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AFFECTED ENVIRONMENT

This section describes the physical resources of Rock Creek Park and the Rock Creek and Potomac Parkway, including both natural and cultural resources. It also describes visitor and community conditions, such as visitor profile, visitation trends, automobile traffic and other transportation within and near the park, and the characteristics of the communities around the park and parkway.

NATURAL RESOURCES

AIR QUALITY

Air quality is included as an impact topic based on the criteria presented in the “Impact Topics - Resources and Values at Stake in the Planning Process” section. The specific concerns related to this impact topic are summarized as part of the “Environmental Consequences” discussion.

National Ambient Air Quality Standards (NAAQS) were established in the 1970 Clean Air Act amendments. The standards are concentrations of contaminants in the air that will protect public health and prevent degradation or harm to the environment.

The District of Columbia operates an ambient air monitoring network. The Air Resources Management Division of the District of Columbia Department of Consumer and Regulatory Affairs is the responsible agency for monitoring and enforcing the applicable standards. A complete table of the NAAQS is available on the internet site of the District of Columbia Air Resources Management Division at <http://mail.enviro.state.dc.us/dcairqua.htm>. The web site also contains monitoring data, and a printed ambient air monitoring data report can be obtained.

The Metropolitan Washington Council of Governments (MWCOC) is a partner in the program and analyzes the air quality data. MWCOC provides an area air quality index and notifies the public of the region’s air quality status. Up-to-date information on the index can be obtained by calling (202) 962-3299. In addition, MWCOC has information available about its environmental programs and publications at <http://www.mwcog.org/>.

Most air pollutants in the District of Columbia region are from vehicle emissions. Air quality has been improving in the region over the past 10 years for all measured contaminants because of improvements in vehicle emission controls (Metropolitan Washington Air Quality Committee 1997). Despite improvements, the entire Washington, D.C. metropolitan area, including Rock Creek Park and the adjacent counties in Virginia and Maryland, is classified as being in non-attainment with the ozone NAAQS by the U.S. Environmental Protection Agency (EPA).

The park and parkway are within a class II air quality area. The air quality is generally good with the exception of ozone. Ozone cannot be measured as a tailpipe emission. Instead, it is a secondary pollutant that is formed in the atmosphere by the combination of volatile organic hydrocarbons and nitrogen oxides with sunlight as a catalyst. Ozone exceedences generally occur in the summer and are region-wide, rather than localized. The occurrence of high levels of ozone is almost always associated with hot stagnant air masses over the region in combination with strong sunlight. High concentrations of ozone can result from the long-range transport of high ozone concentrations that are generated in other regions and drift into the area.

The regional airshed and the study area are in compliance for all other NAAQS pollutants. However, the region only recently became an attainment area for carbon monoxide and now implements a maintenance plan to prevent violations of the carbon monoxide standard. Carbon monoxide is a tailpipe emission, and local monitoring can indicate problem areas.

The National Park Service conducted a short-term air pollution monitoring study in the park and along the parkway from December 7 to 20, 1996 (Robert Peccia and Associates *et al.* 1997). The goal was to assess carbon monoxide concentrations at three locations during peak morning and afternoon rush-hours. Winter sampling was performed, because winter is the worst season for high carbon monoxide emissions. This occurs because vehicles emit more carbon monoxide during cold weather, especially during the cold-startup period, and temperature inversions can trap carbon monoxide emissions close to the ground.

Monitoring sites were located at the intersection of 16th Street and Colorado Avenue, near Military Road; at the intersection of the Rock Creek and Potomac Parkway and Calvert Street; and at the golf course, away from roads. The golf course location was chosen in an effort to establish background (unaffected by local traffic) levels.

Considerable variations were seen in the data as a result of wind direction, precipitation, and atmospheric mixing. On three occasions, wind direction caused the “background” golf course concentrations to be higher than the other sites.

The study did not indicate that there were any “valley effects” that would tend to concentrate pollutants within the narrow valley bottom. In general, the measured levels showed agreement with measurements taken during the same period at other local air monitoring stations around the Washington, D.C. metropolitan area. The data generally confirmed that carbon monoxide is an area-wide air pollutant that is largely derived from vehicle emissions. The sampling results suggested that some of the carbon monoxide detected in the park drifts in from the city.

As shown below, the highest concentration of carbon monoxide was 3.38 parts per million, measured over a 3-hour period at the intersection of 16th Street and Colorado Avenue. This and all other measured concentrations from the park and parkway were well below both the 1-hour and 8-hour NAAQS for carbon monoxide. Based on these limited sampling results, the carbon monoxide levels in the park and along the parkway meet the NAAQSs for carbon monoxide.

1-hour NAAQS for carbon monoxide	35 parts per million
8-hour NAAQS for carbon monoxide	9 parts per million
Maximum carbon monoxide level measured during the December 1996 monitoring	3.38 parts per million

ROCK CREEK AND ITS TRIBUTARIES

Rock Creek and its tributaries are included as an impact topic based on the criteria presented in the “Impact Topics – Resources and Values at Stake in the Planning Process” section. The specific concerns related to this impact topic are summarized as part of the “Environmental Consequences” discussion.

The Rock Creek Watershed map was included previously in the “Servicewide Mandates and Policies” section. Rock Creek flows generally south for 33 miles from its headwaters near Laytonsville, Maryland, to its confluence with the Potomac River at Georgetown. Land uses within the 77-square-mile Rock Creek watershed include urban, suburban residential, agricultural, and parkland.

An estimated 500,000 people reside in the watershed. Approximately 70 percent of the watershed, mostly upstream from Rock Creek Park, is developed. Much of the developed area consists of impervious surfaces, such as buildings, roads, and driveways. Problems within the park that have been produced by upstream development include increased flooding from rapid runoff, abnormal stream bed scouring in some places and sedimentation in others, bank erosion, organic and chemical pollution, and accumulation of litter and other solid waste.

Rock Creek is the primary water feature in the park, and within the area it has two major tributaries.

Broad Branch enters from the northwest, just opposite the intersection of Blagden Avenue and Beach Drive.

Piney Branch enters Rock Creek from the northeast at Piney Branch Parkway, approximately a half mile south of Broad Branch.

Sixteen smaller tributaries enter the creek in Rock Creek Park, primarily from the west. Most Rock Creek tributaries to the east were canalized, covered, and converted into storm drains during the early development of Washington, D.C. (Banta 1993). There also are numerous minor tributaries and many groundwater springs that drain to Rock Creek within the park.

A recent study entitled *Best Management Practices for Water Quality, Rock Creek Park* (URS Greiner Woodward Clyde 1999) identified several facilities as actual or potential sources of water pollution in Rock Creek Park. These include the maintenance yard, public stables, H-3 park police stables, Edgewater park police stables, golf course, roads, and parking lots. For each of these areas, the report provided best management practices (BMPs) to remediate or prevent pollution. The National Park Service has begun implementing the recommended BMPs and will continue to do so, regardless of the alternative selected from this draft general management plan.

As shown in the Sewerlines and Outfalls map, numerous municipal storm sewers converge in the Rock Creek valley and discharge surface water from city streets directly into park waters. The pollutants that surface waters transport from roadways and parking lots are a major source of contamination of Rock Creek and its tributaries during and after precipitation events.

The Sewerlines and Outfalls map also shows that numerous municipal sanitary sewers are located within the park, including pipelines that run under road beds and under the creek channel. Sanitary sewers carry raw sewage, and can pollute park waters when leaks develop. In upper Rock

Creek, high bacterial concentrations are suspected to originate from sanitary sewer leaks, and from failed septic systems in the Maryland portion of the watershed.

A serious source of pollution exists in the southeastern portion of the park where there is an antiquated system of combined sanitary and storm sewers (see the Sewerlines and Outfalls map). Under normal conditions, the flow in these combined sewers is routed to the Blue Plains municipal wastewater treatment plant. However, during storms when rainfall exceeds 0.3 inches per hour, these sewers overflow and discharge raw, untreated sewage directly into Piney Branch and Rock Creek. There are 29 combined sanitary/storm sewer overflow structures on Rock Creek. Together, they can contribute as much as 42.5 million gallons of combined storm water and sewage to the creek during a 1-hour storm (URS Greiner Woodward Clyde 1999).

The Washington, D.C. Water and Sewer Authority (WASA) estimates that 60 to 70 overflow events occur each year (*Engineering News-Record* 2001). In July 2001, the WASA proposed a \$1 billion plan that would reduce overflow discharges throughout its service area by more than 90 percent. It would involve constructing three 20-foot-diameter, concrete-lined tunnels that together could hold approximately 115 million gallons of mixed storm runoff and sewage. Runoff from all but the largest 5 to 10 storms annually would be stored temporarily in the tunnels and then routed to the Blue Plains Wastewater Treatment Plant. One of these tunnels, which would be a half-mile long and have a capacity of 5 million gallons, would be constructed along Rock Creek. The WASA is currently preparing a final plan for submittal to the U.S. Environmental Protection Agency and identifying sources of funding (*Engineering News-Record* 2001).

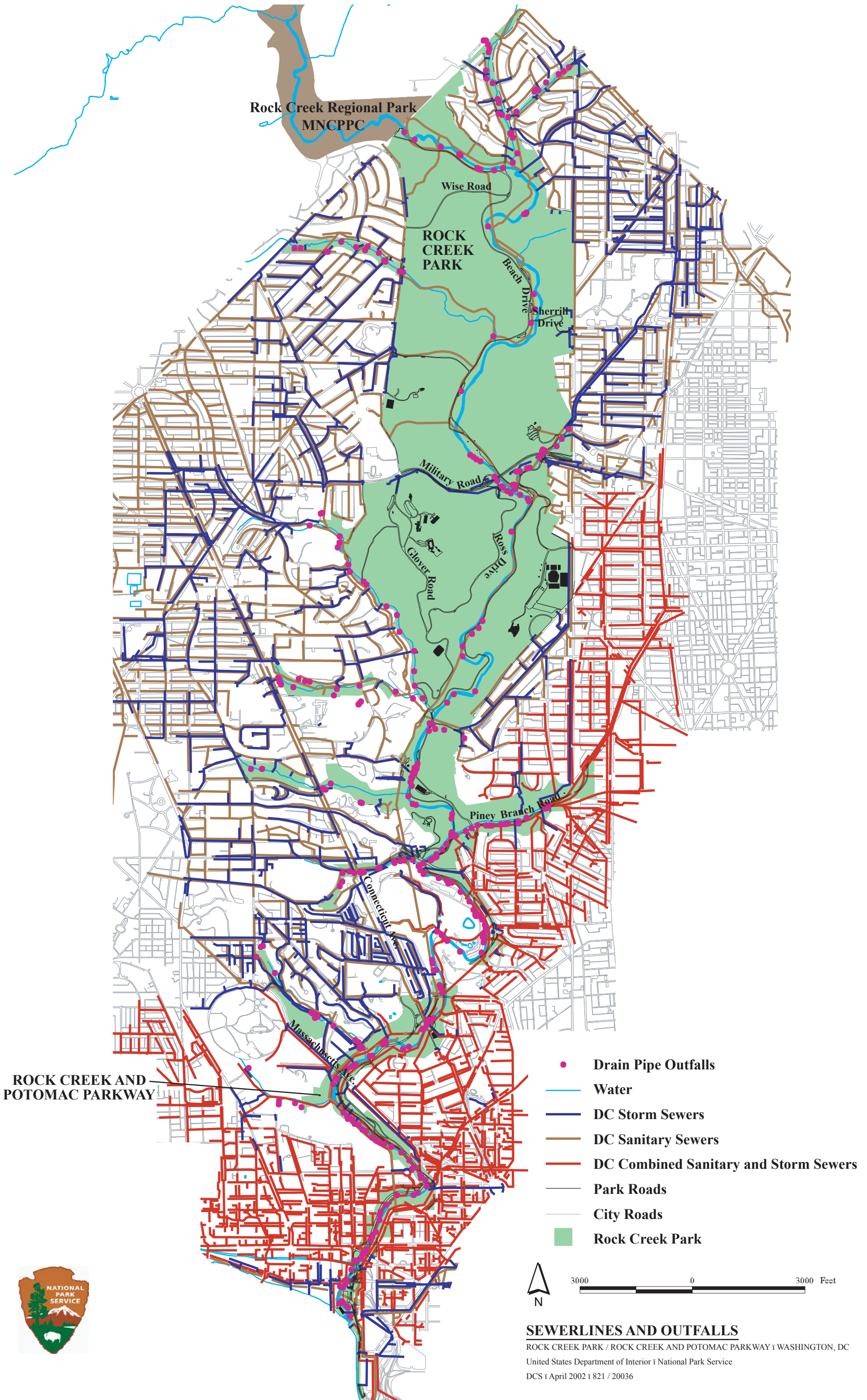
For the purposes of water quality standards, the surface waters of the District of Columbia are classified based both on their current uses and the future uses to which the waters could be restored. Each designation category has applicable water quality standards that are the principal water quality management objectives for the park. The district works to support the designations and meet the applicable standards by granting permits and reviewing permit applications and environmental impact statements. The standards and classification of the district's waters are published in the District of Columbia Register, Chapter 11 of Title 21 DCMR.

The District of Columbia Water Resources Management Division has designated Rock Creek and its tributaries for restoration to meet all five beneficial use classes. The classes and the status of surface waters in the park in meeting the standards associated with the classes are as follows:

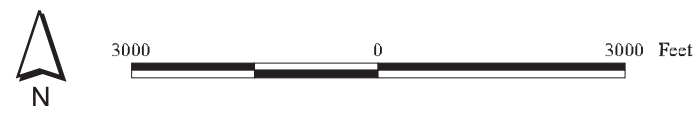
Class A is for primary contact recreation. These standards are not being met in Rock Creek and its tributaries.

Class B is for secondary contact recreation and esthetic enjoyment. These standards are not being met in Rock Creek and its tributaries.

Class C is for propagation of fish, shellfish, and wildlife. The water quality in some of the tributaries partially supports the Class C designation, but the water quality of Rock Creek does not currently support this designation.



ROCK CREEK AND POTOMAC PARKWAY



SEWERLINES AND OUTFALLS
 ROCK CREEK PARK / ROCK CREEK AND POTOMAC PARKWAY / WASHINGTON, DC
 United States Department of Interior / National Park Service
 DCS / April 2002 / 821 / 20036

Class D is for protection of human health related to consumption of fish and shellfish. The Class D standards are partially supported below the Peirce Mill dam. However, the creek above the dam was not assessed for support of the Class D standards, because the dam will continue to be a barrier to the migration of fish until a fish bypass is completed in 2003 as part of the mitigation program for the Woodrow Wilson Bridge.

Class E is for navigation. The Class E designation is supported in Rock Creek.

Rock Creek and its tributaries have also been designated “Special Waters of the District of Columbia” for their scenic and esthetic importance. It is intended that the water quality of such designated waters be maintained and not allowed to degrade.

Some point and non-point sources of water pollutants in Rock Creek Park were identified previously. The types of contaminants contributed to surface waters in Rock Creek Park include the following.

Sediment is transported from unvegetated soils, such as construction sites and agricultural fields.

Storm water runoff from transportation corridors and parking lots within the watershed carries sediments, oil and grease, and metals, such as cadmium, iron, lead, and zinc.

Runoff from lawns and leaking sewerlines are sources of nutrients, including nitrogen and phosphorus, and contributes to high coliform bacteria counts.

Pollution has adversely affected the ability of Rock Creek Park and its tributaries to support aquatic life. Banta (1993) determined that 58 percent of the tributaries of Rock Creek were classified as severely impaired for habitat quality and biological water quality using U.S. Environmental Protection Agency (EPA) biological assessment standards, and that the remaining 42 percent of the creek’s tributaries were moderately impaired.

The *Baseline Water Quality Data/Inventory and Analysis – Rock Creek Park* (NPS 1994) reported that criteria for nitrite, pH, dissolved oxygen, copper, zinc, total and fecal coliform bacteria, and turbidity were exceeded multiple times throughout the study area. A summary of water quality sampling results for these parameters is provided in table 8. The criteria included drinking water standards and EPA freshwater acute toxicity standards. The baseline water quality report concluded that surface water quality in the park was typical of that encountered in streams in metropolitan areas.

A 1996 water quality assessment report was prepared by the District of Columbia for the U.S. Environmental Protection Agency and U.S. Congress pursuant to Section 305(B) of the Clean Water Act (P.L. 97-117) (District of Columbia 1996a). This report documented violations of fecal coliform bacteria and pH standards.

Water quality concerns in Rock Creek appear to have stabilized, both because upstream urbanization has reached a maximum and because of the diligence of government agencies in Maryland in controlling of pollutant discharges and storm water runoff. This particularly includes requiring new development to implement best management practices to control storm water runoff. In addition, there has been a decrease in upstream agriculture, and natural vegetation has been allowed to revegetate abandoned farmlands. This land use change reduces sediment,

TABLE 8: ROCK CREEK WATER QUALITY, 1959 TO 1990^{a/}

Water Quality Parameter	Total Number of Samples	Number Exceeding EPA Standard^{a/}	Percent Exceeding EPA Standard^{a/}
Total nitrite, as N	291	73	25
pH ^{c/}	642	27	4
Dissolved oxygen	342	28	8
Copper	57	6	11
Zinc	58	16	28
Total coliform	419	408	97
Fecal coliform	204	163	80
Turbidity	254	40	16

a/ Source: NPS 1994.

b/ EPA criteria included drinking water and freshwater acute toxicity standards.

c/ pH exceedence defined as greater than 9.0 or less than 6.5.

pesticides, and fertilizers entering the waterway. The *Rock Creek Watershed Conservation Study* (CH2M Hill 1979) led to improvements to Rock Creek and its tributaries within the park.

Park resources management staff members monitor sanitary sewers and facilitate their repair to correct leaks.

The District of Columbia has been given assistance in tracing illegal pollutant discharges connected to storm drains.

Combined sanitary/storm sewer outlets have been identified for retrofitting to reduce discharges.

Dry-weather outfall surveys have led to the cleaning of blocked combined sanitary/storm sewers to halt continual overflowing.

Because the majority of the Rock Creek watershed lies outside of Rock Creek Park and the jurisdiction of the National Park Service, park personnel must work with other federal, local, state, district, and regional agencies and organizations to implement steps that would improve existing water quality in the park. The Chesapeake Bay Program is the most comprehensive interagency effort to improve water resource values in the region.

WETLANDS AND FLOODPLAINS

Wetland and floodplains are included as an impact topic based on the criteria presented in the "Impact Topics - Resources and Values at Stake in the Planning Process" section. The specific concerns related to this impact topic are summarized as part of the "Environmental Consequences" discussion.

The Clean Water Act and Executive Orders 11990 and 11988 identify wetlands and floodplains as national natural assets. They direct all federal agencies to avoid the occupation, adverse modification, or degradation of wetlands and floodplains.

Wetlands. Three temporarily flooded, forested National Wetland Inventory (NWI) -designated wetlands (NWI designation of PFO1A) are found along Rock Creek in the northern portion of the park. Rock Creek is identified as an open water, tidally influenced riverine system (NWI designation of R1OWV) (U.S. Fish and Wildlife Service 1999).

An additional wetland inventory was performed in 1997 (District of Columbia Government 1997a). Its results differ from the NWI only by defining the northernmost forest wetland as being about twice the size of the wetland identified by the NWI.

The most common wetlands in the park are located within the primary floodplain of Rock Creek where the creek it is underlain by Codorus silt loam (Soil Conservation Service 1976). These riparian wetlands are typically covered by sycamore-green ash forest. Other riparian wetlands, not identified by the NWI, are in the narrow alluvial deposits of the Pinehurst Branch, Fenwick Branch, and Joyce Branch drainages.

Vernal pools, also not identified on the NWI, are widely scattered wetland features in the park. These are small, temporary puddles or ponds that appear during wet periods and are dry at other times. If they persist for 4 months or more, including the spring, these limited habitats can be breeding places for frogs, toads, and salamanders. The number of vernal pools in the park today may be reduced from the pre-urbanization era due to past draining or filling activities, stream bed scouring from increased runoff that has resulted from development in the watershed upstream from the park, and lowered water tables from urban groundwater usage.

Other important wetland-related features in the park include groundwater springs and seeps. These small, wet areas are fed by relatively dependable flows of pollutant-free water. Several of these wetlands support endemic, aquatic animal species such as amphipods and other macroscopic invertebrates.

Floodplains. Floodplains in the park were mapped as part of the *Rock Creek Watershed Conservation Study* (CH2M Hill 1979). Flood levels in the park have been substantially affected by urbanization and associated increases in impervious surfaces in the Rock Creek watershed. Stream flows in the main stem of Rock Creek during storm events are estimated to be more than double the predevelopment discharge (CH2M Hill 1979).

Four major park buildings are in the 100-year floodplain. Peirce Mill and the Miller cabin are completely within the 100-year floodplain. Portions of the Lodge House and the Edgewater Stables building are on the fringe of the floodplain, but would not be subject to high velocities or deep water during flooding (CH2M 1979).

Sections of Beach Drive and the Rock Creek and Potomac Parkway are within the 100-year floodplain, as are a number of picnic groves and associated parking areas, picnic shelters, and restrooms. Under NPS floodplain management guidelines, historic structures, picnic facilities, daytime parking facilities, roads, and trails are acceptable within the 100-year floodplain.

A network of storm sewer, sanitary sewer, and combined sanitary/storm sewerlines underlies the park (see the Sewerlines and Outfalls map). Some of these pipelines are within the 100-year floodplain. The storm sewers discharge into drainages that may lead to riparian wetlands, and the combined sanitary/storm sewers experience overflows that may discharge raw sewage into floodplains and wetlands whenever rainfall exceeds 0.3 inches per hour.

DECIDUOUS FORESTS

Deciduous forests are included as an impact topic based on the criteria presented in the “Impact Topics - Resources and Values at Stake in the Planning Process” section. The specific concerns related to this impact topic are summarized as part of the “Environmental Consequences” discussion.

The establishing legislation for the park identifies “timber” as an essential resource to the park. The National Park Service interprets this in an ecological context to mean not individual trees, but the interrelated plant and animal populations that form the forest community. The ecosystem processes provided by forests are a part of this essential resource. In addition, forest stands are an integral component of the scenic quality of the park cited in the establishing legislation. Therefore, regardless of the management alternative selected from this draft general management plan, the National Park Service will maintain the forests consistent with its charge in the 1916 Organic Act to preserve unimpaired the natural resources and values of the park for this and future generations.

Approximately 80 percent (1,662 acres) of the park land area is covered with mature second growth forest. Activities prior to the park’s establishment in 1890, such as timber cutting, farming, and Civil War clearing, removed virtually all of the original forest. A few large oaks still living in the park are estimated to be more than 275 years old and may be remnants of virgin growth. Today’s woodlands are primarily a mixture of deciduous species typical of the eastern deciduous forest in the later stages of succession.

Rock Creek Park runs along the topographic break separating the Piedmont Plateau and the Atlantic Coastal Plain provinces. The vegetation reflects affinities to both of these provinces. The following five forest associations have been identified and mapped in Rock Creek Park using the National Vegetation Classification System developed by The Nature Conservancy (1998).

The beech-white oak/mayapple forest association occurs on moist to somewhat drier slopes. It is the most common of all associations found in the park. Two variants include the mixed oak/beech variant and the beech-tulip poplar variant.

The tulip poplar forest association is uncommon and occurs on moist, mid-slope to low-slope sites that were cleared in the past. The sites are exclusively dominated by tulip poplar.

The chestnut oak-black oak/huckleberry forest association is uncommon and occurs on ridge tops, convex upper slopes, and south-facing slopes on rocky, well-drained soils.

The sycamore-green ash forest association is uncommon and occurs along stream banks, floodplains, and other low-lying areas subject to temporary or irregular flooding.

The Virginia pine-oak forest association is rare because it is an early to mid-successional forest that is being replaced by hardwood forests. Remnants of this association occur on dry soils of hilltops in limited areas where forest succession has not yet replaced it.

An inventory of park vegetation, conducted by park and volunteer staff between 1986 and 1994, documented 656 species of vascular plants in Rock Creek Park between the National Zoo and the Maryland boundary. Five plant species that had been found in the park during a 1919 vegetation

inventory were not found during the 1986 – 1994 inventory. They included swamp shadbush (*Amelanchier canadensis*), shooting star (*Dodecatheon meadia*), dwarf chinkapin oak (*Quercus prinoides*), Allegheny chinkapin (*Castanea pumila*), and a wild rose (*Rosa setigera*). The reasons for their absence in the second inventory are unknown.

Small natural areas such as the park and parkway have been shown to be very important contributors to regional biodiversity (Falkner and Stohlgren 1997). Based on the vegetation inventory, Rock Creek Park continues to serve as a major reservoir of native flora for the region and is important in protecting the natural heritage of this area.

The recent inventory of park vegetation also determined that 238 of the plant species were introduced species, not native to the area. Of this number, 42 species have been judged to be invasive exotic species that, unless controlled, are likely to spread and adversely affect native plant populations. Control of these invasive exotic plants is a serious problem in the park. A program now underway is selectively applying approved herbicides to invasive species in a limited portion of the park. However, control efforts are not able to keep pace with the rate of invasive plant introduction and spread. Management of invasive species will be a continuous need in the park and operational plans will be updated as control strategies and funding evolve.

Soil properties are integral components of determining the species diversity, productivity, and regenerative potential of the deciduous forest system. Therefore, soil characteristics important to these processes are included in this impact topic characterization.

The park's soil resources are adversely affected by accelerated erosion, compaction, and deposition caused by human activities inside and outside the park boundaries. Some areas that receive heavy visitor use are subject to soil compaction, removal of vegetation cover, and erosion. This is particularly evident along streambanks, at picnic groves and other popular recreation areas, and along heavily used or improperly designed and maintained trails. Accelerated erosion caused by increased runoff from the upstream watershed is occurring along the Rock Creek channel in the northern portion of the park. Associated deposition of some of the eroded soils is occurring in the floodplains in the central and southern portions of the park and parkway. The National Park Service will implement measures to protect soils from erosion, compaction, and deposition caused by human activities and to restore areas of soils degradation, as required in *Management Policies* (NPS 2001b).

As described previously in "Servicewide Mandates and Policies," a 1980 memorandum from the Council on Environmental Quality requires the protection of soils that are classified as prime and unique farmlands. In a letter to the National Park Service, the Natural Resources Conservation Service (1998) identified two soil types within the park that are classified as prime farmlands. However, as discussed in "Impact Topics Dismissed from Further Consideration," neither of the prime farmland soil types in the park would be disturbed by management action proposed in any of the alternatives. They will continue to be protected as part of the park's forest resource.

Woodland fires in the park were described in the section entitled "Servicewide Mandates and Policies." An average of two fires occur in park each year. All wildfires are suppressed promptly by the District of Columbia Fire Department or park firefighters.

PROTECTED AND RARE SPECIES

Protected and rare species are included as an impact topic based on the criteria presented in the “Impact Topics - Resources and Values at Stake in the Planning Process” section. The specific concerns related to this impact topic are summarized as part of the “Environmental Consequences” discussion.

The National Park Service is required under the Endangered Species Act to ensure that federally listed species and their habitats are protected on lands within the agency’s jurisdiction. Only one federally listed species, the endangered Hays spring amphipod (*Stygobromus hayi*), is known to inhabit the park.

Lists of the rare and protected species that are documented as occurring in Rock Creek Park are provided in appendix E. Complete lists of federally listed species and the species identified as protected or rare by the states of Maryland and Virginia can be found on the internet. Internet addresses for the lists are presented in the bibliography under these citations:

U.S. Fish and Wildlife Service 1999

Maryland Department of Natural Resources 1994

Maryland Department of Natural Resources 1995

Virginia Department of Conservation and Recreation 1998

Federal- and State-Listed Amphipods. The Hays spring amphipod was discovered in Rock Creek Park in 1998. Earlier, another rare species, Kenk’s amphipod, also known as the Rock Creek groundwater amphipod, (*Stygobromus kenki*), was identified in park springs. Kenk’s amphipod is not currently listed under the Endangered Species Act, but it is under consideration by the U.S. Fish and Wildlife Service (USFWS) for future listing. In addition, three other *Stygobromus* species of amphipods that are listed by the state of Maryland as rare or uncommon have been located in or near the park (Maryland Department of Natural Resources 1995).

Groundwater amphipods are sensitive to environmental pollution, making the present concentration of these species an extremely rare occurrence in the Piedmont region. The relative abundance of rare amphipods in the park has been attributed to the long-term protection of groundwater quality afforded by the park.

The Hays spring amphipod ranges from one-half to one inch long. It is colorless, eyeless, and has adaptive hairs for sensing currents and food. They have life spans of 8 years or more and a low reproductive rate. *Stygobromus* amphipods spend the majority of their lives in groundwater below the surface, feeding on detritus. Amphipods are subject to a number of predators when they are at surface springs, such as stonefly larvae and salamanders, but probably have few if any predators below the surface.

Threats to groundwater amphipods include alterations of groundwater flows, groundwater pollution, loss of detritus as a food source, and disturbance of spring sites. Common pollution problems for amphipods are nitrates in fertilizers (which can result in groundwater oxygen depletion), pesticides, and petroleum leaking from underground storage tanks.

Other State-Listed Species. Washington, D.C. does not currently provide special protection status for rare plant or animal species. As shown in appendix E, the adjoining states of Maryland and Virginia (Maryland Department of Natural Resources 1994; Virginia Department of Conservation and Recreation 1998) list

seven plant species that are documented as occurring in Rock Creek Park as “highly state rare – critically imperiled” (E, S1, or S2)

21 species that are documented as occurring in Rock Creek Park as “watch list – rare or uncommon” (S3)

Although five of these species are trees, most are non-woody, herbaceous species that typically occur in a single population within the park.

Three animal species with known occurrences in Rock Creek Park are listed as rare or uncommon by the adjoining state of Maryland (Maryland Department of Natural Resources 1995). Wetlands, including freshwater springs and outflow channels, provide habitat for each of these species. They include the

yellow-crowned night-heron (*Nyctanassa violacea*), which is considered highly rare

Appalachian spring snail (*Fontigens bottimeri*), which is considered rare

gray petaltail dragonfly (*Tachopteryx thoreyi*), which is considered possibly rare, but of uncertain status

The National Park Service is not under any legal obligation to protect these plant or animal species. However, park policy and management actions include maintaining these uncommon native species as part of the park’s natural heritage.

OTHER NATIVE WILDLIFE

Terrestrial Wildlife. Native wildlife species are included as an impact topic based on the criteria presented in the “Impact Topics - Resources and Values at Stake in the Planning Process” section. The specific concerns related to this impact topic are summarized as part of the “Environmental Consequences” discussion.

The woodlands in Rock Creek Park provide suitable habitat for a variety of wildlife mammal species, despite their location within the city limits of the District of Columbia. Approximately 30 species of mammals have been inventoried in the park. Species of particular interest because of their size or their public attention include the raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), opossum (*Didelphis virginiana*), beaver (*Castor canadensis*), gray squirrel (*Sciurus carolinensis*), eastern chipmunk (*Tamias striatus*), and white-tailed deer (*Odocoileus virginianus*).

White-tailed deer have been recorded for many years, but since the late 1980s their numbers have substantially increased. Aerial infrared photography taken in March 1997 indicated a population of 87 deer, and a repeat survey in March 1998 estimated the number had increased to 155. The deer population is monitored to avoid adverse impacts park resources.

Approximately 160 species of nesting or visiting birds have been found in the park, including the great-horned owl (*Bubo virginianus*), barred owl (*Strix varia*), red-tailed hawk (*Buteo jamaicensis*), broad-winged hawk (*Buteo platypterus*), belted kingfisher (*Megaceryle alcyon*), and numerous songbirds. Most of these are migrants or seasonal visitors. Typically, 22 to 24 species nest in the breeding bird census area in Rock Creek Park (unpublished data from the Rock Creek Park breeding bird census, 1997 through 1999).

In recent years, volunteers evaluating bird populations have noticed pronounced declines in neotropical migrant species. Similarly declining populations of neotropical migrants are evident throughout the United States. These declines are thought to be caused by receding or fragmented habitats both in tropical wintering grounds and in northerly breeding grounds in temperate areas (Friesen *et al.* 1995). Nest parasitism of some species by the brown-headed cowbird (*Molothrus ater*) and predation by crows (*Corvus brachyrhynchos*) also appear to reduce breeding success in many areas, including Rock Creek Park. Consistent with the NPS' preservation mandate, the park staff is exploring options for reducing the declines of migrant species locally, such as cowbird control, improved snag management, and trail rerouting or closure to avoid sensitive habitats.

The variety and numbers of amphibians and reptiles found in the park are markedly reduced compared to inventories from the early and middle parts of the 20th century. Of species historically recorded for Rock Creek Park, only 9 of 17 amphibians and 11 of 24 reptiles have been recorded in recent years. The amphibian observations are consistent with the recent world-wide decline in amphibian numbers and diversity.

Some amphibians such as the gray treefrog (*Hyla versicolor*) and chorus frog (*Pseudacris triseriata*) have disappeared altogether from Rock Creek Park.

Others amphibians, such as the spring peeper (*Hyla crucifer*), wood frog (*Rana sylvatica*), and spotted salamander (*Ambystoma maculatum*) can be found in modest numbers in wetland areas.

Red-backed salamanders (*Plethodon cinereus*), which do not depend on wetlands, are relatively common in moist uplands where they inhabit moist niches under logs and leaf litter.

Factors responsible for the declines in reptile diversity in Rock Creek Park are unknown. Relatively protected and abundant moist upland sites provide habitat for small snakes, such as the northern ringneck snake (*Diadophis punctatus*), which are common. Eastern box turtles (*Terrapene carolina*) and larger snakes such as the black rat snake (*Elaphe obsoleta*) are much less common.

Aquatic Wildlife. Recent surveys have found approximately 35 species of fish in Rock Creek.

Resident native species include five shiners (*Notropis* spp.), two bullheads (*Ictalurus* spp.), and three sunfish (*Lepomis* spp.). Blacknose dace (*Rhinichthys atratulus*) are relatively common and can be found in the main stream and many tributaries.

Other resident species are introduced, including carp (*Cyprinus carpio*), bluegill (*Lepomis macrochirus*), and largemouth bass (*Micropterus salmoides*).

At least two native species, the blueback herring (*Alosa aestivalis*) and the alewife (*Alosa pseudoharengus*), migrate from salt water up Rock Creek to spawn each spring (anadromous). An abandoned sewerline and an abandoned gauging station near Q Street that interrupted their migrations have been removed from Rock Creek (Madaras 2001). The removal of eight other barriers in Rock Creek and the installation of a fish bypass at the Peirce Mill Dam as part of the Woodrow Wilson Bridge mitigation are expected to allow these species to migrate from the mouth of the creek upstream to Needwood Lake in Montgomery County, Maryland (Madaras 2001).

The American eel (*Anguilla rostrata*) is the only species found locally that lives in either fresh or brackish water. Eels migrate to the Sargasso Sea to spawn (catadromous). The removal of barriers in Rock Creek as part of the Woodrow Wilson Bridge mitigation is expected to enhance the habitat for this species.

The urban pollution and storm water runoff problems that were described previously in the section entitled “Rock Creek and Its Tributaries” have adversely affected fish numbers and diversity in the park. Generally, the 16 tributaries of Rock Creek are more severely affected than the main channel. In a 1993 study by NPS staff, no fish were found in nearly half of the tributaries, and only one had more than a single species present. Flooding and scouring during storms, pollution from runoff, and periodic low flows are likely contributing factors.

Non-Native Terrestrial Animals. Several non-native species of wildlife that occur in Rock Creek Park are adversely affecting the park’s natural resources.

Free-roaming domestic cats (*Felis catus*), particularly near the park borders, prey on local populations of songbirds, squirrels, and other small mammals and may reduce their numbers (Mitchell and Beck 1992).

Starlings (*Sturnus vulgaris*) compete with some cavity-nesting birds for nest sites.

The gypsy moth (*Lymantria dispar*) has been present in the park for many years and, at times, has become sufficiently abundant to require aerial spraying to prevent forest defoliation and related impacts.

The effects of these and other exotic animals on native species are not fully known. They could be substantial, considering the small size of the natural areas of Rock Creek Park and the park’s location within an urban setting. However, except for treatments of insect pests, no control efforts are presently contemplated for these species.

Roadkill. Collisions with vehicles kill or injure terrestrial and semi-aquatic animals on roads in Rock Creek Park, along the Rock Creek and Potomac Parkway, and on adjoining city streets. Since 1980, the park staff has kept informal counts of carcasses along roads and streets within and adjacent to the park and parkway. The data include species, date, and location where each carcass was found. The counts are non-systematic and were collected incidental to other activities. Because of the informal nature of the data collection and the frequent removal of roadkill carcasses by scavengers such as crows and raccoons, the park roadkill counts probably are lower than actual animal deaths. Larger, more conspicuous animals, particularly mammals, tend to be

more represented in the count, as opposed to smaller animals such as songbirds, amphibians, and reptiles that are more easily overlooked or scavenged.

For the 10 years between 1991 and 2000, park staff recorded 1,223 roadkilled carcasses. Table 9 summarizes these data by class and by selected species.

Between a quarter and a third of the annual recorded roadkill in the park and vicinity occurs on Beach Drive. For example, in the year 2000, 104 carcasses were recorded, including 28 from Beach Drive. Table 10 shows all roadkilled species recorded from Beach Drive in 2000 and sub-totals for sections of the road under different traffic management strategies.

TABLE 9: RECORDED ROADKILLS IN AND ADJACENT TO ROCK CREEK PARK AND THE ROCK CREEK AND POTOMAC PARKWAY, 1991 THROUGH 2000

Type	Number	Percent of Total Roadkills Recorded
Total recorded roadkills, 1991 through 2000	1,223	100
Mammals	1,088	89
Squirrel	455	37
Raccoon	303	25
Deer	135	11
Opossum	96	8
Other	96	8
Gray fox	3	0.25
Birds	90	7
Reptiles	45	4
Box turtle	22	2
Black rat snake	15	1

TABLE 10: ROADKILLS RECORDED ON BEACH DRIVE IN 2000

Species	Total for Beach Drive	South of Broad Branch Road	Sections Closed to Traffic on Weekends and Holidays	Sections Open to Traffic North of Broad Branch
Raccoon	8	5	3	0
Squirrel	7	3	3	1
Deer	4	1	0	3
Water snake	2	0	1	1
Unidentified bird	2	2	0	0
Red-eyed vireo	1	0	0	1
Snapping turtle	1	0	1	0
Box turtle	1	0	0	1
Opossum	1	1	0	0
Domestic cat	1	0	1	0
Total	28 (100%)	12 (43%)	9 (32%)	7 (25%)
Percent of road length	100%	13%	46%	41%
Average annual road-kill per mile	28/5.8 = 4.8	12/0.70 = 17.1	9/2.7 = 3.3	7/2.4 = 2.9

As shown in the table, the highest incidence of roadkill on Beach Drive occurs south of Broad Branch Road. The roadkill rate on this stretch is five times higher than on more northern portions of Beach Drive, indicating that this area might be an appropriate site for the installation of mitigating measures such as traffic controls or protected wildlife crossings such as culverts.

As shown in table 11, 16 animal carcasses were recorded from the 2-mile-long Rock Creek and Potomac Parkway in the year 2000. This produces an average annual roadkill of eight animals per mile. Contributing factors to this relatively high value probably include the higher traffic speeds on the parkway and heavier traffic level than on most park roads.

TABLE 11: ROADKILLS RECORDED ON THE ROCK CREEK AND POTOMAC PARKWAY IN 2000

Species	Number
Squirrel	5
Raccoon	5
Mallard duck	2
Unidentified bird	2
Crow	1
Deer	1
Total	16

The importance of roadkill to populations of wildlife is difficult to determine. Squirrels, raccoons, and deer sustain the heaviest toll from vehicle collisions. However, these species are common in the region and have high reproduction potentials. Their populations do not appear to be substantially influenced by roadkill. For less common species with more limited reproduction potential, roadkill could be a contributing factor to population reductions or local extirpation (Foreman and Alexander 1998).

Based on casual, undocumented sightings, four species of wildlife may have declined in the park over the past decade or more. These species are the opossum, gray fox, eastern box turtle, and black rat snake. Concern has been expressed that roadkill could be a contributing factor. Recorded roadkill numbers and locations for these species between 1991 and 2000 are shown in table 12. For all four species, approximately a third of the roadkills were recorded *outside* of the park and parkway.

Opossum – The number of road-killed opossum carcasses recorded in and around Rock Creek Park and the parkway has declined over the past 10 years. Numbers have dropped from a high of 16 animals in 1992 to one specimen in 2000.

Although the reason for the decrease is unknown, it is unlikely that roadkill is causing a population decline. Opossums are common in the region and much of the United States. They have a high reproduction potential (2 litters per year with 5 to 13 young per litter) and are highly adapted to living in close proximity to humans, even in densely developed metropolitan areas (Hossler *et al.* 1994; Pennsylvania Game Commission 2001). The decline in roadkill in Rock Creek Park probably reflects population reductions caused by another factor such as a disease outbreak. It is unlikely that roadkill would seriously threaten or cause the extirpation of opossums in the park.

TABLE 12: LOCATIONS OF RECORDED ROADKILLS FOR FOUR SPECIES, 1991 THROUGH 2000

Location	Opossum	Grey Fox	Box Turtle	Black Rat Snake
Park roads				
Rock Creek and Potomac Parkway	18	1		
Beach Drive south of Broad Branch Road	14	1		1
Beach Drive north of Broad Branch Road	8		2	3
Wise Road	4		1	1
Glover Road	3		3	2
Ross Drive	1		1	
Bingham Drive			4	
Joyce Road				1
Nature center/maintenance area	1		1	1
Other park roads	7			
Adjacent non-park roads				
Military Road (though park and nearby)	17	1	2	
Oregon Avenue	14		8	5
Broad Branch Road	4			1
Other non-park roads	5			
Total roadkills recorded 1991-2000	96	3	22	15

Gray Fox – In the past 10 years, three gray foxes have been found dead on roads in and around the park, including one each in 1991, 1994, and 1999. Gray foxes are relatively common in the eastern United States. They have been described as habitat generalists that prefer wooded areas with dense cover for daytime dens and mixed fields and forests for nighttime hunting (Greenburg and Pelton 1994).

A study in Tennessee found that gray foxes had overlapping home ranges of about 1,000 acres, and that a 5,000-acre area supported 12 adult and young foxes (Greenburg and Pelton 1994). New Mexico studies showed that gray foxes were tolerant of low to moderate residential development, but avoided high-density development (Harrison 1993 and 1997). At 1,700 acres, Rock Creek Park may provide sufficient habitat for only a few individuals. Additional habitat on adjoining lands would be necessary to support a larger, more sustainable gray fox population.

Gray foxes, such as young animals dispersing from the den, will travel distances of 50 miles or more (Trippensee 1953). The Rock Creek corridor probably served as a travel route between foxes in the park and populations in woodlands to the north. However, as more of the forested areas in the upper drainage are developed, the interaction of animals in the park with those in other areas probably has been reduced. This would include the recruitment of foxes into the park population.

Gray foxes are very susceptible to canine diseases such as distemper and hepatitis (Nicholson and Hill 1984). The potential for these diseases to be introduced into the gray fox population from the large number of dogs using the park is a threat to gray foxes in the park.

Gray fox populations in and around the park are probably small and are likely stressed by habitat destruction, habitat fragmentation, low recruitment, and periodic disease outbreaks. Roadkills, even infrequent ones, could contribute to an overall reduction of a resident population or even local extirpation.

Box Turtle – There is no clear trend in recorded roadkills of box turtles in and around the park and parkway. Throughout the past 10 years, 22 box turtle roadkills have been recorded, for an average rate between two and three turtles per year.

Prime habitat for box turtles includes wooded uplands and bottomlands. In the wild, box turtles are known to live at least 40 years and there are claims of some turtles living more than 100 years. They do not reach sexual maturity until 4 or 5 years of age. The average clutch size is only four or five eggs, although a female may lay several clutches per year. The female does not protect the nest or hatchlings, and mortality of hatchlings is high, primarily because of predation (Dawson 1999).

Populations of box turtles have declined throughout their range in the eastern United States because of a variety of human-induced factors. Roadkill is believed to be a contributing factor to the declining numbers, along with habitat loss and fragmentation, commercial and personal collecting, predation by animals such as dogs and raccoons that are associated with human development, and disease (Hutchinson 2000; Mitchel, 2000). Because box turtles are long-lived and have a low reproduction potential, losses of individuals can have long-lasting effects on local populations.

A study in the 1950s of mixed forests and agricultural lands in Maryland reported turtle densities at 10 per acre (Hall *et al.* 2000). Other studies in Missouri summarized by Dawson (1999) indicated a lower density, identifying home range size as varying from about 5 acres to about 13 acres and stating that “the home ranges of several individuals will often overlap.”

There is little information on box turtle populations in Rock Creek Park. The riparian wetlands along Rock Creek and its tributaries provide excellent habitat, and sightings of box turtles by park visitors and park staff are relatively common. However, studies of box turtle numbers or densities have never been conducted. Removing box turtles from the park for any purpose, including use as pets, is illegal, but anecdotal evidence suggests that such illegal collecting occurs at a rate far greater than the annual roadkill rate of two or three box turtles. However, the additive effect of roadkill may be a contributing factor in an apparent decline in box turtles in and near the park.

Black Rat Snake – There is no clear trend in the pattern of roadkills of black rat snakes in Rock Creek Park over the past 10 years. Fifteen roadkills were recorded, including five on Oregon Avenue outside of the park.

Black rat snakes are fairly common in the region. They are active during daylight hours and hibernate during the winter months. They prefer dense cover along forest edges, meadows, and hedgerows and tend to avoid open areas such as closely mowed roadsides, road surfaces, and open fields. Black rat snakes use the interior of forests and, often, structures for periodic refuges (Durner 1991; Durner and Gates 1993).

Habitat for the black rat snake has declined in the Washington D.C. metropolitan area over the decades as land has been converted from woodlots and agriculture to high-density development. Within Rock Creek Park, black rat snake populations also may have declined because of continued maturation of forest, as opposed to the mix of woodlands and meadows that existed historically. Roadkill may be a contributing factor affecting local populations, but the degree of effect is unknown.

CULTURAL RESOURCES

ARCHEOLOGICAL RESOURCES

Several studies provide information on Rock Creek Park's archeological resources, previous archeological work in the park, and the status of archeological research. These studies include

Ancient Washington: American Indian Cultures of the Potomac Valley (Humphrey and Chambers 1985)

Archeological Survey Report: An Archeological Investigation of Thirty-One Erosion Control and Bank Stabilization Sites along Rock Creek and Its Tributaries, Rock Creek Park and Rock Creek and Potomac Parkway (NPS, Inashima 1985a)

National Capital Area Archeological Overview and Survey Plan for the Systemwide Archeological Inventory Program, National Park Service, National Capital Area (NPS, Little 1995c)

Rediscovering Archeological Resources at Rock Creek Park (Moran 1997)

Some of the prehistoric and historic objects recovered from Rock Creek Park have been cataloged and are kept in storage at the NPS' Museum Resource Center in Landover, Maryland.

There are at least 10 archeological sites in the Rock Creek valley with known prehistoric occupations. Three are quartzite quarries, three are soapstone quarries, three are short-term campsites, and one is a cremation burial. The latter was excavated prior to construction of a pier for one of the Whitehurst Freeway ramps. Data from that excavation are still being analyzed.

Historic archeological sites in the park are largely associated with historic agricultural and industrial uses during the 18th and 19th centuries, Civil War-era operations, and development of the park under the administration of the U.S. Army Corps of Engineers (1890 to 1933) and the National Park Service (1933 to present).

There is a high probability that there are additional undisturbed prehistoric and historic archeological resources in Rock Creek Park. Archeological sites in the park have not been systematically surveyed or inventoried, and precise information about locations, characteristics, and the significance of the majority of known archeological resources in the park is incomplete. Because the condition of archeological resources, especially those underground, is generally unknown, the impacts of development projects on archeological sites in the park are uncertain.

As described in the "Servicewide Mandates and Policies" section, an archeological identification and evaluation study of the park is required by law. Such a study has been scheduled to begin in fiscal year 2003. In addition, individual surveys will be needed prior to the initiation of ground-disturbing activities. Areas identified as having a high potential for archeological resources must be treated with special sensitivity.

NPS policy at Rock Creek Park is to work with the District of Columbia State Historic Preservation Officer (DCSHPO) to nominate all archeological and historical resources within the park and

parkway that appear to meet the National Register of Historic Places (NRHP) criteria. Although Rock Creek Park is listed on the NRHP, its archeological resources have yet to be individually listed. Currently, 23 archeological sites associated with the earliest occupation of the region and one site associated with an early 19th century industrial complex (Blagden Mill) have been investigated.

HISTORIC RESOURCES AND CULTURAL LANDSCAPES

Several NPS documentary studies provide an understanding of the historic development of the Rock Creek Park area and the Rock Creek and Potomac Parkway. These include:

Rock Creek Park: An Administrative History (NPS, Mackintosh 1985b)

Historic Resource Study: Rock Creek and Potomac Parkway, George Washington Memorial Parkway, Suitland Parkway, Baltimore-Washington Parkway (NPS, Krakow 1990a)

Historic Resource Study: Rock Creek Park, District of Columbia (NPS, Bushong 1990b)

Rock Creek and Potomac Parkway (Historic American Buildings Survey, HABS No. D.C.-697, 1991-2) (NPS, Davis 1992)

Linnaean Hill Cultural Landscape Inventory (NPS, Wheelock *et al.* 1998b)

Peirce Mill Cultural Landscape Inventory (NPS Wheelock *et al.* 1998d)

Europeans began to acquire private rights to land in the Rock Creek valley during the 17th century. However, the Rock Creek valley remained largely untouched by settlement until a trading post was established in 1703 at what was then the navigable mouth of Rock Creek.

Commercial and industrial use of Rock Creek increased steadily in the early decades of the 19th century. The gradient of the streambed and the water flow were sufficient to support a number of mills above and below the district line. The milling industry flourished along the creek in the first half of the 19th century, growing in direct proportion to the development of Georgetown and Washington City. More than a half-dozen water mills operated along its course within the district.

Today only the Peirce Mill stands on the creek near Tilden Street as a reminder of this once-common building type. Peirce Mill functioned as an integral part of a diversified farm complex. After 1890, stone grinding became obsolete and few water-powered flour millers operated in the eastern United States. However, Peirce Mill continued grinding corn, rye, and wheat into flour and meal until 1897 when its main shaft broke.

The Peirce family erected two substantial enclaves of buildings, several of which remain today. They represent the only examples of 19th century structures erected in the park prior to its establishment. The original Peirce family dwelling and its immediate dependencies were located about a quarter mile west of Peirce Mill, just south of present-day Tilden Street. The Peirce estate eventually numbered 11 buildings, many of which were built of solid granite. The Peirce-Klinge Mansion, which houses the park headquarters, was the core of the second major complex of buildings erected by the Peirce family in what would become Rock Creek Park.

Joshua Peirce became a prosperous nurseryman and landscape gardener who specialized in the cultivation of camellias and other exotic plants. His arboretum at Linnaean Hill provided botanical specimens for the grounds of the White House, U.S. Capitol, and many of the national capital's other federal reservations. The expansive landscape surrounding his mansion also included fruit trees and ornamental plants. Today, the Peirce structures stand as rare examples of early 19th century vernacular stone construction in the District of Columbia.

The mills and estates in the Rock Creek valley were served by a network of roads. The courses of five of these pre-Civil War roads exist roughly today in the form of

Tilden Street and Park Road (formerly Peirce's Mill Road)

Klinge Road (formerly Joshua Peirce's Road, laid out in 1831)

Broad Branch Road (surveyed and built in 1839)

Blagden's Mill Road (1847), a road trace on the landscape and a portion of Colorado Avenue

Milkhouse Ford Road, now Rock Creek Ford Road

Most of these early, narrow, unpaved roads were privately built, but they later evolved into public thoroughfares and were eventually acquired by the local government. Further road development was stimulated by the Civil War.

In 1862, army engineers constructed Fort DeRussy as part of a circle of fortifications around the city. They also established Military Road to connect the defenses of the city. Located northeast of the intersection of Military Road and Oregon Avenue, Fort DeRussy was strategically placed to provide formidable resistance to enemy advancement down the valley. The fort saw action during the only Confederate assault on the city in July 1864. Although the fort's structures were removed after the war, Fort DeRussy remains the most pronounced Civil War earthworks site in the national capital area.

Operation of the Godey Lime Kilns began in 1864. The manufacture and sale of lime at this site continued until 1907. The kilns represent an important aspect of the thriving late 19th century commercial activities in Georgetown. The kilns were partially restored by the National Park Service in 1967.

Urban development in the area surrounding the valley began with a building boom in the 1880s. By the late 1880s, tracts north of the old Washington city limits and near the future park had been subdivided into suburban lots, with development potential reaching to the banks of Rock Creek.

The rapid pace of suburban development threatened to destroy the rural character and natural scenery of the Rock Creek valley. In response, a bill establishing Rock Creek Park (Public Reservation 339) was approved by both houses of Congress and signed into law (26 Stat. 492) by President Benjamin Harrison on September 27, 1890. A copy of this legislation is provided in appendix A.

The first park improvements included a road system. The new park drive along the creek, named for Capt. Lansing Beach, incorporated existing road segments and a dirt road created by the con-

struction of a sewerline below Piney Branch in 1896. Walking trails and bridle paths also provided public access.

Boulder Bridge was constructed in 1902. It has become a quintessential symbol of the rustic character and picturesque design of the first park structures. It is Washington's finest example of rustic bridge architecture, and one of the earliest Melan reinforced concrete arch structures of its type built in the district.

In 1901-02, a Senate Park Commission comprehensive plan for the nation's capital included a proposal for a regional park system that extended beyond the boundaries of the district to include such scenic areas as Great Falls. One aspect of their proposal was the development of a parkway, in the wording of the 1913 legislation establishing the Rock Creek and Potomac Parkway, "for the purpose of preventing pollution and obstruction of Rock Creek and of connecting Potomac Park with the Zoological Park and Rock Creek Park."

On June 2, 1912, the reconstructed Joaquin Miller cabin (named for the California author of *Song of the Sierras*) was dedicated at a site just off Beach Drive, approximately a half-mile north of Military Road. The cabin, which had been disassembled and moved from its location across from Meridian Hill Park by the California State Association, soon became an "adopted" historic attraction in the park and a meeting point for picnic groups, hikers, and equestrian riders. Placement of the Miller cabin in the landscape was part of the picturesque improvement of the early 20th century Rock Creek Park, which was also evident in the design of Boulder Bridge, the dam at Peirce Mill, and the rustic stone improvements to Milkhouse Ford.

To accommodate the growing popularity of golf, two nine-hole golf courses were opened in 1923 and 1926 in the east side of the park north of Military Road at the site of a former arboretum, which had been removed in 1920. A remodeled farmhouse served as a clubhouse.

During the 1930s, numerous physical improvements in Rock Creek Park were made by the National Park Service and Depression-era work relief laborers. The National Park Service made an effort to blend new construction with the picturesque park landscape, designing new structures in a rustic style popularly known today as "parkitecture."

In 1935-36, the stone-lodge-style Lodge House was constructed as a U.S. Park Police substation near the intersection of Military Road and Beach Drive. The National Park Service continued to preserve historic buildings, including the Peirce-Klingling Mansion, the other structures at the Linnaean Hill complex, and the Peirce Mill with its adjacent springhouse and barn.

The 1930s marked the beginning of Rock Creek Park's use as a commuter route. The completion of a motor drive from the park's north end to East-West Highway in Maryland in 1932 and the opening of the Rock Creek and Potomac Parkway in 1936 created a continuous automobile route from Maryland to central Washington, D.C. However, it was not until 1966 that a truly continuous automobile route was created with completion of the zoo tunnel. Previously, evening zoo closure and flooding of fords hampered full use.

Historic National Register Properties. Historic properties within the park and parkway that are listed on the National Register of Historic Places (NRHP) include the

Peirce-Klingling Mansion

Peirce Mill

Peirce Springhouse and Peirce Mill Barn

Godey Lime Kilns

Boulder Bridge and Ross Drive Bridge

Fort DeRussy, which is listed as a contributing feature to the “Civil War Fort Sites” National Register nomination

In addition to the listing of individual properties, the area of Rock Creek Park covered by this general management plan was listed in the NRHP as Rock Creek Park Historic District (No. 91001524) on October 23, 1991. The historic district boundaries encompass Public Reservation 339 established as Rock Creek Park on September 27, 1890. The historic district included 31 resources classified as contributing to its significance. These resources are listed in appendix F.

In 1997-98, the National Park Service, in consultation with the District of Columbia State Historic Preservation Officer (DCSHPO), completed a comprehensive survey of structures in Rock Creek Park and the Rock Creek and Potomac Parkway that are eligible for listing on the NRHP. The Rock Creek and Potomac Parkway is eligible for listing, and the National Park Service currently is working with the DCSHPO to finalize a nomination.

Cultural Landscapes. Cultural landscapes reflect the relationship between what is natural and what is man-made. According to *The Secretary of the Interior’s Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes* (Secretary of the Interior 1996), a cultural landscape is “a geographic area (including both cultural and natural resources and the wildlife or domestic animals therein) associated with a historic event, activity, or person or exhibiting other cultural or esthetic values.”

A cultural landscape inventory documents the qualities and attributes of a cultural landscape that make it significant and worthy of preservation. The goal of the National Park Service is to locate and evaluate cultural landscapes and provide information on their location, historical development, characteristics and features, and management to assist park managers in planning, programming, and recording treatment and management decisions.

In 1997, the National Park Service initiated a cultural landscape inventory of the area covered by this general management plan. The inventory team has tentatively determined that

Rock Creek Park meets the criteria for significance and integrity for listing in the National Register as a historic designated landscape

Linnaean Hill (which includes the Peirce-Klinge Mansion) and Peirce Mill meet the criteria for a “component landscape,” which is a definable physical component of a larger landscape that contributes to the significance of a National Register-listed property and is individually significant

VISITOR AND COMMUNITY VALUES

TRADITIONAL PARK CHARACTER AND VISITOR EXPERIENCE

Rock Creek Park was intended in the establishing legislation to be a “pleasure ground.” Visitors come for the scenery and the other sensory experiences that accompany a forested creek valley. They enjoy such features as the changing seasonal colors; life cycles and scents of the forest; sounds of water, wind, and small animals, including birds; and the quiet. The open spaces offer more active recreation and the sounds of people at play.

Recreation Opportunities. One of the favorite ways to experience Rock Creek Park is from Beach Drive. This roadway, which is within the narrow creek valley for much of the length of the park, is a popular site for such activities as walking, in-line skating, and bicycling. In the average week, approximately 40,000 people recreate along its length, with the greatest use during the weekend. Portions of Beach Drive and other park roads are closed to motorized traffic during weekends to accommodate this heavy recreational use.

A popular visitor experience on weekdays is motorized touring on Beach Drive and other park roads. Commuters and others use Beach Drive as a pleasant way to traverse the city in a north/south direction, even if they do not leave their cars for more direct contact with the outdoors. The park averages more than 235,000 visits per week (12.4 million visits per year) from people driving through the park.

The park offers a variety of views, from rugged expanses of mature, second-growth forest with little recent human disturbance to landscapes from the rural past. The engineered bridges are reminders of the monumental city to the south. Rock Creek Park provides a visual respite from the urban surroundings, an experience that draws almost 14.5 million visitors each year.

Rock Creek Park offers visitors a variety of recreation options, including

- paved multi-use trails and weekend closures of Beach Drive for jogging, bicycling, in-line skating, and other nonmotorized uses

- an extensive system of hiking and horseback riding trails

- Rock Creek Horse Center for public horseback riding and horse boarding (concession operated)

- an 18-hole public golf course (concession operated)

- tennis courts, including 21 soft-surface courts and 10 hard surface courts (concession operated)

- scenic roads

- picnic areas, including 20 unrestricted picnic areas and 10 picnic areas requiring a permit

- sports fields suitable for soccer, football, volleyball, field hockey, lacrosse, and rugby

the Carter Barron Amphitheater, which is a 4,200-seat outdoor theater offering summer musical and theatrical performances

Rock Creek Gallery, also known as the Art Barn and the Peirce Mill Barn, which displays work of local artists

two community gardens with a total of about 200 garden plots

Visitor Profile. Visitors to Rock Creek Park are primarily local residents of the Washington, D.C. metropolitan area. However, because it is a national park, it also is visited by people from all over the country and the world who are visiting the area. The park’s recreational visitors come from a wide variety of demographic backgrounds representing many ethnic, racial, and economic groups reflective of the adjacent neighborhoods and society at large.

Most visitors to interpretive centers, concessions, and picnic areas drive to the park in private automobiles. Many users of trails and Beach Drive arrive on foot, bicycle, or in-line skates.

Visitors come to the park for a wide variety of reasons, including walking, hiking, jogging, bicycling, communing with or studying nature, studying history, picnicking and family reunions, interpretive and educational programs, spiritual meditation, reading, writing, and creating art. The length of a visitor’s stay depends on the purpose of the visit. A jogger may only stay an hour while a picnicker may stay all day. Many visitors come to Rock Creek Park on a regular or frequent basis.

Park staff collect annual visitation statistics for the entire area that the park administers. Visitation estimates are developed using park ranger counts, car counting devices, and formulas developed by the NPS’ Socio-Economic Studies Division in 1991. Visitation statistics are gathered and analyzed for all areas administered by the staff, so that visitation cannot be reported just for the area included in this general management plan. Therefore, the visitation statistics in table 13 reflect visitor use on all Rock Creek Park lands.

TABLE 13: AVERAGE ANNUAL VISITATION AT ROCK CREEK PARK, 1991 TO 1997

Visitation ^{a/}	Annual Visitors
Total visits	14,464,000
Nonrecreational (commuters)	12,389,000
Recreational	2,075,000

a/ All values include visitation on Rock Creek Park lands that are not included in this general management plan.

Recreational visits to Rock Creek Park occur fairly evenly over the warmer months of spring, summer, and early fall, and drop off in the late fall and winter. This pattern has been recorded at the nature center, where an average of 31 percent of annual visits occur during spring, another 31 percent occur during summer, 22 percent occur during fall, and 16 percent occur during winter.

Nonrecreational visits (commuters) are distributed evenly throughout the year, with an average of 25 percent of total visits occurring each season. Nonrecreational visitors are overwhelmingly automobile commuters and, to a much lesser extent, nonmotorized commuters, principally cyclists. During scoping, many commenters identified themselves as commuters (by both automo-

bile and bicycle) and emphasized that they consider their commute through the park to be recreational because it is an enjoyable ride through a scenic landscape and provides mental decompression from the workday.

Visitation Trends and Visitor Services. In the 1980s, recreational visitation to Rock Creek Park almost doubled, and then stabilized throughout the 1990s. In 1980 there were 1,060,000 recreational visitors. By 1989, this number had risen to 2,050,000 recreational visitors. Since then, there have been approximately 2 million recreational visitors each year. In the year 2000, the park supported 2,036,000 recreational visits.

At the same time, the park's visitor services have been severely reduced, resulting in a substantial decline in visitation to the park's two interpretive centers. The nature center and planetarium's visitation has dropped by more than half, from 49,000 visitors in 1979 to 24,000 visitors in 1997. Peirce Mill visitation had a similar decline, from 31,000 visitors in 1979 to 12,000 visitors in 1997. Visitor services such as publications and wayside exhibits also are inadequate. The result is that many visitors to Rock Creek Park never know they are in a national park. Most never have contact with park rangers or receive any basic orientation or visitor services.

Noise. In early December 1996, noise levels were measured at 21 sites in and around Rock Creek Park and the Rock Creek and Potomac Parkway (Robert Peccia and Associates *et al.* 1997). Results included the following.

Peak traffic noise levels within the park and parkway ranged from a low of 57 decibels (dB) equivalent sound level (L_{eq}) at the 4th hole of the golf course to 79 dB L_{eq} on the jogging trail south of Calvert, about 10 feet from the Rock Creek and Potomac Parkway.

Peak and off-peak noise levels were quite similar. Readings between these two periods varied by 4 dB or less at all 17 sites at which both peak and off-peak measurements were made.

Peak noise levels at seven sites met or exceeded the Federal Highway Administration's (FHWA's) noise abatement criterion (NAC) of 67 dB L_{eq} . All of these sites were within 100 feet of Beach Drive or the Rock Creek and Potomac Parkway and four of the seven were within 25 feet of the roads. Noise levels at four of these sites also met or exceeded the NAC during off-peak periods.

Generally, the study found the following.

Picnic areas along Beach Drive north of Military Road are not adversely affected by traffic noise.

South of Military Road, traffic noise exceeds FHWA standards at picnic areas that are within 60 feet of Beach Drive.

Visitor facilities within 110 feet to 125 feet of the Rock Creek and Potomac Parkway typically experience noise levels above the FHWA standard.

The noise standard is frequently exceeded along segments of recreation trails within 100 feet of Beach Drive and the parkway.

Noise samples near residences along Oregon Avenue, 16th Street, and Broad Branch Road, at Kalorama Circle and at the National Zoo were all within the FHWA standard.

REGIONAL AND LOCAL TRANSPORTATION

Regional Traffic Flows. Traffic congestion in the Washington, D.C. metropolitan area is the second worst in the nation (Reid 1998). A detailed description of traffic conditions in the vicinity of the park and parkway is provided in *Transportation Study, Rock Creek Park, Washington, D.C.* (Robert Peccia & Associates 1997). The roads in the vicinity of Rock Creek Park are an important component of the urban road network of Washington, D.C.

Principal arterial routes radiate out from the center of the district and include Massachusetts, Wisconsin, Connecticut, Nebraska, Georgia, and Virginia Avenues as well as 16th Street. Many of the arterial streets extend into Maryland and are primary commuter and delivery routes into the district.

Military Road, the Whitehurst Freeway, and Porter, Harvard, Calvert, and M Streets traverse the park and provide for cross-town traffic.

The Year 1990 Average Weekday Traffic Volumes map presents traffic counts on major roads in the vicinity of Rock Creek Park in 1990.

As shown on the map, the major arterials each had an average daily traffic (ADT) count of 20,000 to 40,000 vehicles

On weekdays, the peak-hour morning count and peak-hour evening count were nearly identical (difference of 10 percent or less) for almost every major roadway.

On almost all of these roads, the peak-hour morning count and peak-hour evening count each accounted for approximately 8 percent to 9 percent of the ADT.

During the morning and evening commuting periods, traffic levels on these arterial roadways typically meet or exceed their capacities. Table G.1 in appendix G shows the 1990 average daily traffic volumes for the major roadways in the area. The roadways usually can accommodate these high traffic volumes through aggressive traffic management measures such as reversing lanes during commuting periods.

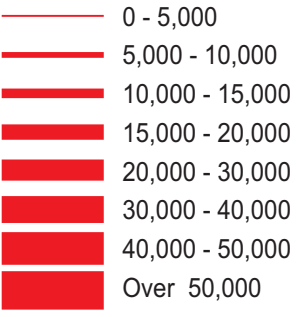
Both morning and evening traffic counts on virtually all of the roads in the mapped area have increased in the past 10 years. However, the patterns described above are still occurring. A traffic validation using actual traffic volumes from the year 1999 is provided in appendix H.

Excellent public transportation opportunities occur in the area. The Washington Area Metropolitan Transit Authority provides Metro Bus service throughout the area. The Metro Rail's red line runs to the west of the park and the green line runs to the east of the park. Several Metro Rail stops are within 1 mile of the central portion of the park.

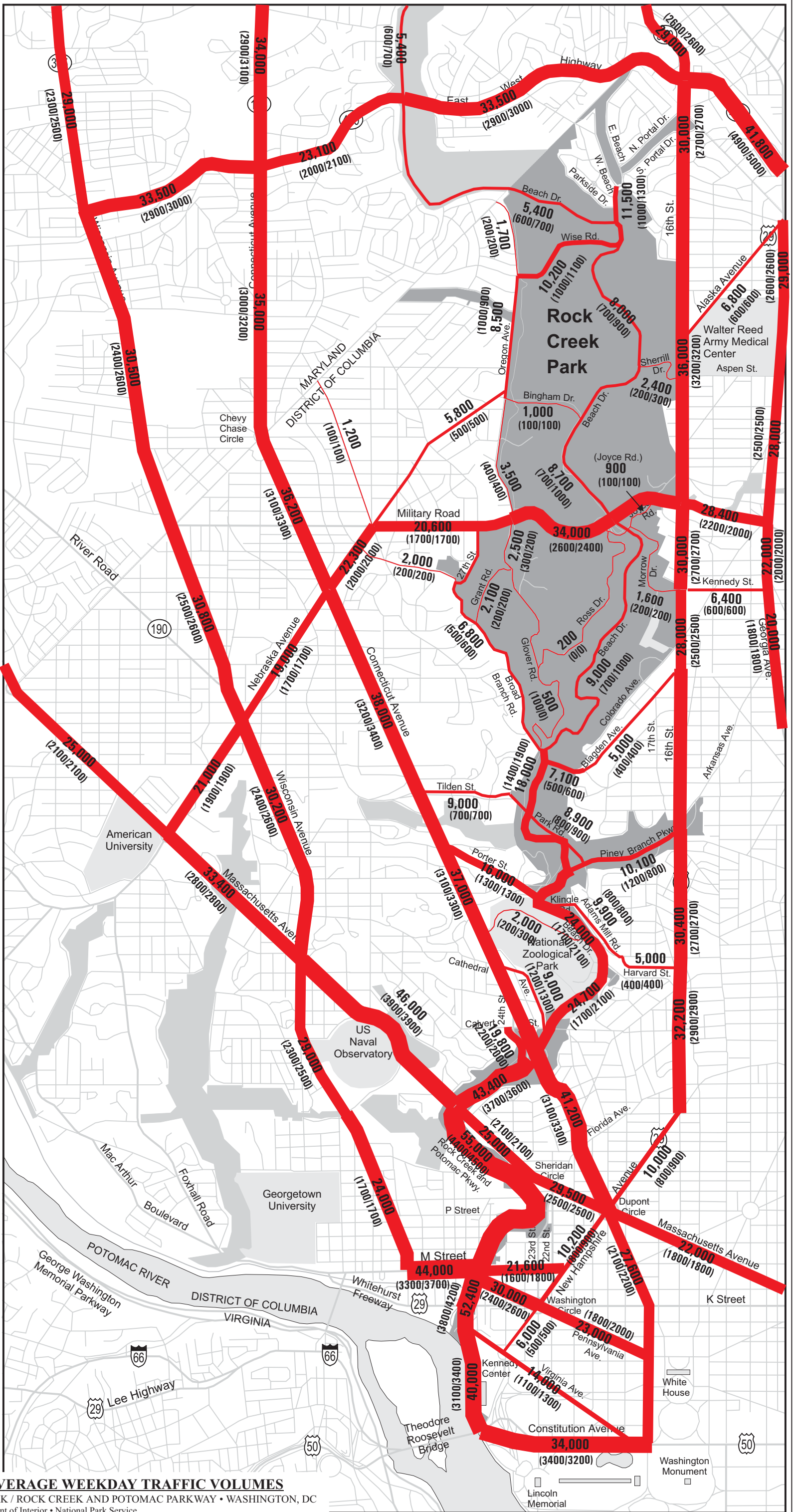


Map Scale: 1" = 0.5 Miles

Rock Creek Park



900 = ADT
 (100/100) =
 (AM Peak Hour/PM Peak Hour)



Local Traffic Flows. The Rock Creek and Potomac Parkway and Beach Drive are the principal roads within Rock Creek Park.

The Rock Creek and Potomac Parkway extends approximately 2.5 miles from the Theodore Roosevelt Bridge in the core of the district north to Calvert Street. The parkway is a four-lane, paved, limited-access facility with a posted speed limit of 35 miles per hour.

As shown on the Year 1990 Average Weekday Traffic Volumes map, this roadway carried more traffic than any other in the vicinity, with average daily traffic (ADT) counts of 40,000 to 55,000 vehicles.

Traffic patterns were very similar to those described above for other arterials, with similar morning and evening traffic volumes and peak-hour counts during the morning and evening each accounting for approximately 8 percent to 9 percent of the ADT.

From Calvert Street, Beach Drive extends approximately 6.5 miles north to the Maryland state line. Beach Drive is a two-lane, paved road with a posted speed limit of 25 miles per hour. In 1990, traffic exhibited the following characteristics.

Between Wise Road and Blagden Avenue, average daily traffic counts were 8,000 to 9,000 vehicles.

From Blagden Avenue south to the Rock Creek and Potomac Parkway, counts ranged from 18,000 to 24,700 vehicles per day.

On all stretches there was slightly more evening traffic than morning traffic. At all sites shown on the map, peak-hour evening traffic represented 9 percent to 11 percent of the average daily traffic, while morning peak-hour traffic accounted for 7 percent to 9 percent of the daily total.

As with the arterials, traffic has increased since 1990 on both the Rock Creek and Potomac Parkway and on Beach Drive. However, accurate estimates of the changes are not available.

Twenty-four entry routes provide access to Rock Creek Park (see Existing Conditions map). Although the park is closed at dark, park roads and entry points remain open.

Major entry points north of Military Road include Beach Drive at the Maryland state line, West Beach Drive, and Wise Road.

South of Military Road, major entry points include Joyce Road, Morrow Drive, Broad Branch Road, Blagden Avenue, Park Road, Tilden Street, and Piney Branch Parkway.

Visitors can also enter the park from 16th Street NW, the Kennedy Street area, and from the National Zoological Park.

Commuting has the greatest effect on traffic flows through Rock Creek Park. Traffic volumes show little seasonal variation and the highest traffic levels correspond to the peak morning and evening commuting times. To accommodate these peaks in commuter traffic, all lanes of the

Rock Creek and Potomac Parkway are designated as one-way southbound during the morning commute period and one-way northbound during the evening commute.

To provide recreational opportunities for pedestrians, bicyclists, and in-line skaters, the park closes portions of Beach Drive to motorized vehicle traffic during the day on weekends and holidays. During these times, Beach Drive is closed from Broad Branch Road to Joyce Road, picnic grove 10 to Wise Road, and West Beach Drive to the Maryland state line. Bingham Drive and Sherrill Drive also are closed.

During the week when all park roads are open to commuter traffic, interactions are common between automobiles and nonmotorized users, such as bicyclists and pedestrians. These particularly occur in areas where a trail does not parallel Beach Drive, where pedestrians and bicyclists often enter the traffic flow.

To understand commuter patterns, the National Park Service commissioned a license plate survey in 1996 (Robert Peccia & Associates 1997). The survey results indicated the following.

During weekday rush-hours, more than 99 percent of all vehicles using the Rock Creek and Potomac Parkway and more than 95 percent of vehicles entering Rock Creek Park pass through without stopping.

Commuting patterns through Rock Creek Park do not simply flow north and south. Instead, many rush-hour drivers use segments of park roads to traverse the park and reenter the city street grid.

Only 3 percent of the vehicles that enter the park at the Maryland state line exit onto the parkway.

In the morning, the greatest number of vehicles that exit onto the parkway enter the park at Broad Branch Road (17 percent), Blagden Avenue (20 percent), and Piney Branch Parkway (34 percent).

In the evening, the patterns are very similar. Only 1 percent of the vehicles that enter from the parkway exit the park at the Maryland state line. The majority of vehicles exit onto Broad Branch Road (18 percent), Blagden Avenue (19 percent), and Piney Branch Parkway (33 percent).

The study also determined vehicle occupancy in August 1996. During commuting periods, the average vehicle occupancy on park roads ranged from a low of 1.09 people per vehicle on Morrow Drive to a high of 1.38 people per vehicle on Tilden Street. On nearby streets in the district, the results ranged from 1.22 people per vehicle on Oregon Avenue to 1.34 people per vehicle on 16th Street. These averages indicate that much of the rush-hour use is by vehicles with a single occupant (Robert Peccia & Associates 1997).

Higher traffic volumes during peak hours cause delays at certain intersections during the commuting periods (Robert Peccia & Associates 1997).

In the morning, the following intersections failed or functioned very poorly: Beach Drive and Blagden Avenue, Beach Drive and Piney Branch Parkway, Beach Drive and Tilden Street/Park Road, and 16th Street and Kennedy Drive/Morrow Road.

In the evening, failures or poor operations occurred at Beach Drive and Joyce Road, Beach Drive and Porter Road, and Beach Drive and Tilden Street/Park Road.

Most vehicles travel at or above the posted speed limit through the park. Spot speed checks revealed that the average speed was 15 miles per hour over the posted speed limit. Commuters in Rock Creek Park also tend to have more aggressive driving habits than do visitors unfamiliar with the park. A detailed speed analysis can be found in *Transportation Study, Rock Creek Park, Washington, D.C.* (Robert Peccia & Associates 1997).

Traffic Safety. An analysis of accidents on park roads between January 1, 1993 and December 31, 1995 was included in the *Transportation Study, Rock Creek Park, Washington, D.C.* (Robert Peccia & Associates 1997). All of the information in this section is from that report.

The accident investigation indicated that the frequency and severity of accidents are relatively low for an urban area. However, the relatively low number of serious accidents in the park may result in part from a perceived risk to personal safety. During weekdays, the high traffic speeds and heavy volumes may discourage recreational use, one of the primary purposes of the park.

According to the 3-year accident study, the greatest safety problems are excessive vehicle speeds and aggressive driving tendencies. Conflicts between automobiles and recreational visitors are common, even when accidents are avoided.

A total of 1,175 accidents were reported from Rock Creek Park and the Rock Creek and Potomac Parkway during the 3-year period. A summary of the accidents, separated into three geographic areas, is provided in table 14.

TABLE 14: SUMMARY OF TRAFFIC ACCIDENTS IN ROCK CREEK PARK AND THE ROCK CREEK AND POTOMAC PARKWAY, 1993 THROUGH 1995

Accident Type	Beach Drive	Other Park Roads	Rock Creek and Potomac Parkway	Total
Total accidents	294 (25%)	224 (19.1%)	657 (55.9%)	1,175 (100%)
Fatal accidents	1 (0.3%)	1 (0.4%)	2 (0.3%)	4 (0.3%)
Injury accidents	75 (25.5%)	45 (20.1%)	155 (23.6%)	275 (23.4%)
Property damage only	218 (74.2%)	178 (79.5%)	500 (76.1%)	896 (76.3%)
Collision with motor vehicle or other object	273 (92.9%)	210 (93.8%)	621 (94.5%)	1,104 (94.0%)
Collision involved pedestrian or bicyclist	13 (4.4%)	4 (1.8%)	11 (1.7%)	28 (2.4%)
Non-collision accidents	8 (2.7%)	10 (4.5%)	25 (3.8%)	43 (3.6%)

Among the recorded accidents, almost 56 percent occurred on the parkway. Twenty-five percent were on Beach Drive, and 19 percent were on other park roads.

In all three areas, most accidents (more than 92 percent) involved collisions with other cars or collisions with objects such as poles, signs, trees, guardrails, rocks, bridges, ditches, or animals. On Beach Drive, collisions of motor vehicles with pedestrians or bicyclists accounted for 4.4 per-

cent of traffic accidents. Other park roads (1.8 percent) and the parkway (1.7 percent) had lower percentages of accidents involving collisions of motorized vehicles with pedestrians or cyclists.

Despite the difference in percentages of accidents involving pedestrians and cyclists, all three areas had similar fatality levels of 0.3 to 0.4 percent. Higher rates of collisions along Beach Drive with pedestrians and bicyclists probably were reflected by the injury rate of more than 25.5 percent, compared to 20.1 percent for other park roads and 23.6 percent along the Rock Creek Parkway. The injury rate along the parkway may reflect the higher traffic speeds.

In the 3-year period, there was little difference by year in the number of accidents occurring or the severity of the accidents (injury versus property damage only). This relatively constant level of accidents was observed in all three areas.

Beach Drive. If traffic conditions were identical throughout the week, each day would be expected to represent approximately 14 percent of the traffic accidents. However, the analysis of accidents on Beach Drive shows otherwise. During the work week, almost 19 percent of traffic accidents occurred on Tuesdays, while only 12 percent occurred on Wednesdays.

On Saturdays, three segments of Beach Drive are closed to motorized vehicles, and commuter use is absent. Despite traffic reductions associated with these factors, fully 14 percent of the traffic accidents on Beach Drive occurred on Saturdays. These same conditions (road closures and lack of commuters) also occur on Sundays, but Sunday accidents represented only about 8 percent of the weekly total.

The locations of the 518 accidents that were recorded in the park north of the parkway were mapped. Of these, nearly 57 percent occurred on Beach Drive. Other roads in the park that had 5 percent or more of the traffic accidents included Piney Branch Parkway (8 percent), Glover Road (6 percent), and Wise Road (5 percent).

Anecdotal evidence would indicate that many accidents occur along the narrow portion of Beach Drive where there is no trail, and pedestrians and cyclists enter the traffic flow. However, mapping shows that only 29 accidents, including six with injuries and no fatalities, occurred in the three-quarter-mile stretch extending from the intersection with Broad Branch Road north across Boulder Bridge and through the gorge area. More than half of these accidents occurred near the intersection at the south end of this segment. Factors that could contribute to the low incidence of traffic accidents along this stretch of road probably include its closure to motorized traffic on weekends and holidays, and the extra caution taken by motorists who recognize the gorge area as potentially dangerous.

The portion of Beach Drive south of the Wise Road intersection to picnic grove #10, which also is closed on weekends, had a similarly low level of accidents. However, this area appears to have an unusually high ratio of injury accidents (almost 60 percent, compared to 23 percent throughout the remainder of the park). The weekend closure segment between West Beach Drive and the Maryland border has accident and injury rates similar to those occurring along other parts of Beach Drive that are not closed on weekends.

Fatalities. Four traffic fatalities occurred in the park and along the parkway during the 3-year period. Two of the fatalities occurred along the Rock Creek and Potomac Parkway. One was located southbound on the parkway near K Street, and the other was on the parkway near Virginia. One of these fatal accidents was in September and the other was in October.

Both were collisions with pedestrians, and in both instances the fatality was a pedestrian.

Both accidents occurred in lighted areas, during mid-week, in the late evening or early night, in rainy weather, and on wet roads.

Contributing factors for both fatalities involved a pedestrian illegally on the roadway wearing clothing that was not visible.

The other two fatalities were recorded in the park.

Both fatalities were single-vehicle accidents where the driver died after colliding with a fixed object. Both occurred during the mid-week, in the late evening or early night.

One accident occurred in March in clear weather on dry roads. It was located on Morrow Drive south of Joyce Road.

The other was in November on wet roads in sleet, hail, or freezing rain. It occurred on Beach Drive near Blagden Road. Driving too fast for conditions was cited as a contributing factor.

Traffic Accidents involving Pedestrians and Bicyclists. As shown in table 14, there were 28 traffic accidents involving motorized vehicles and pedestrians or bicyclists during the 1993 through 1995 period. Eleven of these accidents were reported on the Rock Creek and Potomac Parkway.

Six of these were collisions with pedestrians, four were collisions with bicycles, and one accident report listed a pedestrian or cyclist as a contributing factor.

Two of the 11 accidents were fatalities, both of which killed the pedestrian. Additional information on these two accidents was provided above.

Six of the accidents resulted in injuries, three of which injured a pedestrian or bicyclist. In the other three cases, an occupant of the vehicle was injured.

Seven of the accidents occurred during the mid-week (Tuesday through Thursday). Five occurred during low-light conditions.

Contributing factors included “pedestrian/cyclist illegally in roadway” (six accidents), “pedestrian/cyclist disregarded traffic control” (three accidents), and “pedestrian/cyclist clothing not visible” (two accidents).

Within Rock Creek Park, there were 17 accidents involving pedestrians or bicyclists. Thirteen of these occurred on Beach Drive and four were on other park roads.

Five of the accidents were classified as collisions with pedestrians, and 12 were classified as collisions with bicycles.

Eleven accidents resulted in injuries, four of which injured a pedestrian or bicyclist. In the other seven cases, an occupant of the vehicle was injured. There were no fatalities.

Ten of the accidents occurred on a Saturday or Sunday. Only two occurred during low-light conditions.

All but one of the 17 accidents involved two or more motorized vehicles.

Factors most commonly cited as contributing to these accidents included “driver failed to yield the right of way” (five accidents) and “driver disregarded traffic signs, signals, or road markings” (three accidents).

Accident Rates. The accident rate for a road segment is described as the number of accidents per 100 million vehicle-miles traveled. Accident rates also can be determined for fatal and injury accidents.

Accident, injury, and fatality rates were calculated for the park and parkway for the 3-year period, 1993 through 1995. The results are presented in table 15. The area evaluated for the Rock Creek and Potomac Parkway extended from Calvert Street to Ohio Drive. Park data included Beach Drive from the Maryland line to the intersection with the parkway south of the National Zoo.

For comparison, table 15 also includes average accident, injury, and fatality rates in Washington, D.C. for 1993 through 1995 (calculated from data from the District of Columbia in 1995) and nationwide in 1998 (Federal Highway Administration 1999). The parkway had accident rates that were higher than those occurring throughout Washington, D.C., but lower injury rates, and fatality rates that matched those both in the city and nationwide. On Beach Drive, the accident rate was about 10 percent lower than the citywide rate, with an injury rate that was 33 percent lower and a fatality rate about 20 percent below both the city and national averages.

TABLE 15: ACCIDENT RATES FOR THE ROCK CREEK AND POTOMAC PARKWAY, BEACH DRIVE, AND WASHINGTON, D.C.

Location	Accident Rate (per 100 million vehicle-miles traveled)	Injury Rate (per 100 million vehicle-miles traveled)	Fatality Rate (per 100 million vehicle-miles traveled)
Rock Creek and Potomac Parkway	540	127	1.6
Beach Drive	387	99	1.3
Washington, D.C. area	425	147	1.6
Nationwide	--	125	1.6

Mass Transportation. There are 14 Metrorail stations within 1 mile of the park and parkway (see Vicinity map) and numerous bus stops. The Washington Metropolitan Area Transit Authority provides bus and rail service in the region, which includes the District of Columbia, two counties in Maryland, and three counties in Virginia. Ridership between July and the end of September 1999 totaled more than 1 million, a sizable portion of the 3.2 million residents in the service area (www.wmata.com/METFACTS/facsnfigs.htm).

Transit buses and commercial vehicles are not permitted on park roads or the parkway. The number of visitors entering the park and parkway by foot or bicycle from the mass transit network is unknown, but is believed to be relatively small.

Nonmotorized Transportation Flows. Nonmotorized transportation in this document includes walking, bicycling, and other means of personal transport for the purpose of getting from one location to another. This contrasts with nonmotorized recreation, defined here as walking or riding for pleasure, fitness, or some other recreational purpose.

The 1990 census reported that 5 percent of the population of the District of Columbia bicycles to work. Studies prepared for the National Capital Region Transportation Planning Board (NCRTPB) of the Metropolitan Washington Council of Governments (MWCOG) reported that cyclists represent a wide range of ages, and more than half have an annual income of \$75,000 or greater (Bairstow 1995a and 1995b).

A recent survey (Sacks 1994) found that 67 percent of all users on the paved recreation trails in Rock Creek Park and along the parkway during weekday peak hours were engaged in transportation rather than strictly recreation. Average distance traveled by such users was 5.3 miles. Typical nonmotorized transportation participants in the park and parkway lived within 2 miles of the paved trail system and were going to destinations within 1 mile of the trail.

Bicycling is the most popular form of nonmotorized transportation along the park and parkway, accounting for 54 percent to 86 percent of average weekday nonmotorized transit during a 1-day August 1996 survey (Robert Peccia & Associates 1997). Surveys (Bairstow 1995a and 1995b) of morning peak-hour bicyclists along the Rock Creek and Potomac Parkway trail determined the following characteristics.

Eighty-five percent of the trail users were going to destinations in the district and 16 percent were headed through the park to locations in Arlington, Virginia.

Bicyclists averaged 9.9 miles per trip on paved trails.

Sixty-eight percent of cyclists preferred off-street trails while 20 percent preferred bike lanes on streets or sharing streets with automobiles.

Bad weather was the greatest deterrent to cycling (72 percent). The threat to safety from traffic was the second most frequently mentioned deterrent (35 percent).

The same survey of bicyclists on radial routes into the city documented that paved trails have a 5-fold or greater increased bicycle use compared to designated street routes or low-traffic roads (Bairstow 1995a and 1995b). This survey, combined with 1993 counts, indicated about 60 bicy-

cles per hour during the evening peak-hours on the Rock Creek and Potomac Parkway paved trail at P Street. The studies considered 12 to 80 bikes per hour to be in the high range for the region.

A 1-day, 8-hour sample of nonmotorized transportation in the park and parkway was collected on Thursday, August 22, 1996 (Robert Peccia & Associates 1997). Similarly to the NCRTPB survey (Bairstow 1995a and 1995b), the Peccia survey found preferential use of trails, with an average weekday hourly volume of 34 users per hour on the bike/foot trail south of the Beach Road/Broad Branch Road intersection and 14 users per hour on Beach Drive north of this intersection. Beach Drive in the vicinity of Joyce Road averaged 22 users per hour, and 112 users per hour were recorded on the bike/foot path along the Rock Creek and Potomac Parkway south of P Street.

Little information is available on pedestrian nonmotorized transportation. Most weekday and weekend walkers appear to be recreationists, but a small percentage of pedestrians are likely walking to their jobs or to some other destination.

There are several hundred miles of paved trails and designated bicycle routes in the region. Major trails connecting to the paved trails through Rock Creek Park and the parkway include the Rock Creek Trail (in Rock Creek Regional Park, Maryland), the Capital Crescent Trail, and the C and O Canal Trail.

COMMUNITY CHARACTERISTICS

Community characteristics are included as an impact topic based on the criteria presented in the “Impact Topics - Resources and Values at Stake in the Planning Process” section.

Metropolitan Washington, D.C. The Washington, D.C. metropolitan area is generally illustrated in the Regional map shown at the beginning of this general management plan. More than 4 million people reside in the U.S. Census Bureau’s Washington metropolitan statistical area, including just over 600,000 who live within the boundaries of the district. The remainder of the statistical area consists of five Maryland counties, six Virginia counties, and four Virginia cities (District of Columbia Government 1996c).

Washington, D.C.’s population is approximately 66 percent African American, 30 percent white, and 4 percent other races. Approximately 5 percent of Washington, D.C.’s citizens also identify themselves as Latino. Compared to statistics from the 50 states, the district’s per capita income is the third highest in the nation, and in 1989 was 42 percent above the national average (District of Columbia Government 1996c).

Generalizations cannot be made about ethnic composition of the nearby areas in Maryland and Virginia. For example, populations in some of these communities are 90 percent or more white, while the Takoma Park area just north of the Maryland state line is 36 percent black, 48 percent white, and 16 percent other races, with about 17 percent of the residents identifying a Latino heritage.

Surrounding Wards and Neighborhoods. The Neighborhood map shows the Washington, D.C. wards and neighborhoods in the vicinity of the park. It also shows the Maryland communities of Chevy Chase, Silver Springs, and Takoma Park that are just north of the park.

Within the District of Columbia, eight wards have been established for purposes of voting and representation. As shown in the Neighborhood map, four of the wards border the park. Detailed descriptions of the wards are available in *Indices: A Statistical Index to District of Columbia Services* (District of Columbia Government 1996c). Table 16 summarizes some of the ward characteristics.

Each ward includes from four to six Advisory Neighborhood Commissions (ANCs) that advise the district government on matters of public policy and review and make recommendations concerning neighborhood planning and development. They also participate in the district's comprehensive planning process. The ANCs do not correlate to the traditional neighborhood boundaries shown in the Neighborhood map.

As shown on the map, Rock Creek Park and the parkway are bordered by established urban neighborhoods. Those in the district include Hawthorn, Chevy Chase, Forest Hills, Garfield Heights, Massachusetts Park, North Cleveland Park, Cleveland Park, Massachusetts Avenue Heights, Cathedral Heights, Georgetown, Central, Hillcrest, Mount Pleasant, Crestwood, 16th Street Heights, Brightwood, Shepherd Park, and Colonial Village.

The neighborhoods surrounding the park are some of the most racially, ethnically, and economically diverse in the Washington, D.C. metropolitan area. Many residential and mixed-use areas, including Adams Morgan, DuPont Circle, and Georgetown, as well as office buildings and

foreign embassies, also are located near the park and parkway. During scoping, citizens living in the adjoining neighborhoods both east and west of Rock Creek Park expressed concerns about local increases in traffic that might be associated with changes in park management.

To the north of the park in Montgomery County, Maryland, are communities that are primarily residential, with commercial development extending along the major thoroughfares. These include Connecticut Avenue, Wisconsin Avenue, and 16th Street.

Montgomery County neighborhoods are grouped into planning areas. The three planning areas nearest the park are Bethesda/Chevy Chase, Silver Spring, and Takoma Park. Table 17 summarizes some of the characteristics of the people living in each of these planning areas. A complete profile of the planning areas is available from the Maryland-National Capital Park and Planning Commission at:

<http://www.clark.net/pub/mncppc/montgom/factmap/>

TABLE 16: GENERAL CHARACTERISTICS OF THE POPULATIONS OF WASHINGTON, D.C. WARDS 1 THROUGH 4 ^{a/}

	Ward 1	Ward 2	Ward 3	Ward 4 ^{b/}	Total District
Population	79,641	78,743	77,774	78,425	606,900
Area (acres) ^{c/}	1,222	4,025	4,746	3,087 - 3,706 ^{d/}	27,879 - 29,779 ^{d/}
Land area used for housing	82%	48%	87%	87%	75%
Median household size (number of people)	2.17	1.75	1.91	2.53	2.26
Population density (residents per acre)	66	19	13 - 16 ^{d/}	21 - 25 ^{d/}	20 - 22 ^{d/}
Residential population density (residents per residential acre)	81 - 120 ^{e/}	41 - 108 ^{e/}	19 - 28 ^{e/}	24 - 47 ^{e/}	27 - 58 ^{e/}
Median household income	\$26,798	\$31,716	\$48,967	\$33,025	\$30,727
Age distribution					
Under 18 years	17%	10%	12%	18%	19%
18-64 years	72%	78%	71%	82%	68%
65+ years	11%	12%	17%	18%	13%
Racial composition					
Black	57%	35%	6%	85%	66%
White	30%	57%	88%	12%	30%
Other	13%	8%	6%	3%	5%
Also identified Latino heritage	18%	7%	7%	5%	5%
Education attainment					
Less than high school diploma	32%	19%	6%	36%	27%
High school graduate (only)	16%	12%	9%	25%	21%
College, 1-3 years	16%	17%	15%	24%	19%
College, 4 or more years	36%	52%	70%	25%	33%
Housing unit occupancy`					
Owner occupied	25%	26%	47%	53%	35%
Renter occupied	64%	60%	48%	42%	54%
Vacant	11%	14%	5%	5%	11%

a/ All data are from District of Columbia Government 1996c. All population data are based on the 1990 census.

b/ Ward 4 data for age distribution and education attainment are in error in the source document and total more than 100 percent.

c/ Excludes public rights-of-way and areas within Rock Creek Park.

d/ The source document presents two values for this parameter. Therefore, both values are presented here as a range.

e/ The source document presents two values for this parameter, and a third can be calculated by dividing population by land area used for housing. Therefore, the maximum and minimum values are presented here as a range.

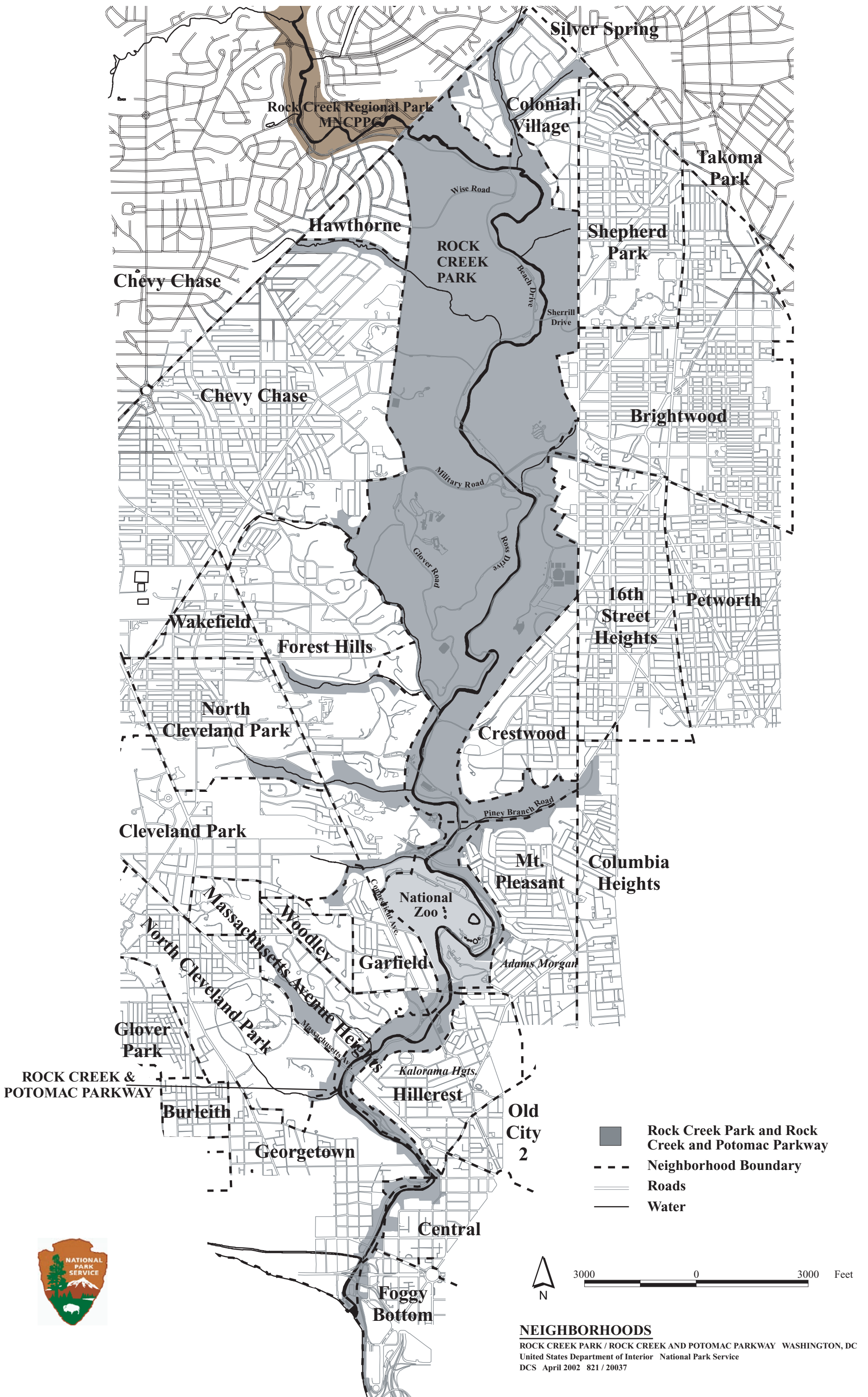


TABLE 17: GENERAL CHARACTERISTICS OF THE POPULATIONS OF MARYLAND COMMUNITIES NEAR ROCK CREEK PARK ^{a/}

	Bethesda/ Chevy Chase (Planning Area 35)	Silver Spring (Planning Area 36)	Takoma Park (Planning Area 37)	Total Montgomery County
Population	85,000	31,820	34,855	823,500
Area (acres)	12,864	2,816	4,096	318,080
Average household size (number of people)	2.37	2.06	2.63	2.64
Population density (residents per acre)	7	11	8	3
Median household income (1996)	\$95,495	\$49,500	\$44,030	\$66,085
Age distribution				
Under 18 years	21%	18%	26%	25%
18-64 years	59%	70%	66%	63%
65+ years	20%	12%	8%	12%
Racial composition				
Black	3%	26%	36%	13%
White	90%	62%	48%	73%
Other	7%	12%	16%	14%
Also identified Latino heritage	5%	8%	17%	9%
Education attainment level				
Less than high school diploma	4%	7%	15%	8%
High school graduate (only)	18%	22%	29%	28%
Some college, no degree	2%	6%	5%	5%
College degree	76%	65%	51%	59%
Housing unit occupancy				
Owner occupied or vacant	74%	35%	43%	71%
Rental unit	26%	65%	57%	29%

a/ All data are from Maryland-National Capital Park and Planning Commission 1999. All population data are based on the 1997 census update survey.

In addition to Rock Creek Park, many other recreational and educational opportunities exist in the area. Some of these are identified below. However, Rock Creek Park is unique because it is the only major natural area in this urban environment.

More than 40 recreation centers, 25 swimming pools, and 75 tennis courts provide active recreational opportunities in the areas neighboring the park.

More than 100 public and private schools are located in the surrounding area, along with major universities such as American University, University of the District of Columbia, George Washington University, Georgetown University, and Howard University.

Many other public parks occur in the area, including the C&O Canal National Historical Park, the sites of the Civil War Defenses of Washington, Meridian Hill Park, Dumbarton Oaks Park, Glover-Archbold Park, Montrose Park, and the National Zoological Park.

Montgomery County's Rock Creek Regional Park borders Rock Creek Park to the north. The regional park follows Rock Creek through southern Montgomery County and provides many recreational opportunities such as fishing, boating, canoeing, picnic shelters, a golf course, and trails.