substantial reproduction may occur even when 100% of the dominant harem stallions are sterilized if other males perform as little as 10% of the breeding. Adequate suppression of population growth may be attained only if a large proportion of all males in the population are sterilized (Garrott and Siniff 1992).

Another study on the use of vasectomy on wolves suggested that population reduction depends largely on the degree of annual immigration. With high immigration periodic sterilization produced only moderate reductions in population size relative to an untreated population. Similar reductions in population size were obtained by periodically removing large numbers of wolves (Haight and Mech 1997).

Long-term population stability would become an issue with the sterilization of bucks, along with genetic variability (a few non-dominant bucks could breed the entire herd). If females did not become pregnant, their estrous cycle could be extended, resulting in later pregnancies and lower survival for fawns born later in the year (as a result of a higher winter-kill potential). The population dynamic and makeup of the herd could suffer.

ALTERNATIVE C — NON-LETHAL COMBINATION

This alternative would combine fencing of large exclosures and reproductive controls, in addition to the fencing of small sensitive areas and use of repellents that are common to all alternatives. The reproductive control of does is considered in two components – contraception and sterilization – as described in alternative B.

Fencing of Large Exclosures

Under this alternative, in addition to the smaller areas that would be fenced under all alternatives, fencing would include larger fenced exclosures to allow reforestation. It has been suggested at other eastern parks that the minimum area to be fenced at one time to meet the goal of forest regeneration within the park is 5

to 10% of the forested area (NPS 2004c). The exact size and number of exclosures appropriate for Rock Creek Park would need to be determined.

The exclosures would be placed in scattered locations throughout the park in locations that are least visible to park neighbors. When defining areas to be fenced and the level of fencing required, park staff would also consider the fenced areas in relation to visitor use areas, park boundaries, accessibility, and maintenance requirements. Preference would also be given to placing exclosures around naturally occurring disturbed areas (e.g., blow downs, disease-stricken areas) when available. The exclosures would have a minimum fence height of eight feet. The fences would consist of woven wire with 3- to 4-inch openings. These openings would allow most small animals to move freely through the fences. Metal posts would be placed every 12 feet along each side of the exclosure, with concrete-reinforced 4x4 wooden posts at 100-foot intervals and as corner supports. Due to the size of these fences, Rock Creek Park would need to initiate Section 106 consultation under the National Historic Preservation Act and obtain permission from the Commission on Fine Arts.

Although deer have the ability to jump eight feet, this is only when driven and when they see a place to land. Once the vegetation inside the fence sprouts, little opportunity would exist for deer to jump the fence. During construction, considerations of topography would be made so land is not significantly higher outside the fence to make it easier for deer to jump into the fenced area. Fenced areas would be monitored for holes, and any deer finding a way into the exclosure would be removed.

Deer would be driven out of the exclosures during construction by park staff before completion. Visitors would not be able to use the fenced areas during and after construction. All exclosures would be maintained by park staff. Maintenance would consist of visual inspection for fence integrity at least four times per year and after any major storm event.

It is estimated that at least 10 years would be required for seedling growth in the exclosures to exceed the typical deer browse height (150 cm). After seedlings exceed 150 cm (above deer browse height), the exclosures would be relocated to different areas of the park. New exclosures may be placed in adjacent areas to take advantage of one side of the previous exclosure to minimize relocation costs and labor.

Fencing would not decrease deer browse pressure or bring the deer population down on its own. When the fence is erected, deer would be displaced and may find more opportunities outside the park boundary.

ALTERNATIVE D — LETHAL REDUCTION WITH FIREARMS

The lethal reduction with firearms alternative would include direct reduction by sharpshooting and limited capture and euthanasia in select situations.

Direct Reduction by Sharpshooting

Qualified federal employees, such as USDA, Wildlife Services or U.S. Park Police, would be used to implement this alternative. High-velocity, small caliber rifles would be used from close range. Every effort would be made to make the shootings as humane as possible and to minimize suffering. Noise suppression devices and night vision equipment may be used to reduce disturbance to the public. The park would comply with all federal firearm laws administered by the Bureau of Alcohol, Tobacco, and Firearms.

The action would largely occur at night during late fall and winter months when deer are more visible to reduce the amount of time required to complete the action. For nighttime actions, a spotlight would be used. If areas of the park are closed or have visitor restrictions, shooting could be conducted during the day, when necessary, with minimal effect to the park and park visitors, maximizing effectiveness and minimizing the overall time of restrictions. The public would be notified of any park closures before the actions. Visitor access may be denied as necessary during the time the reduction is taking place, and the park and the perimeter of the closed area would be patrolled by U.S. Park Police during direct reduction efforts to ensure public safety.

Safety considerations at Rock Creek Park include the extensive park roadway system that is used 24 hours a day. Roads in the vicinity of sharpshooting actions may need to be temporarily closed when these actions occur. Similarly, a patrolled perimeter would need to be established around the area when actions are occurring to prevent people using park trails from entering the area.

Bait stations may be required to attract deer to safe removal locations. Bait stations would be established away from public use areas to maximize the efficiency and safety of the reduction action. Bait station locations would be approved by park staff before implementation. A bait station would consist of placing small grains, apples, hay or other attractive food on the ground in designated locations to attract deer. The amount of bait placed in any one location could be in the range of 20 to 100 pounds, depending on the bait used and the number of deer in the immediate area. U.S. Park Police noted that there are areas in the valleys where bait stations could be placed against embankments to minimize safety risks.

Deer carcasses would be collected, field-dressed, and processed, and records would be kept on the age and gender of each animal. Waste, such as removed hides and entrails, would be used or disposed of consistent with federal and state laws and regulations. Venison would be donated to local charity organizations. The local food bank would be notified before the harvest so that the charity can be prepared to accept and distribute the meat. Refrigerated storage would be used if air temperatures are above 50 degrees at the time of the removals. Based on similar experiences in neighboring Montgomery County, it would cost approximately $50 to process each deer for donation.

Rock Creek Park would focus direct reduction efforts on does or antlerless deer. There would be a preference for removing antlerless deer because this would reduce the population level more efficiently over the long term. Buck-only removal would not control population growth, as deer populations are largely dependent on the number of does with potential for reproduction. Harvest of antlerless deer is necessary to stabilize or reduce populations. The West Virginia University Agricultural Extension Service recommends that to reduce deer population rapidly, at least 15 antlerless deer should be taken for every 10 antlered deer (W. Virginia University 1985).

Capture and Euthanasia

In situations where direct reduction through sharpshooting would not be appropriate, such as trapped or injured deer, or deer in heavily populated areas or small tributary parks, reduction would be undertaken through capture and euthanasia. The preferred technique would be for qualified federal employees to trap the deer, approach them on foot, and euthanize using either a gun or a penetrating captive bolt and potassium chloride.

Deer would be captured with nets or traps and euthanized as humanely as possible. Several methods of wildlife trapping may be used, including but not limited to drop nets or clover traps. Most of the trapping methods involve providing bait to attract deer. The clover traps involve a confined space that humanely holds the deer to allow staff to approach the deer to euthanize it. Drop net traps are similar in that they often use bait to attract deer to the drop zone, where suspended nets are triggered to drop over the deer

and restrain them for staff to approach (Lopez et al. 1998). The method of capture would be selected based on the specific circumstances (location, number of deer, accessibility, and reason why sharpshooting was not advised) for each deer or group to be removed by this method. Warning signs would be erected around the trap area prohibiting public access.

Capture and euthanasia would typically result in increased stress levels in captured deer, compared to the direct reduction by sharpshooting method, as a result of the close interaction with humans. This method would be implemented only in select situations and would supplement the direct reduction method described above. Meat from deer could not be donated because of the chemicals used for euthanasia and would be disposed of using approved methods (e.g., burial or incineration).

ALTERNATIVE E — LETHAL REDUCTION WITHOUT FIREARMS

Under this alternative, lethal reduction would occur, but would use chemical euthanasia by injection instead of sharpshooting. This alternative would involve the delivery of a lethal dose of a drug to the deer by a dart gun. Actions under this alternative would occur under supervision of a veterinarian or NPS park practitioner. However, when drugs of any type are used, whether for immobilization or for euthanasia, the meat from that animal cannot be donated as food and the carcass cannot be left to decompose naturally. In these cases the euthanized animals would be buried on site.

ALTERNATIVE F — LETHAL REDUCTION FOLLOWED BY NON-LETHAL MAINTENANCE MEASURES

Actions taken under this alternative would use lethal means to reduce the deer population to the desired deer density. Once the desired density has been reached, non-lethal maintenance measures would be used to maintain the reduced population. Lethal methods for population reduction would include direct reduction by sharpshooting and capture and euthanasia, as appropriate. The method for implementing these measures would be the same as described under alternative D. Non-lethal maintenance measures would include the use of reproductive control in does, either with contraceptives or by sterilizations. The components of the reproductive control of does are described under alternative B.

ALTERNATIVES CONSIDERED BUT NOT CARRIED FORWARD

The following alternatives were considered during internal scoping, but were dismissed from further consideration because they did not meet the purpose and need or action, or were not considered reasonable alternatives, as defined by DO-12. These alternatives will not be analyzed in the white-tailed deer management plan/EIS.

Public Hunt by Bow or Firearm

Park enabling legislation does not allow hunting and District of Columbia laws forbid hunting; therefore, a public hunt would not be legally possible. NPS regulations, 36 CFR 2.2, state that hunting is prohibited in national parks unless specifically authorized as a discretionary activity under federal statutory law.

Predator Reintroduction

Reintroducing predators into Rock Creek Park is not feasible due to a lack of suitable habitat that is large enough to support them. The proximity to humans is not appropriate for reintroducing predators that would prey on deer, such as gray wolves or cougars. Other native animals, as well as domestic pets, could

also become potential prey if predators were reintroduced to the park area. In addition, the natural predation of deer in a small natural area such as Rock Creek Park would not be effective in controlling the population at the level needed to protect and maintain plant abundance and diversity.

Use of Poison

Under this alternative, poison mixed with food sources such as grains would be used to kill deer. Death from poisoning would not be immediate, and health concerns about people potentially hunting and eating poisoned deer that have wandered out of the park could be an issue. In addition, non-target native wildlife or roaming pets could potentially eat a tainted carcass or the poison itself.

Capture and Relocation

Under this alternative, deer within Rock Creek Park would be captured and relocated to areas a sufficient distance from the park to ensure they would not return.

Deer would need to be relocated out of the District of Columbia: however, this is not possible since most states prohibit the transfer of deer across state lines as a result of wildlife disease-related issues. Deer relocation methods have been shown to cost from $400–$800 per deer (Porter 1991). Given the abundance of deer in the region and most of the United States, recipients for such a program would be very limited.

Live capture and relocation methods can result in high mortality rates among captured and/or relocated deer. Implementation of this alternative could result in the death of more than 50% of the deer during the first year after release (Jones and Witham 1990). In one study, only 15% of the relocated deer had survived one year after relocation (O'Bryan and McCullough 1985). The exact mortality would be based on factors such as how long the deer are captured, how they are captured, if tranquilizers are used, how far the deer are moved, etc.

Supplemental Feeding

Providing supplemental food sources for deer would potentially decrease browsing pressure on vegetation resources at Rock Creek Park. However, increasing food sources would increase deer health and production, leading to a growing deer population. In the long-term, this would compound problems associated with high deer numbers (Maryland Department of Natural Resources (MDNR) 1998). Supplemental feeding would also impact other park wildlife, artificially influencing both native and non native populations.

Introduction of Parasites or Disease

Under this alternative deer parasites or disease would be introduced to kill deer. Although biological controls such as the introduction of parasites or disease have been used in other vertebrate and invertebrate species, nothing practicable has been introduced for deer control. Death from such methods would not be immediate or humane. Health concerns about people potentially hunting and eating diseased deer that have wandered out of the park could be an issue. Non-target native wildlife or roaming pets could potentially eat a diseased carcass. In addition, such parasites or diseases have the potential to affect other wildlife species or even humans, or spread to the deer population outside the park.

Fencing the Entire Park

The entirety of several park units could be fenced to prevent deer from entering or leaving the park. The minimum fence height would need to be approximately 8 feet to prevent deer from jumping over the barrier. Vehicular and pedestrian access would need to be maintained. Therefore, fencing would only occur in large areas. Vegetation within the fenced areas would continue to suffer the effects of deer browse, the deer population within the fenced area would continue to increase, and the health of the contained herd would suffer. Therefore, all deer within the fence would either need to be removed or the deer population within the fence would need to be managed with other methods to meet the goals of the park management plan. For these reasons, this alternative was dismissed.

RELATIONSHIP TO OTHER PLANS, POLICIES, AND ACTIONS

Past, present, and reasonably foreseeable future actions that will be considered in the cumulative impact analysis are provided herein and a brief description of each is provided below (Table 3).

ROCK CREEK PARK PLANS, POLICIES, AND ACTIONS

Fish Passage Improvements. As a part of the Woodrow Wilson Bridge project, manmade barriers to fish movement in Rock Creek Park are being removed. The project, which began in December 2003, is removing or bypassing several manmade barriers within Reservation 339 that for generations have prevented herring and other migratory fish from returning to primordial spawning areas that lie upriver. A total of 23 fish barriers will be removed or modified in several streams that find their way into the Potomac River. In Rock Creek Park, six fish barriers are being removed or modified, while two more are being remedied in the adjacent National Zoological Park. Removal of these passages will have a beneficial effect on the aquatic habitat in the park and will alter the Peirce Mill cultural landscape.

Mountain/Motor Bikes on Earthworks. The Fort Circle Parks contain many earthworks. Unauthorized recreational use of the sites includes use of the earthworks as ramps for mountain and motorbikes, which negatively affect the resource. This unauthorized use of the earthworks is expected to continue into the reasonably foreseeable future. Park staff report erosion of the earthworks, to which this activity has contributed.

Parkwide Archeological Survey. Rock Creek Park is currently in year 3 of a 4-year parkwide archeological survey. Its overall goal is to identify and understand cultural patterns in land use and the changing character of the park landscape over time. More specifically, the survey will provide information necessary to manage the park's historic resources effectively and develop information and material to interpret the history and prehistory of the park.

Dumping. According to park staff, illegal dumping occurs frequently in the park. This takes many forms including the dumping of landscaping waste, which increases the potential for introduction of non-native species into the park. Dumping of other commercial waste and household waste also occurs in the park, which has the potential to impact sensitive species if the dumping occurs in areas where that habitat is available. Dumping into park water bodies (i.e., illegal drain connections, draining of residential pools) can also affect water quality within the park.

Vandalism. Rock Creek Park is the occasional subject of vandalism, including fire. Intentionally set fires have the potential to destroy large areas of vegetation if the events are frequent or large.

Illegal Camping. Illegal camping occurs throughout the park. Human disturbance in areas where illegal camping occurs includes displacement of wildlife and potential poaching.

Social Trails, Off-Trail Use, and Other Visitor Uses. While there are many established trails, paths, and other use areas in Rock Creek Park, visitors often venture away from designated use areas into the undisturbed forested areas of the park. If an area is accessed enough an informal path may develop, becoming a social trail. Off-trail users in the park include geocaching clubs (following clues to an endpoint); running clubs (also known as hashing); dog walking, illicit behavior, and Walter Reed Army Medical Center, the Boy Scouts, and other groups for training including orienteering. These uses are not allowed by Rock Creek Park. Off-trail users can create temporary disturbances, but do often characteristically use an area enough that a social trail forms. Off-trail users can trample vegetation,

potentially during periods critical to the survival of the plants. These uses have the potential to impact vegetation, wildlife and wildlife habitat, water resources, threatened and endangered species, and visitor use and experience.

Non-native Wildlife/Unrestrained Pets. In addition to native wildlife, Rock Creek Park is home to non-native wildlife. Species include English sparrows, European starlings, and feral dogs and cats. Non-native species compete with native wildlife and/or present indirect competition through utilization of similar habitats. Native species such as cowbirds have been thought to be a factor in declining populations of other bird species whose nests they use to lay their eggs, leaving the next owners to raise the young cowbirds. Feral cats, known to be present in the park, are efficient predators of birds and small mammals. Unrestrained pets cause similar problems, contributing to the potential harassment of native park wildlife. For example, off-leash dogs can run through and potentially silt over amphibian eggs in vernal ponds and interrupt breeding behavior.

Pests. Since the mid-1970s, the most prevalent pest concern at Rock Creek Park was gypsy moth, which the park eradicated through spraying in 1989 and 1990and now monitors. Currently, and in the future, additional pest concerns include anthracnose, sudden oak death, emerald ash borer, and the Asian long horned beetle.

Wildlife Disease. Park habitat and wildlife are influenced by a number of outside sources over which the park has little control. In the 1980s there was an outbreak of rabies in raccoons living in the park. West Nile virus is, and will continue to be, a concern for the park. West Nile virus, an established factor in avian mortality, has been identified in more than 100 bird species. Many long distance neotropical migrant species are not only affected by the disease but contribute to the spread of the virus along migration routes. Migratory birds moving through the District of Columbia region may be infected by West Nile virus and there are documented cases within the region and the park. Mortality of migrant as well as resident birds in Rock Creek Park may occur and could have a long-term impact on the avian resources of the park.

Another current and future concern in relation to wildlife disease and public safety is Lyme disease. Lyme disease poses a public health concern regarding white-tailed deer because they host the ticks responsible for the spread of the disease. Studies cited by the Maryland Department of Natural Resources in its *Deer Management Plan* suggest that high deer densities lead to an increase in the incidence of Lyme disease, and that significant tick populations do not occur in the absence of deer (MDNR 1998).

Future concerns related to wildlife disease in Rock Creek Park include Chronic Wasting Disease (CWD) and Epizootic Hemorrhagic Disease (EHD). Although CWD has not reached Rock Creek Park, there is the potential for it to occur in or near the park in the future, depending on the spread of the disease and the susceptibility of the deer. The closest reported case of CWD to Rock Creek Park is in Hampshire County, West Virginia, approximately 95 miles, measuring as the crow flies from the center of Washington, DC to the center of Hampshire County. EHA has not been found in the park, although a few deer found in the District of Columbia have been tested for EHD. The closest confirmed case of EHD to Rock Creek Park was at the Monocacy Battlefield in Frederick, Maryland, approximately 50 miles away.

Deer-Vehicle Collisions. Starting in 1981, Rock Creek Park began collecting data on wildlife roadkill in Rock Creek Park. The first deer roadkill was recorded in 1989. Because heavy commuter and local use of park roadways, deer/vehicle collisions will continue to occur at Rock Creek Park.

Commuter Traffic. Rock Creek Park contains a number of park roads that serve as local commuter routes. Beach Drive, which bisects the length of the park from the Maryland state line to the Rock Creek and Potomac Parkway, was designed as an internal park touring road to provide recreational access to the

valley. Today, Beach Drive is a multi-use resource within the park that functions as a north-south commuter route during the week. On weekends and holidays, portions of Beach Drive are closed to vehicular traffic and used as a recreational area by pedestrians and bicyclists and others participating in non-motorized activities. Rock Creek and Potomac Parkway serves as a travel corridor that connects Beach Drive and Rock Creek Park with Potomac Park. These sources of ambient noise are expected to continue into the future.

Park Operations and Maintenance. Past, present, and future park operation and maintenance activities have the potential to impact numerous resource areas. Activities that would be considered include, but are not limited to:

- development of a wireless telecommunications facilities management plan;
- hazard tree removal;
- routine maintenance along roads and picnic grounds;
- trail maintenance (maintained by park staff and the Potomac Appalachian Trail Club);
- cultural and natural resource management; and
- interpretive and educational programs.

All park operations and maintenance activities operate within budgetary constraints with future budgets dictating the level of services the park is able to provide. This trend is expected to continue. The future of park operations and maintenance is expected to be influenced by increased visitation, changes in the types of recreational activities within the park, as has occurred in the past, and the changing diversity of the community.

Park maintenance performed by park staff and outside contractors for park landscaping will also be considered, as the use of leaf blowers, snow blowers, mowers, etc., contributes to the ambient noise in the park.

Horseback Riding. Rock Creek Park contains horse stables as well as horseback trails throughout the park. Horseback riding has the potential to increase or introduce non-native species through animal feed or animal wastes, as well as create trail erosion from heavy use.

Rock Creek Park Golf Course. The Rock Creek Park golf course is a 4,798-yard, par-65 public course noted for its hilly and challenging terrain. The golf course was constructed between 1923 and 1926. The course is open every day from dawn to dusk and includes a golf school, a golf shop, putting green, and a snack bar. The highest use period at the golf course, on average, is April through October. Park staff have noted that the golf course is an area of high deer population.

Canopy Tree Trail. Rock Creek Park is proposing to construct a tree canopy walkway at the Nature Center in Reservation 339. The trail would be suspended approximately 50 to 70 feet above the surface and will allow individuals the unique experience of exploring in the tree canopy. The suspended trail would be approximately a ½ mile long and would be an opportunity for the park to enhance recreational opportunities.

Multi-Use Trail Rehabilitation. Rock Creek Park currently had plans to rehabilitate a section of multi-use trail from Pierce Mill to Potomac Park. This project will include some widening and realignment. A proposal for this project has been submitted for funding.

Telecommunications Facilities. There are currently two telecommunication towers permitted within Rock Creek Park in Reservation 339, one at the tennis center and one at the maintenance yard. Under a court order, the National Park Service revised and released the *Rock Creek Park Telecommunications Facilities Environmental Assessment* (NPS 2003c). The U.S. District Court for the District of Columbia ordered the National Park Service to prepare and file an EA for release to the public. As part of this decision, the NPS is required to develop and adopt a telecommunications facilities management plan to assist the park in future decision making regarding potential wireless telecommunications facilities permit applications. The park expects to receive applications for telecommunication towers in the future.

Rock Creek Park General Management Plan and Fort Circle Park General Management Plan. The 2002 Draft *General Management Plan for Rock Creek Park and Rock Creek and Potomac Parkway* and the *Fort Circle Park General Management Plan* established a series of desired conditions for park resources at each unit that would be directly applicable to a plan for managing deer within the park (see *Rock Creek Park and Administered Units Planning Documents*, page 10).

Return of Predators. Park staff have recently noted the appearance of coyotes to Rock Creek Park. Coyote sightings have been reported since May 2004 and were confirmed by staff in September 2004. Several animals have been seen in Rock Creek Park. Most of the sightings have been on the western side of the park in the Oregon Avenue/Bingham Road and Oregon Avenue/Military Road areas.

Special and Community Events. Facilities in Rock Creek Park include a tennis center and amphitheatre which host numerous special events during the year, mainly during the summer months. The amphitheater season extends May through September and shares parking with the tennis center. Special events include the Legg Mason tennis tournament and weekly summer events at Carter Barron. In addition to special events within the park, special events held by park neighbors will also be considered. Rock Creek Park is bordered by a number of public uses including schools, churches, embassies, and other similar institutions. Special events from these organizations create temporary sources of noise that contribute to the park's soundscape.

Breeding Bird Census. There are two historical Breeding Bird Census Areas located in Rock Creek Park units. The first area is located in Rock Creek Park (Reservation 339) and the other in Glover-Archbold Park. Breeding species spend the nesting season in Rock Creek Park and, since 1948, volunteers have conducted a breeding bird census in the Rock Creek Park. The census has been conducted in Glover-Archbold Park since 1960. Volunteers observe and compile a list of species heard and seen each year from mid-March to early July. Data compiled from the volunteer surveys identified migratory and resident breeding species.

Scientific Research Studies. Rock Creek Park frequently receives applications for research permits to conduct for scientific studies in the park. An example is a study conducted by Dr. Michel Fay. Dr. Fay is associated with National Geographic Society and has completed a transect study for Rock Creek Park that examined the effects of human habitation on wildlife. Although the field work is complete, the report has not been published. Other permits issued in the past include research on water quality, plant surveys, and wildlife. Information on research permits in Rock Creek Park, and throughout the national park system, can be found at http://science.nature.nps.gov/reserch/ac/ResearchIndex. Requests for scientific research studies are processed as received. These requests are expected to continue into the future.

Interpretive Programs, Planned Visitor Improvements, and Park Volunteers. Rock Creek Park hosts many interpretive programs as part of park operations. Interpretive programs include puppet shows, nature talks, nature hikes, animal viewing, wildlife kits, planetarium programs, exhibits, films, and self-guided nature trails. The park also has programs that focus on deer, with a deer kit provided to school teachers. Three urban wildlife kits (deer, turtle, owl), designed for pre-kindergarten through grade 3, are available for loan from the Rock Creek Park Nature Center (NPS 2003a). The park added a trail in 2003 that is focused on the visually impaired to add to the interpretation program. This trail uses a rope system around the wheelchair accessible paved nature trail near the Nature Center and was an Eagle Scout project. Rock Creek Park receives many requests from volunteer groups to conduct work in the park. These requests must be coordinated so that they do not overlap. Volunteer efforts within the park have included stream and park clean-ups. One issue that the park must contend with is controlling volunteer group size and frequency so that other park resources are not damaged during the volunteer activities.

Reconstruction of Rock Creek and Potomac Parkway. Rock Creek Park will be reconstructing Rock Creek and Potomac Parkway by resurfacing and repair of the entire length of Beach Drive; road repair on Cathedral Avenue from Calvert Street to Route 2; and repaving of the Rock Creek & Potomac Parkway from P Street to Calvert Street, in Washington, D.C in order to eliminate unsafe driving conditions. Environmental compliance for this project is currently on-going.

LOCAL/STATE PLANS, POLICIES, AND ACTIONS

Landscaping on Adjacent Properties and Within the Park and the Spread of Non-Native Plant Species: Many residential land uses are located along the boundary of Rock Creek Park. On some of these residential properties non-native vegetation has been planted for landscaping and these non-native plants have spread into Rock Creek Park. Likewise, some of the Rock Creek Park administered units are designed landscapes that include non-native vegetation, which have the potential to expand from outside the designed unit into Rock Creek Park's natural landscapes. Other park landscaping activities, such as mowing lawns, remove potentially available habitat for other species. Non-native vegetation competes with native species, potentially impacting these native species. The spread of non-native vegetation also impacts cultural landscapes in the park by replacing historical plant species.

Urban Development and Boundary Encroachment. Rock Creek Park is located in a highly-urbanized area that has undergone much development since the mid-1970s and will continue to develop in the foreseeable future. Some of this development has occurred along the boundaries of Rock Creek Park, and at times on small portions of Rock Creek Park land. Management decisions at Rock Creek Park must be made with consideration of the surrounding land uses that have continued to develop around the various Rock Creek Park units. With respect to deer issues within the park, bordering neighbors have complained about deer browse on landscape vegetation. More generally, urbanization of the area has limited, and will continue to limit, the amount of green space and wildlife habitat available in the area, putting more pressure on Rock Creek Park's resources and displacing some wildlife.

For example, with the development of the Phillips estate, vegetation and habitat will be lost, and wildlife will likely be displaced to Glover-Archbold Park. Tregaron Estates, adjacent to Reservations 365 and 635, has been proposed for subdivision development. Tregaron Partnership Limited is proposing a planned unit development for the site. The Tregaron Estate is a 20-acre wooded parcel between Macomb Street and Klingle Road, west of Connecticut Avenue. The Washington International School owns six acres of the Tregaron estate and leases use of the remaining 14 acres. Developers have proposed building 9 homes on this land, pending further study of restoration of the landscape architecture. At the same time, the Washington International School also has a proposal for some additional building on its portion of the Tregaron Estate.

Other concerns with urbanization include an increasing amount of impervious surfaces, which would lead to an increase in stormwater runoff. Resource areas that would be affected by urbanization and boundary encroachment include vegetation, wildlife and wildlife habitat, cultural resources, public safety, and visitor use and experience.

District of Columbia Animal Control. District of Columbia Animal Control, a part of the Department of Health, provides animal control and animal disease prevention services and assists the public with animal-related problems. Services offered by this agency include, but are not limited to, animal disease control, rabies suspect control, stray animal control, dangerous dog control, licensing, enforcement, sterilization, and adoption. Specific activities that would be related to a deer management plan include: conducting disease surveillance (i.e., Lyme disease); enforcement animal control laws; disposal of animals by redemption to owner, release to the wild, humane intravenous euthanasia; providing education via pamphlets, classroom visits; and assisting District of Columbia agencies, such as the Metropolitan Police Department, as required (DCDOH n.d.).

Montgomery County Deer Management Plan. The MNCPPC management plan was created on the premise that deer are an important and valued part of the county's natural heritage; however, deer are an opportunistic species that can, in the absence of checks and balances, become abundant enough to conflict with human interests. This plan was developed to be open-ended and adaptable, as deer-human conflicts vary and one single management prescription may not be appropriate. The *White-tailed Deer Management Plan for Montgomery County* establishes goals and objectives for managing deer in the county, develops a plan of action for each of the problem issues identified, and sets a timetable for implementation of these actions.

D.C. Water and Sewer Authority (WASA) Combined Sewer Overflows (CSOs) Including Planned Removal. Approximately 1/3 of The District of Columbia is served by combined sewers, including the parts of Rock Creek Park south of Piney Branch. When the capacity of a combined sewer is exceeded during storms, the excess flow, a mixture of sewage and stormwater runoff, is discharged into Rock Creek and other tributary waters, affecting water quality. This is a past and present condition.

The District of Columbia's National Pollutant Discharge Elimination System (NPDES) permit issued by the U.S. Environmental Protection Agency (EPA) requires the preparation of a Long-Term Control Plan (LTCP). The LTCP provides a schedule to control CSO discharges to the area waterways. In August 2002, WASA submitted a final LTCP to EPA and the District Department of Health for approval. In response to public comments, the final LTCP proposed significant reductions in CSO discharges compared to the draft plan. WASA is waiting for regulatory agency approval on the final LTCP. This plan recommends the sewer separation of four CSOs in the Rock Creek watershed (D.C. WASA 2002). WASA's 10-year capital improvement program will cover FY 2001 to FY 2010 with ten-year disbursements totaling an estimated $1.61 billion. This program addresses wastewater treatment, combined sewer overflow, stormwater, and sanitary sewer, as well as water service.

WASA also has plans to separate the combined sewer in Piney Branch. This project would include the construction of an underground structure that would capture flow during storm events. After storm events the captured volume would be pumped through the pipes and treated. The purpose of this project would be to reduce the amount of raw sewage entering the Piney Branch Tributary. In addition, WASA plans to mitigate the stormwater flow into Dumbarton Oaks Park by capturing the flow before it enters the park and piping it around the park. The flow would be discharged at a point below the park to reduce stormwater erosion.

Agricultural Activity in Rock Creek Headwaters. The headwaters of Rock Creek are located in Montgomery County, Maryland. Historically, discharges from agricultural activities in the creek

headwaters have affected downstream waters. Currently, and in the reasonably foreseeable future, Montgomery County is implementing measures to reduce these impacts and improve water quality. In 1998 the county made a commitment to assess the condition of approximately 1,500 miles of streams to determine water quality issues (Montgomery County 2003). Other efforts to improve the headwaters have included, and will continue to include, the establishment of buffers around these surface waters.

Intercounty Connector (ICC). The ICC is a proposed 18-mile, limited access, toll road linking U.S. Route 1 in Prince George's County to I-270/I-370 in Montgomery County, Maryland. On July 11, 2005, the state of Maryland announced its preferred alignment for the roadway that would begin in Gaithersburg, Maryland at Shady Grove Road and I-370 and go east to I-95 and U.S. 1.

Flight Paths Over Parks. When considering soundscapes, flight paths over the park were discussed as a component of ambient noise in the park. These flights include helicopter use, including the presidential helicopter, military plane overflights, and the flight path for Ronald Reagan National Airport, a small portion of which is located over Glover-Archbold Park and Reservation 404. These overflights are a component of the past and current soundscape, and are expected to continue into the future.

U.S. Park Police. Two stations comprise the U.S. Park Police West District; the Rock Creek Station is in Rock Creek Park (D-3). The D-3 personnel patrol 1,800 acres of Rock Creek Park and adjacent parks such as Meridian Hill, Glover-Archbold Park, Fort Totten (and other Fort Circle Parks), portions of the C&O Canal, and the newly acquired Capitol Crescent Trail located along a portion of the Potomac River. This station does not have adequate space for operational needs. A new station may be located outside the park or inside the park at an area known as H3, where currently wood chipping activities occur. There is no funding to accomplish this and it is unknown when it may occur. Also located within Rock Creek Park along the Rock Creek and Potomac Parkway is Edgewater Stables, where U.S. Park Police horses are kept. Operations of the U.S. Park Police would be considered during the development of a deer management plan/EIS.

Metropolitan Branch Trail. The District of Columbia is currently in the process of planning and implementing the Metropolitan Branch Trail. The Metropolitan Branch Trail is a proposed eight-mile multi-use trail that runs from Silver Spring, Maryland to Union Station in the District. It includes a segment proposed to connect the trail to the Anacostia Tributaries Trail System in West Hyattsville, Maryland. The trail will provide a direct access route to seven of the Washington Area Metro Red Line stations and will connect to the Washington area's trail network at the Capital Crescent Trail and the East Coast Greenway. Part of the trail is proposed to cross NPS-owned land at Fort Totten, so plans for the Metropolitan Branch Trail should be considered when developing a white-tailed deer management plan for the park.

Education and Outreach by Community Groups. In addition to park interpretive and education programs, community groups and friends groups also provide environmental education to the surrounding community in regard to stormwater management. These programs include storm drain stenciling, use of French drains, rain gardens, and other best management practices.

1986 Revised Master Plan for the National Zoo. The National Zoo is currently updating its 1986 Revised Master Plan. The plan will address visitor services, circulation, and transportation analysis; trends with regard to potential audience identification; programs; land use and environmental analysis; infrastructure; zoo animal exhibit planning; site and facilities planning; and cost estimation, among other issues. Proposals within the plan will be in accordance with current standards and guidelines for animal care while maintaining the zoo's historic character. The plan will also examine how to carry out the goals of

the National Zoo's recently completed strategic plan. Recent projects at the zoo have included replacing the boundary fence and the current renovation of exhibits.

Table 3: Cumulative Impact Scenario

Impact Topic	Study Area	Past Actions	Current Actions	Future Actions (15 years)
Temporal boundaries for all resources are from the mid-1960s when deer were first sighted in Rock Creek Park to 15 years from the completion of the Plan/EIS, unless otherwise noted				
Soils	Rock Creek Park and Adjacent Landowners	Impervious surface run-off Visitor uses Social trails Off trail users Urban development Dumping Park operations Illegal camping	Same as past, plus: Approved route for Inter County Connector Reconstruction of Rock Creek Park and Potomac Parkway	Same as current, plus: Stormwater/run-off best management practices Inter County Connector development Reconstruction of Rock Creek Park and Potomac Parkway
Vegetation	Rock Creek Park and Adjacent Land Owners	Dumping Non-native plant control Adjacent property landscaping Park landscaping Vandalism (fire) Illegal camping Visitor uses Off-trail uses Social trails Unrestrained pets Boundary encroachment Increasing deer population Gypsy moth mgt	Past actions plus: Anthracnose Sudden oak death Gypsy moth mgt—monitoring Reconstruction of Rock Creek Park and Potomac Parkway	Same as present actions plus: Asian long horned beetle (Anoplophora glabripennis) Reconstruction of Rock Creek Park and Potomac Parkway
Wildlife and Wildlife Habitat	Range of Doe Movement	Dumping Non-native plant control Increasing deer population Unrestrained pets DC Pest Control Park mgt and operations Rabies Distemper West Nile virus Illegal camping Poaching Vehicle collisions Visitor uses Social trails Off trail uses	Same as past.	Same as past, plus: Rabies and rabies vaccine trials Chronic Wasting Disease (deer) Epizootic Hemorrhagic Disease

Impact Topic	Study Area	Past Actions	Current Actions	Future Actions (15 years)
Temporal boundaries for all resources are from the mid-1960s when deer were first sighted in Rock Creek Park to 15 years from the completion of the Plan/EIS, unless otherwise noted				
		Non-native wildlife Urban development		
Cultural Resources / Landscapes	Administered Units of Rock Creek Park	Park development and maintenance Spread of non-natives Telecommunications facilities development Mountain/motor bikes on earthworks Fire/vandalism Fort Circle Parks GMP Rock Creek Park GMP Urbanization	Park development and maintenance Spread of non-natives Mountain/motor bikes on earthworks Fire/vandalism Fort Circle Parks GMP Rock Creek Park GMP Archeological survey Urbanization	Same as current actions, plus: Fish passage improvements (ladder)
Water Resources	Watershed	Sewer outfalls Impervious surface run-off Visitor uses Social trails Off trail users Urban development Dumping Agricultural discharge in headwaters Park operations Improvements to headwater agricultural discharges Flood events (bankful)	Same as past, plus: Headwater improvements Approved route for Inter County Connector Reconstruction of Rock Creek Park and Potomac Parkway	Same as current, plus: Combined sewer overflow removal (DC WASA) Stormwater/run-off best management practices Inter County Connector development Reconstruction of Rock Creek Park and Potomac Parkway
Threatened & Endangered Species, Species of Special Concern, Rare and Sensitive Species	Administered Units of Rock Creek Park	Dumping Non-native plant control Adjacent property landscaping Park landscaping Vandalism (fire) Illegal camping Visitor uses Off-trail users Social trails Unrestrained pets Boundary encroachment Increasing deer population Gypsy moth mgt Non-native wildlife Hydrologic regime changes Groundwater pollution	Same as past, plus: Anthracnose Sudden oak death Gypsy moth mgt—monitoring Roadkill Increased development outside park Coyotes	Same as present, plus: Asian long horned beetle West Nile virus

Impact Topic	Study Area	Past Actions	Current Actions	Future Actions (15 years)
Temporal boundaries for all resources are from the mid-1960s when deer were first sighted in Rock Creek Park to 15 years from the completion of the Plan/EIS, unless otherwise noted				
Soundscapes	Park Boundary and Adjacent Landowners	Park operations Traffic Helicopter use Landscaping contractors Military overflights Emergency services Community events	Same as past actions	Same as past actions
Socioeconomic		Landscaping impacts Non-native plants (from park) Vehicle collisions	Same as past actions	Same as past actions
Public Safety	Park Boundary	Vehicle collision Disease Deer-related property damage Fear of wildlife Urbanization Crime U.S. Park Police operations	Same as past actions	Same as past actions
Visitor Use and Experience	Park Boundary	Dumping Non-native plant control Deer Unrestrained pets Park mgt and operations Rabies Lyme disease West Nile virus Illegal camping Poaching Vehicle collisions Social trails Off trail users Non-native wildlife Urban development Vehicle traffic Breeding bird census Scientific research Interpretation programs Trail for the visually impaired	Same as past actions, plus: Shrinking green space surrounding park Volunteer overuse Parking Reconstruction of Rock Creek Park and Potomac Parkway	Same as present, plus: Rabies and rabies vaccine trials Fish passage improvements (ladder) Reconstruction of Rock Creek Park and Potomac Parkway

Impact Topic	Study Area	Past Actions	Current Actions	Future Actions (15 years)
Temporal boundaries for all resources are from the mid-1960s when deer were first sighted in Rock Creek Park to 15 years from the completion of the Plan/EIS, unless otherwise noted				
Park Management and Operations	Park Boundary	Maintenance U.S. Park Police operations Interpretation programs Budgetary constraints Cultural resource mgt Natural resource mgt Vehicle traffic Lack of NPS identity	Same as past actions, plus: Archeological survey MWCOG Working Group Increasing visitation Changes in recreation	Same as present actions, plus: Archeological protection and interpretation

.

AFFECTED ENVIRONMENT

DO-12 says (in accordance with NPOMA) that if information critical to decision making is lacking, then the action should be modified to eliminate that portion of the action where impacts are uncertain. In addition, NEPA and CEQ specify what must be done in the absence of information: "When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking" (Section 1502.22). The "Affected Environment" should state clearly what information is available, where conflicts exist in the data/interpretation, and what information is lacking.

See Director's Order 12 Handbook 2.8; and Director's Order 12 4.4 and 4.5 (unavailable information and use of technical and scientific analysis in decision making).

The following resources have been collected or will be collected on deer management at Rock Creek Park. These documents and other references, as well as other relevant documents from the previous deer management plans for national park units in the eastern United States and adjoining municipalities, will be used to prepare the Affected Environment section of the environmental impact statement.

LEGISLATION

NPS 1985 *Rock Creek Park: An Administrative History*

Enabling Legislation for each unit

ROCK CREEK PARK PLANNING DOCUMENTS

NPS 1993 *Tennis Stadium, Rock Creek Park, Final Environmental Impact Statement*

NPS 2003 *Environmental Assessment Bell Atlantic Mobile Applications for Wireless Telecommunications Facilities, Maintenance Yard and Tennis Center, Rock Creek Park*

NPS 2000 *Management Policies 2001*

NPS 2000 *Strategic Plan*

NPS 2002 *Rock Creek and the Rock Creek and Potomac Parkway Draft General Management Plan/Environmental Impact Statement*

NPS 2004 *Management Plan/Environmental Assessment Fort Circle Parks*

ROCK CREEK PARK RESOURCE INFORMATION

Cooper 1999 Neotropical Migrant Birds in Rock Creek Park

Holmes 1897 Stone Implements of the Potomac-Chesapeake Tidewater Province

Inashima 1985 Archeological Survey Report: An Archeological Investigation of Thirty-One Erosion Control and Bank Stabilization Sites along Rock Creek and Its Tributaries

Janni 1999 List of Birds Recorded in the Rock Creek Park Nature Center Area 1990–1999

Munford 1982 The Piney Branch Quarry Site: An Analysis of a Lithic Workshop in Washington, D.C.

National Audubon Society n.d. National Audubon Christmas Bird Count Data - Washington D.C. Count. Rock Creek Nature Center and Carter Barron Sections, 1980–2002

National Audubon Society 2002 Audubon WatchList

NPS n.d. Rock Creek Park Volunteer Breeding Bird Census Data

NPS 2001 Bird Checklist of Rock Creek Park

NPS 1997 Technical Report of Monitoring of Carbon Monoxide Concentrations and Noise Levels in Rock Creek Park

The park was asked to provide the relevant documents/data for the purposes of this plan and EIS.

ENVIRONMENTAL CONSEQUENCES

DO-12 has made important changes (see 4.5 (g)) in the way the National Park Service analyzes, describes, and documents (formats) its NEPA analysis.

Using the best available data, the context, duration, and intensity of impacts, including cumulative impacts, must be defined. NPS must systematically analyze the impact of each alternative in terms of its context, duration, and intensity of effect on unit resources and values and based on this analysis determine the potential for impairment.

The park was briefed on what methods could be used for impact assessment, and how they will be involved in setting up the criteria for impact intensity. The impact methodology, defined by DO-12 § 4.5(G)(7)(a), describes methods used to determine impact.

1. *Explain any assumptions.*
2. *Define or explain how data will be interpreted.*
3. *Describe thresholds used to measure context.*
4. *Describe the duration and intensity of impacts.*

Impact indicators must be set up for each impact topic.

For each resource, thresholds help to establish the sideboards for understanding the severity and the magnitude of the impact. Example of intensity: Impact to wildlife and wildlife habitat from the implementation of a white-tailed deer management plan would be:

> *Negligible* — There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them. Impacts would be short in duration and within natural fluctuations.
>
> *Minor* — Impacts would be detectable, but would not be expected to be outside the natural range of variability and would not have any long-term effects on native species, their habitats, or the natural processes sustaining them. Population numbers, population structure, genetic variability, and other demographic factors for species might have small, short-term changes, but long-term characteristics would remain stable and viable. Occasional responses to disturbance by some individuals could be expected, but without interference to feeding, reproduction, or other factors affecting population levels. Key ecosystem processes might have short-term disruptions that would be within natural variation. Sufficient habitat would remain functional to maintain viability of all species. Impacts would be outside critical reproduction periods for sensitive native species.
>
> *Moderate* — Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they could be outside the natural range of variability for short periods of time. Breeding animals of concern are present; animals are present during particularly vulnerable life stages, such as migration or juvenile stages; mortality or interference with activities necessary for survival can be expected on an occasional basis, but is not expected to threaten the continued existence of the species in the park unit. Population numbers, population structure, genetic

variability, and other demographic factors for species might have short-term changes, but would be expected to rebound to pre-impact numbers and to remain stable and viable in the long term. Frequent responses to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, or other factors affecting short-term population levels. Key ecosystem processes might have short-term disruptions that would be outside natural variation (but would soon return to natural conditions). Sufficient habitat would remain functional to maintain viability of all native species. Some impacts might occur during critical periods of reproduction or in key habitat for sensitive native species.

Major — Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they would be expected to be outside the natural range of variability for long periods of time or be permanent. Population numbers, population structure, genetic variability, and other demographic factors for species might have large, short-term declines, with long-term population numbers significantly depressed. Frequent responses to disturbance by some individuals would be expected, with negative impacts to feeding, reproduction, or other factors resulting in a long-term decrease in population levels. Breeding colonies of native species might relocate to other areas of the park. Key ecosystem processes might be disrupted in the long term or permanently. Loss of habitat might affect the viability of at least some native species.

Impairment — Some of the major impacts described above might be an impairment of park resources if their severity, duration, and timing resulted in the elimination of a native species or significant population declines in a native species, or they precluded the park's ability to meet recovery objectives for listed species. In addition, major impacts to park resources and values would:

contribute to deterioration of the park's wildlife resources and values to the extent that the park's purpose could not be fulfilled as established in its enabling legislation;

affect resources key to the park's natural or cultural integrity or opportunities for enjoyment; or

affect the resource whose conservation is identified as a goal in the park's planning documents.

Results of Discussion with Park: Preliminary discussion occurred with park staff on impact analysis. Before beginning the draft environmental impact statement, methodologies and impact thresholds that are appropriate for measuring impacts to park resources will be presented and discussed with park staff.

CONSULTATION AND COORDINATION

Coordination and consultation efforts for this planning process will focus on the means or processes to be used to include the public; the major interest groups; and local public entities. Park staff place a high priority on meeting the intent of public involvement in the NEPA process and giving the public an opportunity to comment on proposed actions. As part of the National Park Service NEPA process, issues associated with the action were identified during the internal scoping meeting with NPS staff. Future coordination with the U.S. Park Police, MNCPPC, the District of Columbia, and coordination with other affected agencies and the interested public is proposed.

In addition, the park discussed developing a science team to provide input and answer questions on the technical nature of deer management. The park has already had preliminary meeting of such a team. As part of the plan and EIS, the park proposed that the science team consist of representatives from the U.S. Geological Survey (USGS), Rock Creek Park resource management and interpretation staff, the NPS National Capital Region Center for Urban Ecology, the Smithsonian, Maryland National Capital Park and Planning Commission, the District of Columbia, Maryland Department of Natural Resources, Catoctin Mountain Park, among other subject experts. The science team would not provide input on policy questions related to the plan, but would be asked to:

- Identify the scientific information needed to define action thresholds;
- Provide input on the feasibility of alternatives being considered including technical feasibility, criteria for management locations, and any omissions from the alternatives considered;
- Provide input on monitoring protocols; and
- Assist in the development of the adaptive management approach included in the deer management plan.

Beyond internal scoping, the park is participating in *Metropolitan Washington Council of Governments Deer Working Group,* A Metropolitan Washington Council of Governments group that is looking at wildlife/vehicle collision reduction. The group does not have any final products at this point but is getting close to having a final draft of a white paper and will also produce an educational video (K. Ferebee, NPS, pers. comm., August 19, 2005).

The park will conduct public scoping as part of the EIS process. At the internal scoping meeting, the park began to develop a public participation plan. The goals of this public participation plan would include, but not be limited to:

- Reach a level of public understanding regarding the required legal and planning process associated with the deer management plan.
- Involve the public so that the public is aware that the park is listening to and trying to address their concerns.
- Provide information to the public on both management methods that are possible and management methods that are not technically feasible at this time (e.g.. the park cannot

mix contraception chemicals into feed for the deer) to reduce or eliminate miscommunication regarding possible management measures.

- Provide information to the public on the impact deer are having on Rock Creek Park resources
- Obtain feedback from the pubic regarding their views on the Rock Creek Park deer population and possible management methods.
- Provide timely and accurate information to the public.
- Increase the public's understanding about Rock Creek's Park mission and how this mission relates to deer management.

To achieve these objectives, Rock Creek Park proposes holding a public meeting to present the purpose, need, and objectives, as well as, the preliminary alternatives. This meeting would begin with an open house format, followed by a short presentation by park staff and then an opportunity for the public to provide formal testimony. The open house portion of the meeting will include stations where park and project staff can answer questions and record comments. The meeting would be held in the National Zoo auditorium, which is Metro-accessible, and two identical meetings would possibly be held depending on the level of interest. Other details of the public meeting would include having sign language and Spanish language interpreters present and setting time limits for public testimony (three minutes per individual; five minutes per group representative).

For both public scoping and the draft EIS, a 60-day comment period is proposed. The public would be able to use the NPS Planning, Environmental and Public Comment (PEPC) website to comment on-line during public scoping and during the public comment period for the draft EIS. A newsletter to update the public on project milestones, such as public scoping meetings and release of the draft EIS, is also planned for this project.

The public participation plan would also include a coordinated media strategy that would be developed by Rock Creek Park's public information officer. This strategy would include making sure information on the project is provided in local libraries and on the PEPC website. For example, the Internal Scoping Report would be posted on PEPC for public information. The media strategy would also include development of a media package to send to the community and other interested parties and possibly programming on public access television stations.

The park also determined that Montgomery County and the District of Columbia would be invited to be cooperating agencies because of their proximity, similar interests and activities, and special expertise related to deer management.

As part of the EIS process NPS will coordinate with local and federal agencies to identify issues and/or concerns related to natural and cultural resources within Rock Creek Park. The following individuals, groups, and agencies were identified during the internal scoping meeting to be contacted during the planning process:

CONGRESSIONAL DELEGATES

- Eleanor Holmes Norton, District of Columbia Delegate

- Christopher Van Hollen, Jr., 8th Congressional District, Maryland
- Albert R. Wynn, 4th Congressional District, Maryland
- Barbara Mikulski, U.S. Senate

FEDERAL AGENCIES

- Advisory Council on Historic Preservation
- Chesapeake and Ohio Canal National Historic Park
- National Arboretum
- Smithsonian National Zoo and National Zoo Police
- State Department—Embassies
- U.S. Army Corps of Engineers
- U.S. Department of Agriculture, Wildlife Services
- U.S. Fish and Wildlife Service, Chesapeake Bay Field Office
- U.S. Navy, Naval Observatory
- U.S. Park Police
- U.S. Secret Service

DISTRICT OF COLUMBIA AND LOCAL GOVERNMENTS

- Advisory Neighborhood Commissions
- Commission of Fine Arts
- D.C. City Council
- D.C. Department of Health, Fisheries and Wildlife Division
- D.C. Department of Transportation
- D.C. Fire and Emergency Services
- D.C. Historic Preservation Office, State Historic Preservation Officer
- D.C. Metropolitan Police Department
- D.C. Office Of Planning

- D.C. School District
- Maryland Department of Natural Resources
- Maryland National Capital Park and Planning Commission – Montgomery County
- Metropolitan Washington Council of Governments
- National Capital Park and Planning Commission

ORGANIZATIONS/OTHER

- AAA Potomac
- Adjacent Property Owners
- American Automobile Association, National Office
- Audubon Naturalist Society
- Audubon Naturalist Society of Central Atlantic States
- Blair Road Garden Association
- Boy Scouts of America
- Boys and Girls Club
- Capital Area Food Bank
- Carter Barron Community Task Force
- Chevy Chase Citizens Association
- Community Gardens
- Crestwood Neighborhood League
- Defenders of Wildlife
- Discovery Creek Children's Museum
- Eastern National
- Exotic Pest Plant Council
- Fort Reno Garden Association
- Fort Stevens Garden Association
- Friends of Chevy Chase

- Friends of Meridian Hill
- Friends of Montrose and Dumbarton Oaks Park
- Friends of Peirce Mill
- Friends of Rock Creeks Environment (FORCE)
- Friends of the Earth
- Fund for Animals
- Girl Scout Council of the Nation's Capital
- Glover-Archbold Garden Association
- Glover Park Citizens' Association
- Golf Course Specialists Inc
- Green Peace
- Hillandale Community Group
- Humane Society of the United States
- Interstate Commission of Potomac River Basin
- Kalorama Citizens' Association
- Maryland Native Plant Society
- National Geographic Society
- National Park Foundation
- National Parks & Conservation Association
- National Wildlife Federation
- Nature Conservancy
- North Rock Creek Park Alliance
- Park Concessionaires (golf course, riding stables, etc.)
- Peabody Garden Association
- People for the Ethical Treatment of Animals (PETA)
- Potomac Appalachian Trail Club

- Rock Creek Garden Association
- Rock Creek Golf Course
- Sierra Club
- Smithsonian
- Tilden Gardens
- Washington Parks
- Whitehaven Garden Association
- Universities (Howard, Georgetown, American, University of Maryland, University of the District of Columbia)

REFERENCES

AAA

2003 AAA Mid-Atlantic News Release: Love-struck Deer Risk Being Car-struck. Washington, D.C. October 2003.

Advisory Council on Historic Preservation (36 CFR 800)

2001 *Protection of Historic Properties.* Implementing Regulations for Section 106 of the *National Historic Preservation Act of 1966*, as amended.

Alverson, W. S.

1988 "Forests too Deer: Edge Effects in Northern Wisconsin." *Conservation Biology* 2:348–58.

Anderson, R. C.

1994 "Height of White-flowered Trillium *(Trillium grandiflorum)* As an Index of Deer Browsing Intensity." *Ecological Applications* 4:104–9.

Augustine D. J., and L. E. Frelich.

1998 "Effects of White-tailed Deer on Populations of an Understory Forb in Fragmented Deciduous Forest." *Conservation Biology* 12:995–1004.

Baker, D. L., M. A. Wild, M. M. Conner, H. B. Ravivarapu, R. L. Dunn, and T. M. Nett

2002 "Effects of GnRH Agonist (Leuprolide) on Reproduction and Behavior in Female Wapiti (*Cervus elaphus nelsoni).*" *Reproduction Supplement* 60:155–67

2004 "Gonadotropin-Releasing Hormone Agonist: A New Approach to Reversible Contraception in Female Deer." *Journal of Wildlife Diseases* 40:713–24

Bushong, William

1990 Rock Creek Park Historic District. National Register of Historic Places Registration Form. Copy on file at Rock Creek Park, Washington, D.C.

Coffey, M. A.

1999 White-tailed deer in national parks. NPS-Natural Resource Information Division Fact Sheet. National Park Service, U.S. Department of the Interior. Available at <www.nature.nps.gov/facts/fdeer2.htm>.

Cooper, Barry

1999 Neotropical Migrant Birds in Rock Creek Park. Administrative Record Document #39, pages 1064–1070.

Craven, S. R., and S. E. Hygnstrom

1994 "Deer." In *Prevention and Control of Wildlife Damage*, edited by S. E. Hygnstrom, R. M. Timm, and G. E. Larson, D25–40. Lincoln: University of Nebraska.

Curtis, P. D., R. L. Pooler, M. E. Richmond, L. A. Miller, G. F. Mattfeld, and F. W. Quimby

2002 "Comparative Effects of GnRH and Porcine Zona Pellucida (PZP) Immunocontraceptive Vaccines for Controlling Reproduction in White-tailed Deer (*Odocoileus virginianus*)." *Reproduction Supplement* 60:131–41

D.C. Department of Health (DCDOH)

n.d. D.C. Department of Health Environmental Health Administration Animal Disease Prevention Division. Available at: http://doh.dc.gov/doh/cwp/view,a,1374,q,584356,dohNav_GID,1818,.asp.

D.C. Water and Sewer Authority

2002 WASA's Recommended Combined Sewer System Long Term Control Plan. Control Plan Highlights. July.

deCalesta, D. S.

1994 "Effect of White-tailed Deer on Songbirds within Managed Forests in Pennsylvania." *Journal of Wildlife Management* 58:711–18.

Ferebee, Ken.

2005 National Park Service, Rock Creek Park. Personal Communication via email. August 19, 2005.

Garrott, Robert A., and Donald B. Siniff

1992 "Limitations of Male-Oriented Contraception for Controlling Feral Horse Populations." *Journal of Wildlife Management* 56:456–64.

Haight, Robert G., and L. David Mech

1997 "Computer Simulation of Vasectomy for Wolf Control." *Journal of Wildlife Management* 61:1023–31.

Hazel, R.B.

1995 Deer Management. North Carolina Cooperative Extension Service. September 22, 1995. Available online at: http://www.ces.ncsu.edu/nreos/forest/woodland/won-12.html.

Holmes, William H.

1897 *Stone Implements of the Potomac-Chesapeake Tidewater Province.* Annual Report 15. Bureau of American Ethnology, Washington, D.C.

Inashima, Paul

1985 Archeological Survey Report: An Archeological Investigation of Thirty-One Erosion Control and Bank Stabilization Sites along Rock Creek and Its Tributaries. U.S. Department of the Interior, National Park Service, Denver Service Center, Seneca, Maryland.

Janni, Ottavio

1999 List of Birds Recorded in the Rock Creek Park Nature Center Area 1990–1999. Administrative Record Document #242, pages 932–935.

1982 The Piney Branch Quarry Site: An Analysis of a Lithic Workshop in Washington, D.C. M.A. thesis, George Washington University, Washington, D.C.

Jones, J. M., and J. H. Witham

1990 "Post-translocation Survival and Movements of Metropolitan White-tailed Deer." *Wildlife Society Bulletin,* vol. 18.

Kilpatrick J. F., I. K. M. Liu, J. W. Turner, R. Naugle, and R. Keiper

1992 "Long-term Effects of Porcine Zona Pellucidae Immunocontraception on Ovarian Function in Feral Horses (*Equus caballus*)." *Journal of Reproduction and Fertility* 94: 437–44.

Knox, W.M., K.V. Miller, and R.L. Marchinton.

1988 "Recurrent estrous cycles in white-tailed deer." *Journal of Mammalogy* 69:384–386.

Lopez R. R., N. J. Silvy, J. D. Sebesta, S. D. Higgs, M. W. Salazar

1998 "A Portable Drop Net for Capturing Urban Deer." In 1998 *Proceedings of the Annual Conference of Southeast Association of Fish and Wildlife Agencies* 52:206–9.

Maryland Department of Natural Resources

1998 "*Charting the Course For Deer Management In Maryland" A management plan for white-tailed deer in Maryland*. Available at: <http://www.dnr.state.md.us/wildlife/contents.html>.

McCabe, R. E. and T. R. McCabe

1984 Of slings and arrows: an historical retrospection. White-tailed Deer Ecology and Management. Edited by L. K. Halls.

2005 2005–2006 Guide to Hunting & Trapping in Maryland. May.

McShea, W. J.

2000 "The influence of Acorn Crops on Annual Variation in Rodent and Bird Populations." *Ecology* 81:228–38.

McShea, W. J., and J. H. Rappole

2000 "Managing the Abundance and Diversity of Breeding Birds Populations through Manipulation of Deer Populations." *Conservation Biology* 14.

Miller L. A., K. Crane, S. Gaddis, and G. J. Killian

2000 "Immunocontraception of White-tailed Deer with GnRH Vaccine." *American Journal of Reproductive Immunology* 44: 266–74.

2001 "Porcine Zona Pellucida Immunocontraception: Long-term Health Effects on White-tailed Deer." *Journal of Wildlife Management* 65 (4): 941–45.

Montgomery County

1995a Comprehensive Management Plan for White-tailed Deer in Montgomery County Maryland. Updated 2004.

1995b Inventory of Rare, Threatened, and Endangered Plant Populations and Significant Habitats on Selected Park Lands of M-NCPPC in Montgomery County, Maryland.

2002 Montgomery County Deer Management Program Annual Report and Recommendations FY 2003. June.

2003 Countywide Stream Protection Strategy 2003 Update.

Naugle, R. E., A. T. Rutberg, H. B. Underwood, J. W. Turner, Jr., and I. K. M. Liu

2002 "Field testing immunocontraception on white-tailed deer (*Odocoileus virginianus*) on Fire Island National Seashore, New York, USA." *Reproduction Supplement* 60:145–53.

National Park Service, U.S. Department of the Interior (NPS)

n.d. Rock Creek Park Educational Programs. Available at: http://www.nps.gov/rocr/naturecenter/education

1985 *Rock Creek Park: An Administrative History*. Barry Mackintosh. History Division, National Park Service, U.S. Department of the Interior, Washington, D.C.

1990 *Historic Resource Study: Rock Creek Park, District of Columbia*. William Bushong. Washington, D.C.

1993 Tennis Stadium, Rock Creek Park, Washington, D.C. Final Environmental Impact Statement. Denver Service Center.

1995 Secretary of the Interior's Standards for the Treatment of Historic Properties (36 CFR 68).

1996 *Natural Resources Management Plan, Rock Creek Park*. Washington, D.C.

1999a Environmental Assessment Bell Atlantic Mobile Applications for Wireless Telecommunications Facilities, Maintenance Yard and Tennis Center, Rock Creek Park, Washington, D.C. National Capital Region, Washington, D.C.

1999b *Draft Management Plan/Environmental Assessment Civil War Defenses of Washington*, Washington, D.C.

2000a National Park Service Strategic Plan (FY 2000 – FY 2005) NPS D-1383/August 2000. Washington, D.C.

2000b *Cultural Landscape Report: Dumbarton Oaks Park, Rock Creek Park*. U.S. Department of the Interior, National Park Service, National Capital Region, Cultural Landscape Program. Washington, D.C.

2001a *Management Policies 2001*. U.S. Department of the Interior, National Park Service. Washington, D.C. 137 pp.

2001b *Cultural Landscape Report: Meridian Hill Park, Rock Creek Park*. U.S. Department of the Interior, National Park Service, National Capital Region. architrave p.c. architects. Washington, DC. November 30, 2001.

2002a Rock Creek Park and the Rock Creek and Potomac Parkway *Draft General Management Plan Environmental Impact Statement.* Washington, D.C.

2002b National Capital Parks Index.

2003a. Rock Creek Park Long-range Interpretive Plan. Washington, D.C.

2003c *Telecommunications Facilities Environmental Assessment.* Washington, D.C.

2004a Rock Creek Park Environmental Commitment Statement. Available on the Internet at www.nps.gov/rocr.

2004b Fort Circle Parks *Draft Management Plan Environmental Assessment.* Washington, D.C.

2004c Invasive Exotic Plant Management Plan. Draft. Washington, D.C.

2004d Catoctin Mountain Park Deer Management Plan/EIS Final Internal Scoping Report. October.

O'Bryan, M. K., and D. R. McCullough

1985 "Survival of Black-tailed Deer Following Relocation in California." Journal of Wildlife Management 49:115–19.

Porter, W. F.

1991 "White-tailed Deer in Eastern Ecosystems: Implications for Management and Research in National Parks." Natural Resources Report NPS/NRSUNY/NRR-91/05. Washington, D.C.

Potter, Stephen

n.d. *Piney Branch Quarry Site.* National Register of Historic Places Nomination Form. On file at the Historic Preservation Division, District of Columbia Department of Consumer and Regulatory Affairs.

Rhoads, A.F.

n.d. Deer Impact on Herbaceous Plants and Shrubs in the Forest. Morris Arboretum, University of Pennsylvania. Philadelphia, PA.

Robert Peccia and Associates

1997 Transportation Study, Rock Creek Park, Washington, D.C. Peccia and Associates, Helena, MT. March.

Rudolph, B. A., W. F. Porter, and H. B Underwood

2000 "Evaluating Immunocontraception for Managing Suburban White-tailed Deer in Iron

2001 dequoit New York." *Journal of Wildlife Management* 64:463–73.

Swihart, R. K., and M.R. Conover

1991 "Reducing Deer Damage to Yews and Apple Trees: Testing Big Game Repellent®, Ropel®, and Soap as Repellents." *Wildlife Society Bulletin* 18:156–62.

Turner, John W. Jr., Jay F. Kirkpatrick, Irwin K. M. Liu

1996 "Effectiveness, Reversibility, and Serum Antibody Titers Associated with Immunocontraception in Captive White-Tailed Deer." J. Wildl. Manage. 60(1).

U.S. Centers for Disease Control and Prevention

2003 "CDC Lyme Disease Home Page," available at: http://www.cdc.gov/ncidod/dvbid/lyme/index.htm

U.S. Department of Agriculture

2000a *Environmental Assessment: Shooting White-tailed Deer to Contribute to Deer Population Reduction Objectives in New Jersey.*

2000b *Pre-Decisional Environmental Assessment, Deer Damage Management in the Commonwealth of Virginia.*

2003 *Environmental Assessment, White-tailed Deer Damage Management in Pennsylvania.*

U.S. Fish and Wildlife Service, U.S. Department of the Interior

1992 *Migratory Bird Treaty Act of 1918*. In Digest of Federal Resource Laws of Interest to the U.S. Fish and Wildlife Service. Available at http://laws.fws.gov/lawsdigest/migtrea.html.

2002 A Guide to the Laws and Treaties of the United States for Protecting Migratory Birds; revised May 12, 2002. Available at http://migratorybirds.fws.gov/intrnltr/treatlaw.html.

Warren, Robert J., and Daniel B. Warnell

2000 "Overview of Fertility Control in Urban Deer Management." Proceedings of the 2000 Annual Conference of the Society for Theriogenology, 2 December, San Antonio, Texas, Society for Theriogenology, Nashville, Tennessee. Available at: <http://coryi.org/Florida_panther/deerfertilitycontrol.pdf>

West Virginia University Extension Service

1985 "Deer and Agriculture in West Virginia." West Virginia University Extension Service Publication Number 806.

Wilds, Claudia

Finding Birds in the National Capital Area. Second edition. Smithsonian Institute Press; pp. 55–58.

Appendix A

Environmental Screening Form