SECTION 4. ENVIRONMENTAL ANALYSIS: AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes the environmental consequences associated with each alternative at project Sites A, B, and C. The organization of this section is by impact topic, which further refines the issues and concerns into distinct topics for analysis. These topics allow a standardized comparison between the alternatives based on their impact to the environment. A comparison matrix is provided in Table 3.

METHODOLOGY

The methodology of the impact analysis follows the guidance provided in NPS DO-12 and CEQ's NEPA implementation guidelines at 40 CFR Parts 1500 through 1508. The environmental consequences associated with the proposed alternatives are considered in terms of direct, indirect, and cumulative impacts. A direct impact is one that is caused by an action and occurs at the same time and place. An indirect impact is one that is caused by an action that is later in time or further removed in distance, but still reasonably foreseeable. Cumulative effects are defined by CEQ as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7).

Each impact is further described in terms of type (beneficial or adverse); context (site-specific, local, or regional); intensity (negligible, minor, moderate, or major); duration (short- or long-term); and impairment (would or would not impair park resources and values). Because definitions of intensity vary by impact topic, intensity definitions are provided separately for each impact topic analyzed.

The *NPS Management Policies* (2000c)and DO-12 require analysis of potential effects to determine if actions would *impair* park resources and values. The fundamental purpose of the National Park System, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid or minimize, to the greatest degree practicable, adverse impacts on park and monument resources and values. However, the laws do give NPS management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given NPS management discretion to allow certain impacts within parks, that discretion is limited by statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise.

The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including opportunities that otherwise would be present for the enjoyment of those resources or values. An impact to any park resource or value may constitute impairment. However, an impact would more likely constitute impairment to the extent it affects a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- Key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or
- Identified as a goal in the park's Master Plan or GMP or other relevant NPS planning documents.

A determination on impairment is made in the conclusion statement of the impact analysis of each alternative.

CUMULATIVE IMPACTS AND CONCURRENT PROJECTS WITHIN THE REGION

In the context of this EA, cumulative impacts are analyzed and expressed in terms of x + y = z; with x being the impacts described as a result of actions being proposed under each alternative; y being impacts of other

past, present, and reasonably foreseeable future actions; and z being the cumulative impact. Cumulative impacts are considered for all alternatives and are presented at the end of each impact topic discussion and analysis.

To assess the cumulative impacts of the action alternatives, ongoing and future construction and planning projects within the region were identified as described below. The sources for identifying regional projects include James City County Planning Commission, the Virginia Department of Transportation (VDOT), Colonial NHP, and the City of Williamsburg.

Within the Papermill Creek watershed, the Colonial Williamsburg Foundation is currently planning a 1,395-acre residential and business community to the east of Sites A, B, and C. The plan calls for the majority of the land to be allocated for parks, Parkway, and recreation centered on three existing golf courses about 1/2 mile from the project area.

In addition, several planned residential and commercial developments are currently underway within the Williamsburg region. The City of Williamsburg identified the Colonial Williamsburg Lodge development as a concurrent project located about 1/2 mile north of the proposed project site. The City of Williamsburg did not identify any other construction or drainage improvement projects currently in progress in the area. The College of William and Mary, located about 1 mile northwest of the project area, is undergoing a renovation and expansion project, which began in 2004 and will continue through 2010. Activities will include building rehabilitation, renovation, and limited new building construction.

Approximately 2 miles southwest of the project site, the Williamsburg Farms Country Inn is planning to construct and operate a 36-room inn. Approximately 2 miles southwest of the project site, the Williamsburg Farms Agricultural and Forestal District (AFD) withdrew approximately 6 acres that will be combined with existing property not in the AFD to create four single-family lots on Jockey's Neck Trail. Approximately 3 miles southwest of the project site, Gospel Spreading Church AFD has annexed about 70 acres for use as low density (i.e., 3+ acre lot size) residential housing. Approximately 4 miles southeast of the project, Busch Gardens is constructing a 40,000-square-foot building as part of its Oktoberfest Expansion.

VDOT is currently repaving a 16-mile stretch of Interstate 64 from Camp Peary in York County to the Jefferson Avenue interchange in Newport News to provide a smoother riding surface. These activities will take place about 4 miles southeast of the proposed project site.

CULTURAL RESOURCES, SECTION 106 OF NHPA, AND NEPA

Section 101(b)(4) of the National Environmental Policy Act of 1969, as amended, requires the Federal government to coordinate and plan its actions to "preserve important historic, cultural, and natural aspects of our national heritage." The Council on Environmental Quality's implementing regulations further require that Federal impacts on historic and cultural resources be included as part of the NEPA process.

In this EA, impacts on cultural resources are described in terms of type, context, duration, and intensity. This is consistent with the Council on Environmental Quality's implementing regulations for NEPA. These impact analyses are also intended to comply with the requirements of both NEPA and Section 106 of the NHPA. In accordance with Section 106 of the NHPA, impacts on cultural resources were identified and evaluated by 1) determining the Area of Potential Effects (APE); 2) identifying cultural resources within the APE that are either listed, or eligible for listing, in the National Register; 3) applying the criteria of adverse effects to cultural resources located within the APE that are either listed, or eligible for listing, in the National Register; and 4) considering alternatives that would avoid, minimize, or mitigate adverse effects to cultural resources.

Under the Advisory Council for Historic Preservation's implementing regulations for Section 106 (36 CFR 800), a determination of either adverse effect or no adverse effect must be made for all cultural resources located within the APE that are either listed, or eligible for listing, in the National Register. An adverse effect occurs whenever a proposed project impacts, either directly or indirectly, the characteristics that qualify a property for inclusion in the National Register.

Adverse effects include, but are not limited to: 1) physical destruction of or damage to all or part of the property; 2) alternation of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access that is not consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* (36 CFR 68) and applicable guidelines; 3) removal of the property from its historic location; 4) change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance; 5) introduction of visual, atmospheric, or audible elements that diminish the property's significant historic features; 6) neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and 7) transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance. Adverse effects also include any reasonably foreseeable effects caused by the proposed project that may occur later in time, be further removed in distance, or be cumulative.

Table 3 summarizes environmental consequences of each alternative.

Table 3: Summary of Environmental Consequences/Impact Comparison Matrix

SITE A			
Impact Topic	**Alternative 1 - No Action**	**Alternative 2 – Replace Existing 24-inch Culvert with 30-inch RCP**	**Alternative 3 (Environmentally Preferred Alternative)– Add Parallel 24-inch RCP**
Water Quality	Minor, long-term, adverse impacts to water quality would occur because runoff from storm events would not be adequately controlled, leading to increased erosion and sedimentation within the watershed. The impacts to water quality would not result in impairment.	Minor, localized, short-term, adverse effects to water quality would occur as a result of construction activities. There would be long-term beneficial effects associated with decreased erosion and sedimentation in the watershed. The impacts to water quality would not result in impairment.	Minor, localized, short-term, adverse effects to water quality would occur as a result of construction activities. There would be long-term beneficial effects associated with decreased erosion and sedimentation in the watershed. The impacts to water quality would not result in impairment.
Hydrology and Hydraulics	Periodic flooding would continue, altering streamflows and channel morphology. This would result in moderate, long-term, adverse effects to hydrology and hydraulics.	Long-term, beneficial impacts on hydrology and hydraulics are expected; therefore, no impairment to park resources would occur.	Long-term, beneficial impacts on hydrology and hydraulics are expected; therefore, no impairment to park resources would occur.
Floodplains	Flooding would continue to degrade roadways, negatively impacting driver safety and historic Parkway structures. However, no changes to the floodplain are anticipated and no construction would occur within the floodplain; therefore, floodplain impacts would be negligible. The impacts to floodplains would not result in impairment.	During construction activities, minor, short-term, localized impacts to the floodplain would occur as a result of the temporary movement of excavated fill material. In the long-term, beneficial impacts at the local project site would occur with the reduction of the flood hazard. The impacts to floodplains would not result in impairment.	During construction activities, minor, short-term, localized impacts to the floodplain would occur as a result of the temporary movement of excavated fill material. In the long-term, beneficial impacts at the local project site would occur with the reduction of the flood hazard. The impacts to floodplains would not result in impairment.

Impact Topic	Alternative 1 - No Action	Alternative 2 – Replace Existing 24-inch Culvert with 30-inch RCP	Alternative 3 (Environmentally Preferred Alternative)– Add Parallel 24-inch RCP
Wetlands	No direct impacts to wetlands would occur, as none would be filled or disturbed. Over time, increases in sedimentation and erosion may result in minor, adverse, long-term, cumulative fill of wetlands. The impacts to wetlands would not result in impairment.	Minor short- and long-term impacts to wetlands would occur. Short-term impacts include increased turbidity downstream during construction and removal of vegetation within and on stream banks. Less than 0.0025 acres of wetlands would be impacted. The impacts to wetlands would not result in impairment.	Minor short- and long-term impacts to wetlands would occur. Short-term impacts include increased turbidity downstream during construction and removal of vegetation within and on stream banks. Less than 0.018 acres of wetlands would be impacted. The impacts to wetlands would not result in impairment.
Visitor Experience and Recreation Resources	Moderate, long-term adverse impacts to Parkway users would continue to occur during heavy rains and flooding. The impacts to visitor experience and recreation resources would not result in impairment.	Moderate, long-term beneficial impacts would occur as a result of flood reduction along the Parkway. There would be moderate, short-term adverse impact during the construction period if Parkway detours or temporary closures are necessary. The impacts to visitor experience and recreation resources would not result in impairment.	Moderate, long-term beneficial impacts would occur as a result of flood reduction along the Parkway. There would be moderate, short-term adverse impact during the construction period if Parkway detours or temporary closures are necessary. The impacts to visitor experience and recreation resources would not result in impairment.
Cultural Resources	Damage to the historic roadway and drainage systems would continue as a result of the recurring flood hazard, leading to moderate, long-term, adverse impacts to cultural resources. The impacts to cultural resources would not result in impairment.	Moderate, short-term impacts would occur during construction with the demolition of a portion of the roadbed and the existing, historic drainage system. Minor long-term, beneficial impacts on historic structures (e.g., roadway and surrounding resources) would occur with the flood hazard reduction.	Moderate, short-term impacts would occur during construction with the demolition of a portion of the roadbed. Minor long-term, beneficial impacts on historic structures (e.g., roadway and surrounding resources) would occur with the flood hazard reduction.

SITE B			
Impact Topic	**Alternative 1 - No Action**	**Alternative 2 – Replace Existing Culvert with CON-SPAN Structure**	**Alternative 3 (Environmentally Preferred Alternative)– Add Parallel Culvert System**
Water Quality	Minor, long-term, adverse impacts to water quality would occur because runoff from storm events would not be adequately controlled, leading to increased erosion and sedimentation within the watershed. The impacts to water quality would not result in impairment.	Minor, localized, short-term, adverse effects to water quality would occur as a result of construction activities. There would be long-term beneficial effects associated with decreased erosion and sedimentation in the watershed. The impacts to water quality would not result in impairment.	Minor, localized, short-term, adverse effects to water quality would occur as a result of construction activities. There would be long-term beneficial effects associated with decreased erosion and sedimentation in the watershed. The impacts to water quality would not result in impairment.
Hydrology and Hydraulics	Periodic flooding would continue, altering streamflows and channel morphology. This would result in moderate, long-term, adverse effects to hydrology and hydraulics.	Long-term, beneficial impacts on hydrology and hydraulics are expected; therefore, no impairment to park resources would occur.	Long-term, beneficial impacts on hydrology and hydraulics are expected; therefore, no impairment to park resources would occur.
Floodplains	Flooding would continue to degrade roadways, negatively impacting driver safety and historic Parkway structures. However, no changes to the floodplain are anticipated and no construction would occur within the floodplain; therefore, floodplain impacts would be negligible. The impacts to floodplains would not result in impairment.	During construction activities, minor, short-term, localized impacts to the floodplain would occur as a result of the temporary movement of excavated fill material. In the long-term, beneficial impacts at the local project site would occur with the reduction of the flood hazard. The impacts to floodplains would not result in impairment.	During construction activities, minor, short-term, localized impacts to the floodplain would occur as a result of the temporary movement of excavated fill material. In the long-term, beneficial impacts at the local project site would occur with the reduction of the flood hazard. The impacts to floodplains would not result in impairment.
Wetlands	No direct impacts to wetlands would occur as none would be filled or disturbed. Over time, increases in sedimentation and erosion may result in minor, adverse, long-term, cumulative fill of wetlands. The impacts to wetlands would not result in impairment.	Minor short- and long-term impacts to wetlands would occur. Short-term impacts include increased turbidity downstream during construction and removal of vegetation within and on stream banks. Less than 0.023 acres of wetlands would be impacted. The impacts to wetlands would not result in impairment.	Minor short- and long-term impacts to wetlands would occur. Short-term impacts include increased turbidity downstream during construction and removal of vegetation within and on stream banks. Less than 0.011 acres of wetlands would be impacted. The impacts to wetlands would not result in impairment.

Impact Topic	Alternative 1 - No Action	Alternative 2 – Add Parallel Culvert System	Alternative 3 – Replace Existing Culvert with CON-SPAN Structure
Visitor Experience and Recreation Resources	Moderate, long-term adverse impacts to Parkway users would continue to occur during heavy rains and flooding. The impacts to visitor experience and recreation resources would not result in impairment.	Moderate, long-term beneficial impacts would occur as a result of flood reduction along the Parkway. There would be moderate, short-term adverse impact during the construction period if Parkway detours or temporary closures are necessary. The impacts to visitor experience and recreation resources would not result in impairment.	Moderate, long-term beneficial impacts would occur as a result of flood reduction along the Parkway. There would be moderate, short-term adverse impact during the construction period if Parkway detours or temporary closures are necessary. The impacts to visitor experience and recreation resources would not result in impairment.
Cultural Resources	Damage to the historic roadway and drainage systems would continue as a result of the recurring flood hazard, leading to moderate, long-term, adverse impacts to cultural resources. The impacts to cultural resources would not result in impairment.	Moderate, short-term impacts would occur during construction with the demolition of a portion of the roadbed. Minor long-term, beneficial impacts on historic structures (e.g., roadway, dam and surrounding resources) would occur with the flood hazard reduction.	Moderate, short-term impacts to the Papermill Dam and the Parkway would occur during construction with the demolition of a portion of the roadbed and the existing, historic drainage system. Minor long-term, beneficial impacts on historic structures (e.g., roadway, dam, and surrounding resources) would occur with the flood hazard reduction.
SITE C			
Impact Topic	**Alternative 1 - No Action**	**Alternative 2 – Replace Existing Culvert with 24-inch RCP**	**Alternative 3 – Install Parallel 24-inch RCP**
Water Quality	Minor, long-term, adverse impacts to water quality would occur because runoff from storm events would not be adequately controlled, leading to increased erosion and sedimentation within the watershed. The impacts to water quality would not result in impairment.	Minor, localized, short-term, adverse effects to water quality would occur as a result of construction activities. There would be long-term beneficial effects associated with decreased erosion and sedimentation in the watershed. The impacts to water quality would not result in impairment.	Minor, localized, short-term, adverse effects to water quality would occur as a result of construction activities. There would be long-term beneficial effects associated with decreased erosion and sedimentation in the watershed. The impacts to water quality would not result in impairment.
Hydrology and Hydraulics	Periodic flooding would continue, altering streamflows and channel morphology. This would result in moderate, long-term, adverse effects to hydrology and hydraulics.	Long-term, beneficial impacts on hydrology and hydraulics are expected; therefore, no impairment to park resources would occur.	Long-term, beneficial impacts on hydrology and hydraulics are expected; therefore, no impairment to park resources would occur.

Impact Topic	Alternative 1 - No Action	Alternative 2 – Replace Existing Culvert with 24-inch RCP	Alternative 3 – Install Parallel 24-inch RCP
Floodplains	Flooding would continue to degrade roadways, negatively impacting driver safety and historic Parkway structures. However, no changes to the floodplain are anticipated and no construction would occur within the floodplain; therefore, floodplain impacts would be negligible. The impacts to floodplains would not result in impairment.	During construction activities, minor, short-term, localized impacts to the floodplain would occur as a result of the temporary movement of excavated fill material. In the long-term, beneficial impacts at the local project site would occur with the reduction of the flood hazard. The impacts to floodplains would not result in impairment.	During construction activities, minor, short-term, localized impacts to the floodplain would occur as a result of the temporary movement of excavated fill material. In the long-term, beneficial impacts at the local project site would occur with the reduction of the flood hazard. The impacts to floodplains would not result in impairment.
Wetlands	No direct impacts to wetlands would occur, as none would be filled or disturbed. Over time, increases in sedimentation and erosion may result in minor, adverse, long-term, cumulative fill of wetlands. The impacts to wetlands would not result in impairment.	Minor short- and long-term impacts to wetlands would occur. Short-term impacts include increased turbidity downstream during construction and removal of vegetation within and on stream banks. Less than 0.003 acres of wetlands would be impacted. The impacts to wetlands would not result in impairment.	Minor short- and long-term impacts to wetlands would occur. Short-term impacts include increased turbidity downstream during construction and removal of vegetation within and on stream banks. Less than 0.003 acres of wetlands would be impacted. The impacts to wetlands would not result in impairment.
Visitor Experience and Recreation Resources	Moderate, long-term adverse impacts to Parkway users would continue to occur during heavy rains and flooding. The impacts to visitor experience and recreation resources would not result in impairment.	Moderate, long-term beneficial impacts would occur as a result of flood reduction along the Parkway. There would be moderate, short-term adverse impact during the construction period if Parkway detours or temporary closures are necessary. The impacts to visitor experience and recreation resources would not result in impairment.	Moderate, long-term beneficial impacts would occur as a result of flood reduction along the Parkway. There would be moderate, short-term adverse impact during the construction period if Parkway detours or temporary closures are necessary. The impacts to visitor experience and recreation resources would not result in impairment.
Cultural Resources	Damage to the historic roadway and drainage systems would continue as a result of the recurring flood hazard, leading to moderate, long-term, adverse impacts to cultural resources. The impacts to cultural resources would not result in impairment.	Moderate, short-term impacts would occur during construction with the demolition of a portion of the roadbed and the existing, historic drainage system. Minor long-term, beneficial impacts on historic structures (e.g., roadway and surrounding resources) would occur with the flood hazard reduction.	Moderate, short-term impacts would occur during construction with the demolition of a portion of the roadbed. Minor long-term, beneficial impacts on historic structures (e.g., roadway and surrounding resources) would occur with the flood hazard reduction.

WATER QUALITY

AFFECTED ENVIRONMENT

Surface Water Resources

The Papermill Creek watershed lies within the James River Basin, which covers slightly more than 25 percent of the total surface area of Virginia. The James River, located approximately 2.15 miles south of the project area, drains to the Chesapeake Bay. Sites A, B, and C are located in the 1,051-acre Papermill Creek watershed, which drains to James River via College Creek. Papermill Creek is a relatively undeveloped watershed with approximately 10 percent impervious surface area (NPS, 2005a). The Parkway runs north to south near the western boundary of the watershed.

Papermill Creek is a non-tidal, third-order stream that extends from College Creek upstream to a series of hydrologically connected ponds located on the Golden Horseshoe Golf Course (Capelli, 1999). The ponds collect stormwater runoff that is conveyed to Papermill Creek. Numerous first- and second-order streams are found upstream of the golf course ponds, and most of these have been modified by human activity. Papermill Creek is designated as a Virginia Class III waterbody (Non-tidal Coastal and Piedmont Waters) (9 Virginia Administrative Code [VAC] 25-260).

Water quality analyses, including both macrobenthic and chemical analyses, were conducted for Papermill Creek by researchers from the College of William and Mary from August 1998 to April 1999. The analyses indicated that the water temperature of Papermill Creek is high compared to similar streams in the region and that the creek contains high levels of total dissolved solids (TDS), which correlates to high salinity (Capelli, 1999). Researchers concluded that the creek, particularly the upper reaches, is essentially a warm, near-brackish system, rather than a cool, freshwater system as would be expected under natural conditions. According to monitoring results, the creek exhibits increased levels of chloride, increased alkalinity, and reduced calcium levels. The analysis also detected elevated phosphorus levels, which can be responsible for excess algal and plant growth; however, no excess algal or plant growth was observed in the creek (Capelli, 1999).

Researchers hypothesized that the unusually high temperature and levels of TDS were due to a significant portion of the creek's flow deriving from the discharge of deep groundwater used to cool the condensers of air conditioning units used by Colonial Williamsburg (Capelli, 1999). Data from the wells used for heat dissipation by Colonial Williamsburg indicate that the water chemistry of the well water is similar to Papermill Creek (i.e., increased chloride, increased alkalinity, and reduced calcium). The well values were more extreme than those found in the creek, indicating that the groundwater is moderated to some degree before being discharged to Papermill Creek, though not sufficiently to return it to normal freshwater condition (Capelli, 1999).

The researchers also concluded that the creek was degraded due to urban runoff and the effects of acute rapid changes in water chemistry that occur when Papermill Creek, which exhibits increased salinity, is diluted for short periods by rain events and then returns to pre-storm conditions (Capelli, 1999).

Despite a diversity of habitat types found within Papermill Creek (e.g., sand/silt, sticks and snags, decaying leaf litter, larger rocks and gravel), the abundance and diversity of macrobenthos found in the creek were extremely low (Capelli, 1999). The majority of taxa present in the creek during sampling were from taxonomic families with a moderate to high tolerance for disturbance. These findings indicate that Papermill Creek is severely disturbed. Low levels of dissolved oxygen combined with high salinity and temperature are likely at least partially responsible for the lack of abundance and diversity of macrobenthos (Capelli, 1999). In addition, a 1998 oil spill, which occurred approximately 6 months prior to macrobenthic sampling, may have had an effect on the number and variety of macrobenthos found in the creek.

More recently, the College Creek Alliance (CCA) has conducted water quality monitoring of Papermill Creek. The sampling point for this monitoring is located in the lower reaches of the creek, which is in better condition

than the upper reaches. Relative to the 1998-1999 monitoring, CCA monitoring results show slightly lower temperatures, slightly reduced conductivity (which correlates to reduced salinity and TDS), and comparable levels of dissolved oxygen (CCA, 2005).

Groundwater Resources

Four principal aquifers exist in James City County. The Quaternary Aquifer, which at 40 feet below ground surface is the uppermost aquifer, is used for small water supplies. The Quaternary is subject to fertilizer and pesticide runoff from residential and agricultural areas, as well as pollution from septic systems (NPS, 1994).

The Yorktown and Eocene-Paleocene Aquifers lie below the Quaternary. The Yorktown Aquifer, with an estimated water storage capacity of 45 to 100 billion gallons, supplies water for domestic use in Williamsburg and Norge. The Eocene-Paleocene Aquifer, with an estimated water store of 35 to 90 billion gallons, supplies water to domestic wells from Jamestown to the Chickahominy River.

The lowest unit in the system is the Cretaceous Aquifer (NPS, 1994). This aquifer is the most productive, with an estimated storage capacity of 545 to 1,050 billion gallons. Municipalities and industries are the primary users of this aquifer. Water quality of the Cretaceous Aquifer is generally good, although sodium and bicarbonate concentrations are slightly elevated (NPS, 1994).

Shallow groundwater testing conducted in Colonial NHP in 1993 indicated potential local sources of groundwater contamination from nitrate and ammonia at several sites near Jamestown Island, Williamsburg, and Yorktown (NPS, 1994). No contamination source was identified. Salinity and phosphate concentrations were low or below detectable levels.

Regulatory Framework

The Organic Act requires the NPS to preserve and conserve natural resources, including water resources, on all park lands under its jurisdiction.

The Federal Water Pollution Control Act, commonly known as the Clean Water Act (CWA), was promulgated in 1972 to restore and maintain waters of the United States. Specific sections of the CWA that must be considered when Federal agencies conduct construction or development activities in or near a waterway include Section 404, which prohibits unauthorized discharges of dredged or fill material into waters of the United States; Section 401, which grants states the authority to administer a water quality certification program in conjunction with Section 404 permit requirements; and Section 402, which requires a NPDES permit for point source discharges of pollutants into waterways (including stormwater runoff from construction sites).

Under Section 404, a permit is required for the discharge of dredged or fill materials into waters of the United States, including wetlands. The USACE administers the Section 404 permit program.

Section 401 is administered by VDEQ through the Virginia Wetland Protection Permit (Virginia Code 62.1-44.15). VDEQ must certify that proposed activities that would result in discharges to surface water are consistent with the CWA and protect instream beneficial uses. In Virginia, Section 404 and Section 401 permit requirements can be met through a joint permit process coordinated by USACE and VDEQ.

Under authority of the EPA, the Virginia Department of Conservation and Recreation (VDCR) administers the Virginia Section 402 NPDES permitting program, which is known as the Virginia Pollutant Discharge Elimination System (VPDES). Project applicants must register for a general permit from VDCR if their construction activities are larger than 2,500 sf and less than one (1) acre within a Chesapeake Bay Preservation area (DCR, 2005) .

Additionally, Section 303(d) of the CWA and EPA regulations (40 CFR §130.7) requires states to identify waters not in compliance with State water quality standards, develop biennial lists of impaired waters, and develop Total Maximum Daily Loads (TMDLs) for listed impaired waters. The Virginia Water Quality Monitoring, Information, and Restoration Act (Code of Virginia §62.1-44.19:4 through 19:8) directs VDEQ to act as the lead agency for the identification of impaired waters and TMDL development in Virginia. In

September 2004, VDEQ released the *Final 2004 305(b)/303(d) Water Quality Assessment Integrated Report* (VDEQ, 2004), which included Virginia's updated 2004 303(d) list of impaired waters.

No waterbodies in the immediate vicinity of the project area are listed on Virginia's 303(d) list of impaired waters (VDEQ, 2004). However, various segments of the James River in James City County are listed as impaired for not meeting designated aquatic life and shellfishing uses. The causes of impairment in these various segments include reduced benthic diversity, high turbidity, and elevated levels of bacteria, which could result in human health effects from contaminated shellfish consumption. The source of these impairments is unknown.

Virginia Water Quality Standards are outlined in 9 VAC 25-260. The standards define the water quality criteria required to support existing beneficial uses of Virginia waters. Within Colonial NHP, waters are designated as either Class II (Estuarine Waters) or Class III (Non-tidal Coastal and Piedmont Zone Waters). Dissolved oxygen, pH, and temperature criteria for Class II and III waters are provided in Table 4.

Table 4: Virginia Surface Water Quality Standards

Class	Dissolved Oxygen Minimum (mg/L)	Dissolved Oxygen Daily Mean (mg/L)	pH	Temperature Maximum (°C)
II	4.0	5.0	6-9	n/a
III	4.0	5.0	6-9	32

Source: 9 VAC 25-260

The Virginia Erosion and Sediment Control Law, which is implemented by the VDCR in conjunction with localities, requires an approved erosion and sediment control plan for projects disturbing 10,0000 sf or more of land. In James City County, erosion and sediment control plans are reviewed and approved by the Colonial Soil and Water Conservation District.

The Virginia Stormwater Management Act, administered by VDCR, enables the development of stormwater management programs at the local level. The Act requires stormwater management plans to be prepared for designated development and construction activities in the State to ensure that post-development runoff does not exceed pre-development rates.

Virginia's Chesapeake Bay Preservation Act, administered by the VDCR, Division of Chesapeake Bay Local Assistance, empowers localities to consider water quality issues when making land use decisions. The Act allows the localities to designate Resource Protection Areas (RPAs) and Resource Management Areas (RMAs), which are granted special protection. RPAs include natural areas most sensitive to disturbance, such as tidal wetlands and shores. Designation of RMAs is left to local discretion but may include nontidal wetlands, floodplains, and areas with highly erodible soils. In James City County, the entire County, with the exception of RPAs, is designated as an RMA.

On July 13, 2005, NPS sent letters to the USACE, VDEQ, and VDCR requesting information on water resources in the project area and potential regulatory requirements associated with the proposed actions (Appendix B).

ENVIRONMENTAL CONSEQUENCES

Definition of Intensity Levels

For the purposes of analyzing potential impacts to water resources, the thresholds of change for the intensity of an impact are defined as follows:

Negligible: Impacts are effects that are not detectable, well below water quality standards, and within historical baseline water quality conditions.

Minor: Impacts are effects that are detectable but well within or below water quality standards and within historical baseline water quality conditions.

Moderate: For most waters, impacts are effects that are detectable, within or below water quality standards, but historical baseline water quality conditions are being altered on a short-term basis. However, in Outstanding National Resource Waters (ONRWs) this threshold may approach the requirements for statutory impairment.

Major: For most waters, impacts are effects that are detectable and significantly and persistently alter baseline water quality conditions. Water quality standards are locally approached, equaled, or slightly and singularly exceeded on a short-term and temporary basis. However, in ONRWs this threshold would probably constitute statutory impairment.

SITE A

Alternative 1 - No Action

Under the No Action Alternative, the culvert at Site A would not be upgraded and no slope protection, bank armoring, or erosion control measures would be implemented. Erosion and sedimentation in the watershed would worsen due to silt accumulation from flood waters which would cause an increase in water velocity exiting the culvert. Excess sediment in streams could adversely affect water quality by smothering bottom-dwelling organisms, preventing light from penetrating the water column, and carrying nutrients or toxic substances downstream. Because drainage improvements and erosion control measures would not be implemented at Site A, erosion and sedimentation would continue to affect water quality in Papermill Creek; however, it is unlikely that this would result in violations of the Virginia Water Quality Standards. The No Action Alternative would result in a minor, long-term, adverse impact to water resources in the project area.

Cumulative Impacts: Future development throughout the watershed will result in increased stormwater runoff to Papermill Creek. The Site A culvert would be subjected to increased flows that it does not have the capacity to handle. Erosion and sedimentation in Papermill Creek would worsen under this scenario. When combined with past, present, and reasonably foreseeable future actions, the No Action Alternative, under which no drainage improvements or erosion control measures would be implemented, would result in an adverse cumulative impact.

Conclusion: Under the No Action Alternative, minor, long-term, adverse impacts to water resources would occur because runoff from storm events would not be adequately controlled and erosion control measures would not be implemented, leading to increased erosion and sedimentation that would negatively impact water quality. Past, present, and reasonably foreseeable projects or events would have an adverse cumulative effect. The impacts to water quality would be minor and would not result in impairment.

Alternative 2 - Replace Existing 24-inch Culvert with 30-inch RCP

Under Alternative 2, the existing 24-inch HDPE pipe would be replaced with a 30-inch RCP. The larger pipe would allow floodwaters up to the design storm to be conveyed in the channel, reducing flooding along the banks and consequently erosion and sedimentation. This would result in long-term, water quality benefits to Papermill Creek and other downstream surface waters.

Construction activities at Site A may temporarily result in increased erosion and sedimentation in surface waters due to the use of heavy equipment near the creek. BMPs such as silt fences and revegetation of bare soils would be implemented to minimize impacts. NPS would obtain a joint Section 401/404 permit from USACE and VDEQ for construction of the new culvert and would abide by all permit conditions. The Proposed Action would result in 960 sf of ground disturbance; therefore, a VPDES permit would not be required (permit required for activities greater than 2,500 sf) The combined construction activities at Sites A, B, and C would likely disturb more than 10,000 sf of land; therefore, the NPS would prepare an erosion and

sediment control plan. Project activities are not expected to result in violations of Virginia Water Quality Standards. NPS would comply with all Federal, State, and local regulations pertaining to water quality.

Overall, Alternative 2 would result in minor, localized, short-term, adverse effects to water quality. These effects would occur during construction activities and would be minimized through the use of BMPs. In the long-term, Alternative 2 would have a beneficial impact on water quality.

Cumulative Impacts: Other past, current, and future development activities in the project area would increase stormwater runoff and adversely affect surface water quality. However, since the potential adverse impacts of Alternative 2 would be short-term and localized, occurring only during and immediately following construction activities, and since no projects are planned in the immediate vicinity of Site A, it is unlikely that adverse cumulative impacts would result from the implementation of Alternative 2. Since Alternative 2 would improve drainage and help control stormwater in the watershed, it is expected that this alternative would help alleviate the adverse cumulative impacts of future development in the project area.

Conclusion: Alternative 2 would result in minor, localized, short-term, adverse effects to water quality associated with construction activities, and long-term beneficial effects associated with decreased erosion and sedimentation in the watershed. No adverse cumulative effects are expected. The impacts to water quality would not result in impairment.

Alternative 3 - Add Parallel 24-inch RCP

Under Alternative 3, the existing culvert system would be upgraded by adding an adjacent 24-inch RCP. The additional capacity would allow floodwaters up to the design storm to be conveyed in the channel, reducing flooding along the bank and consequently erosion and sedimentation. This would result in long-term, water quality benefits to Papermill Creek and other downstream surface waters.

Construction activities at Site A may temporarily result in increased erosion and sedimentation in surface waters due to the use of heavy equipment near the creek. BMPs such as silt fences and revegetation of bare soils would be implemented to minimize impacts. NPS would obtain a joint Section 401/404 permit from USACE and VDEQ for construction of the new culvert and would abide by all permit conditions. The Proposed Action would result in 800 sf of ground disturbance; therefore, a VPDES permit woudl not be required (permit required for activities greater than 2,500 sf) The combined construction activities at Sites A, B, and C would likely disturb more than 10,000 sf of land; therefore, the NPS would prepare an erosion and sediment control plan. Project activities are not expected to result in violations of Virginia Water Quality Standards. NPS would comply with all Federal, State, and local regulations pertaining to water quality.

Overall, Alternative 3 would result in minor, localized, short-term, adverse effects to water quality. These effects would occur during construction activities and would be minimized through the use of BMPs. In the long-term, Alternative 3 would have a beneficial impact on water quality.

Cumulative Impacts: Other past, current, and future development activities in the project area would increase stormwater runoff and adversely affect surface water quality. However, since the potential adverse impacts of Alternative 3 would be short-term and localized, occurring only during and immediately following construction activities, and since no projects are planned in the immediate vicinity of Site A, it is unlikely that adverse cumulative impacts would result from the implementation of Alternative 3. Since Alternative 3 would improve drainage and help control stormwater in the watershed, it is expected that this alternative would help alleviate the adverse cumulative impacts of future development in the project area.

Conclusion: Alternative 3 would result in minor, localized, short-term, adverse effects to water quality associated with construction activities, and long-term beneficial effects associated with decreased erosion and sedimentation in the watershed. No adverse cumulative effects are expected. The impacts to water quality would not result in impairment.

SITE B

Alternative 1 - No Action

Under the No Action Alternative, the culvert at Site B would not be upgraded and no slope protection, bank armoring, or erosion control measures would be implemented. Erosion and sedimentation in the watershed would worsen due to silt accumulation from flood waters which would cause an increase in water velocity exiting the culvert. Excess sediment in streams could adversely affect water quality by smothering bottom-dwelling organisms, preventing light from penetrating the water column, and carrying nutrients or toxic substances downstream. Because drainage improvements and erosion control measures would not be implemented at Site B, erosion and sedimentation would continue to affect water quality in Papermill Creek; however, it is unlikely that this would result in violations of the Virginia Water Quality Standards. The No Action Alternative would result in a minor, long-term, adverse impact to water resources in the project area.

Cumulative Impacts: Future development throughout the watershed will result in increased stormwater runoff to Papermill Creek. The Site B culvert would be subjected to increased flows that it does not have the capacity to handle. Erosion and sedimentation in Papermill Creek would worsen under this scenario. When combined with past, present, and reasonably foreseeable future actions, the No Action Alternative, under which no drainage improvements or erosion control measures would be implemented, would result in an adverse cumulative impact.

Conclusion: Under the No Action Alternative, minor, long-term, adverse impacts to water resources would occur because runoff from storm events would not be adequately controlled and erosion control measures would not be implemented, leading to increased erosion and sedimentation that would negatively impact water quality. Past, present, and reasonably foreseeable projects or events would have an adverse cumulative effect. The impacts to water quality would not result in impairment.

Alternative 2 – Replace Existing Culvert with CON-SPAN Structure

Under Alternative 2, the existing culvert system would be replaced with a 4-foot by 28-foot CON-SPAN structure. Erosion control stone would be used to stabilize the bank and minimize erosion. Together these measures would minimize erosion and sedimentation in the watershed. This would result in long-term, water quality benefits to Papermill Creek and other downstream surface waters.

Construction activities at Site B may temporarily result in increased erosion and sedimentation in surface waters due to the use of heavy equipment near the creek. BMPs such as silt fences and the revegetation of bare soils would be implemented to minimize impacts. NPS would obtain a joint Section 401/404 permit from USACE and VDEQ for construction of the new culvert and would abide by all permit conditions. The Proposed Action would result in 1,600 sf of ground disturbance; therefore, a VPDES permit woudl not be required (permit required for activities greater than 2,500 sf) The combined construction activities at Sites A, B, and C would likely disturb more than 10,000 sf of land; therefore, the NPS would prepare an erosion and sediment control plan. Project activities are not expected to result in violations of Virginia Water Quality Standards. NPS would comply with all Federal, State, and local regulations pertaining to water quality.

Overall, Alternative 2 would result in minor, localized, short-term, adverse effects to water quality. These effects would occur during construction activities and would be minimized through the use of BMPs. In the long-term, Alternative 2 would have a beneficial impact on water quality.

Cumulative Impacts: Other past, current, and future development activities in the project area would increase stormwater runoff and adversely affect surface water quality. However, since the potential adverse impacts of Alternative 2 would be short-term and localized, occurring only during and immediately following construction activities, and since no projects are planned in the immediate vicinity of Site B, it is unlikely that adverse cumulative impacts would result from the implementation of Alternative 2. Since Alternative 2 would involve upgrading the drainage system and implementing erosion control practices, it is expected that this alternative would help alleviate the adverse cumulative impacts of future development in the project area.

Conclusion: Alternative 3 would result in minor, localized, short-term, adverse effects to water quality associated with construction activities, and long-term beneficial effects associated with decreased erosion and sedimentation in the watershed. No adverse cumulative effects are expected. The impacts to water quality would not result in impairment.

Alternative 3 – Add Parallel Culvert System

Under Alternative 3, an additional culvert system would be added to the existing culvert in place at Site B. Bioengineered bank protection and erosion control stone would be used to stabilize the bank and minimize erosion. Together these measures would minimize erosion and sedimentation in the watershed. This would result in long-term, water quality benefits to Papermill Creek and other downstream surface waters.

Construction activities at Site B may temporarily result in increased erosion and sedimentation in surface waters due to the use of heavy equipment near the creek. BMPs such as silt fences and the revegetation of bare soils would be implemented to minimize impacts. NPS would obtain a joint Section 401/404 permit from USACE and VDEQ for construction of the new culvert and would abide by all permit conditions. The Proposed Action would result in 6,000 sf of ground disturbance; therefore, a VPDES permit would be required (permit required for activities greater than 2,500 sf). The combined construction activities at Sites A, B, and C would likely disturb more than 10,000 sf of land; therefore, the NPS would prepare an erosion and sediment control plan. Project activities are not expected to result in violations of Virginia Water Quality Standards. NPS would comply with all Federal, State, and local regulations pertaining to water quality.

Overall, Alternative 3 would result in minor, localized, short-term, adverse effects to water quality. These effects would occur during construction activities and would be minimized through the use of BMPs. In the long-term, Alternative 3 would have a beneficial impact on water quality.

Cumulative Impacts: Other past, current, and future development activities in the project area would increase stormwater runoff and adversely affect surface water quality. However, since the potential adverse impacts of Alternative 3 would be short-term and localized, occurring only during and immediately following construction activities, and since no projects are planned in the immediate vicinity of Site B, it is unlikely that adverse cumulative impacts would result from the implementation of Alternative 3. Since Alternative 3 would involve upgrading the drainage system and implementing erosion control practices, it is expected that this alternative would help alleviate the adverse cumulative impacts of future development in the project area.

Conclusion: Alternative 3 would result in minor, localized, short-term, adverse effects to water quality associated with construction activities, and long-term beneficial effects associated with decreased erosion and sedimentation in the watershed. No adverse cumulative effects are expected. The impacts to water quality would not result in impairment.

SITE C

Alternative 1 - No Action

Under the No Action Alternative, the culvert at Site C would not be upgraded and no slope protection, bank armoring, or erosion control measures would be implemented. Erosion and sedimentation in the watershed would worsen due to silt accumulation from flood waters which would cause an increase in water velocity exiting the culvert. Excess sediment in streams could adversely affect water quality by smothering bottom-dwelling organisms, preventing light from penetrating the water column, and carrying nutrients or toxic substances downstream. Because drainage improvements and erosion control measures would not be implemented at Site C, erosion and sedimentation would continue to affect water quality in Papermill Creek; however, it is unlikely that this would result in violations of the Virginia Water Quality Standards. The No Action Alternative would result in a minor, long-term, adverse impact to water resources in the project area.

Cumulative Impacts: The Site C culvert currently does not meet the 25-year storm event standard and additional unplanned development would subject the Site C culvert to increased flows that it does not have the capacity to handle. Erosion and sedimentation in Papermill Creek would worsen under this scenario. When

combined with past, present, and reasonably foreseeable future actions, the No Action Alternative, under which no drainage improvements or erosion control measures would be implemented, would result in an adverse cumulative impact.

Conclusion: Under the No Action Alternative, minor, long-term, adverse impacts to water resources would occur because runoff from storm events would not be adequately controlled and erosion control measures would not be implemented, leading to increased erosion and sedimentation that would negatively impact water quality. Past, present, and reasonably foreseeable projects or events would have an adverse cumulative effect. The impacts to water quality would not result in impairment.

Alternative 2 - Replace Existing Culvert with 24-inch RCP

Under Alternative 2, the existing 15-inch PVC pipe would be replaced with a 24-inch RCP. The larger pipe would allow floodwaters up to the design storm to be conveyed in the channel, reducing flooding along the bank and consequently erosion and sedimentation. This would result in long-term, water quality benefits to Papermill Creek and other downstream surface waters.

Construction activities at Site C may temporarily result in increased erosion and sedimentation in surface waters due to the use of heavy equipment near the creek. BMPs such as silt fences and the revegetation of bare soils would be implemented to minimize impacts. NPS would obtain a joint Section 401/404 permit from USACE and VDEQ for construction of the new culvert and would abide by all permit conditions. The Proposed Action would result in 800 sf of ground disturbance; therefore, a VPDES permit woudl not be required (permit required for activities greater than 2,500 sf) The combined construction activities at Sites A, B, and C would likely disturb more than 10,000 sf of land; therefore, the NPS would prepare an erosion and sediment control plan. Project activities are not expected to result in violations of Virginia Water Quality Standards. NPS would comply with all Federal, State, and local regulations pertaining to water quality.

Overall, Alternative 2 would result in minor, localized, short-term, adverse effects to water quality. These effects would occur during construction activities and would be minimized through the use of BMPs. In the long-term, Alternative 2 would have a beneficial impact on water quality.

Cumulative Impacts: Other past, current, and future development activities in the project area would increase stormwater runoff and adversely affect surface water quality. However, since the potential adverse impacts of Alternative 2 would be short-term and localized, occurring only during and immediately following construction activities, and since no projects are planned in the immediate vicinity of Site C, it is unlikely that adverse cumulative impacts would result from the implementation of Alternative 2. Since Alternative 2 would improve drainage and help control stormwater in the watershed, it is expected that this alternative would help alleviate the adverse cumulative impacts of future development in the project area.

Conclusion: Alternative 2 would result in minor, localized, short-term, adverse effects to water quality associated with construction activities, and long-term beneficial effects associated with decreased erosion and sedimentation in the watershed. No adverse cumulative effects are expected. The impacts to water quality would not result in impairment.

Alternative 3 – Install Parallel 24-inch RCP

Under Alternative 3, the existing culvert system would be upgraded by installing an adjacent 24-inch RCP. The additional capacity would allow floodwaters up to the design storm to be conveyed in the channel, reducing flooding along the bank and consequently erosion and sedimentation. This would result in long-term, water quality benefits to Papermill Creek and other downstream surface waters.

Construction activities at Site C may temporarily result in increased erosion and sedimentation in surface waters due to the use of heavy equipment near the creek. BMPs such as silt fences and the revegetation of bare soils would be implemented to minimize impacts. NPS would obtain a joint Section 401/404 permit from USACE and VDEQ for construction of the new culvert and would abide by all permit conditions. The Proposed Action would result in 800 sf of ground disturbance; therefore, a VPDES permit woudl not be required (permit required for activities greater than 2,500 sf) The combined construction activities at Sites A,

B, and C would likely disturb more than 10,000 sf of land; therefore, the NPS would prepare an erosion and sediment control plan. Project activities are not expected to result in violations of Virginia Water Quality Standards. NPS would comply with all Federal, State, and local regulations pertaining to water quality.

Overall, Alternative 3 would result in minor, localized, short-term, adverse effects to water quality. These effects would occur during construction activities and would be minimized through the use of BMPs. In the long-term, Alternative 3 would have a beneficial impact on water quality.

Cumulative Impacts: Other past, current, and future development activities in the project area would increase stormwater runoff and adversely affect surface water quality. However, since the potential adverse impacts of Alternative 3 would be short-term and localized, occurring only during and immediately following construction activities, and since no projects are planned in the immediate vicinity of Site C, it is unlikely that adverse cumulative impacts would result from the implementation of Alternative 2. Since Alternative 2 would improve drainage and help control stormwater in the watershed, it is expected that this alternative would help alleviate the adverse cumulative impacts of future development in the project area.

Conclusion: Alternative 3 would result in minor, localized, short-term, adverse effects to water quality associated with construction activities, and long-term beneficial effects associated with decreased erosion and sedimentation in the watershed. No adverse cumulative effects are expected. The impacts to water quality would not result in impairment.

HYDROLOGY AND HYDRAULICS (STREAMFLOW CHARACTERISTICS)

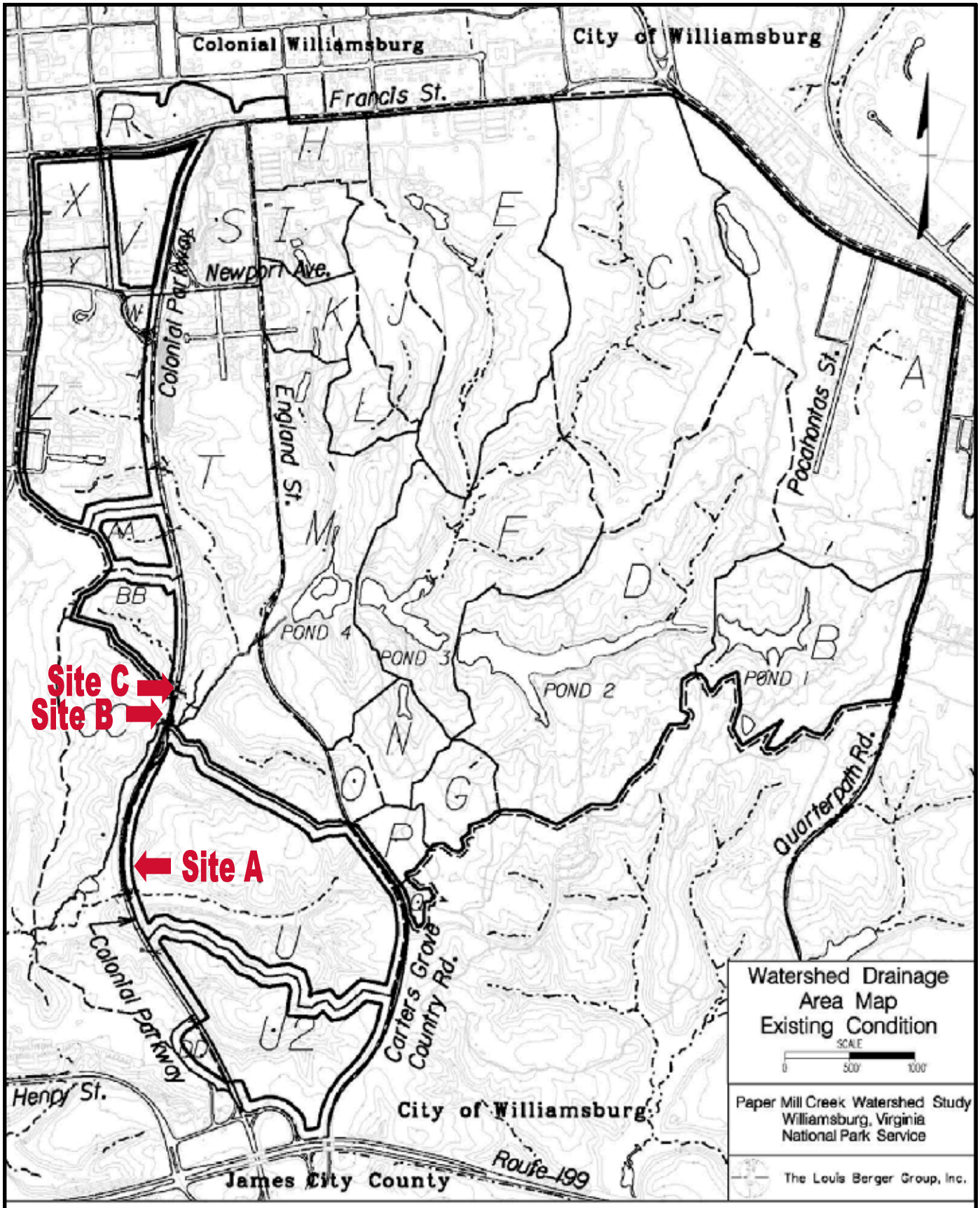
AFFECTED ENVIRONMENT

Papermill Creek is a third-order stream that drains to College Creek. Along the majority of the creek's reach, the banks are vegetated; however, the bank extent is limited in many locations by the creek's proximity to the Parkway. Numerous storm drains along the Parkway allow discharge runoff directly to the creek. The streambed substrate consists mostly of a sand/silt mixture that is typical of coastal plain streams (Capelli, 1999).

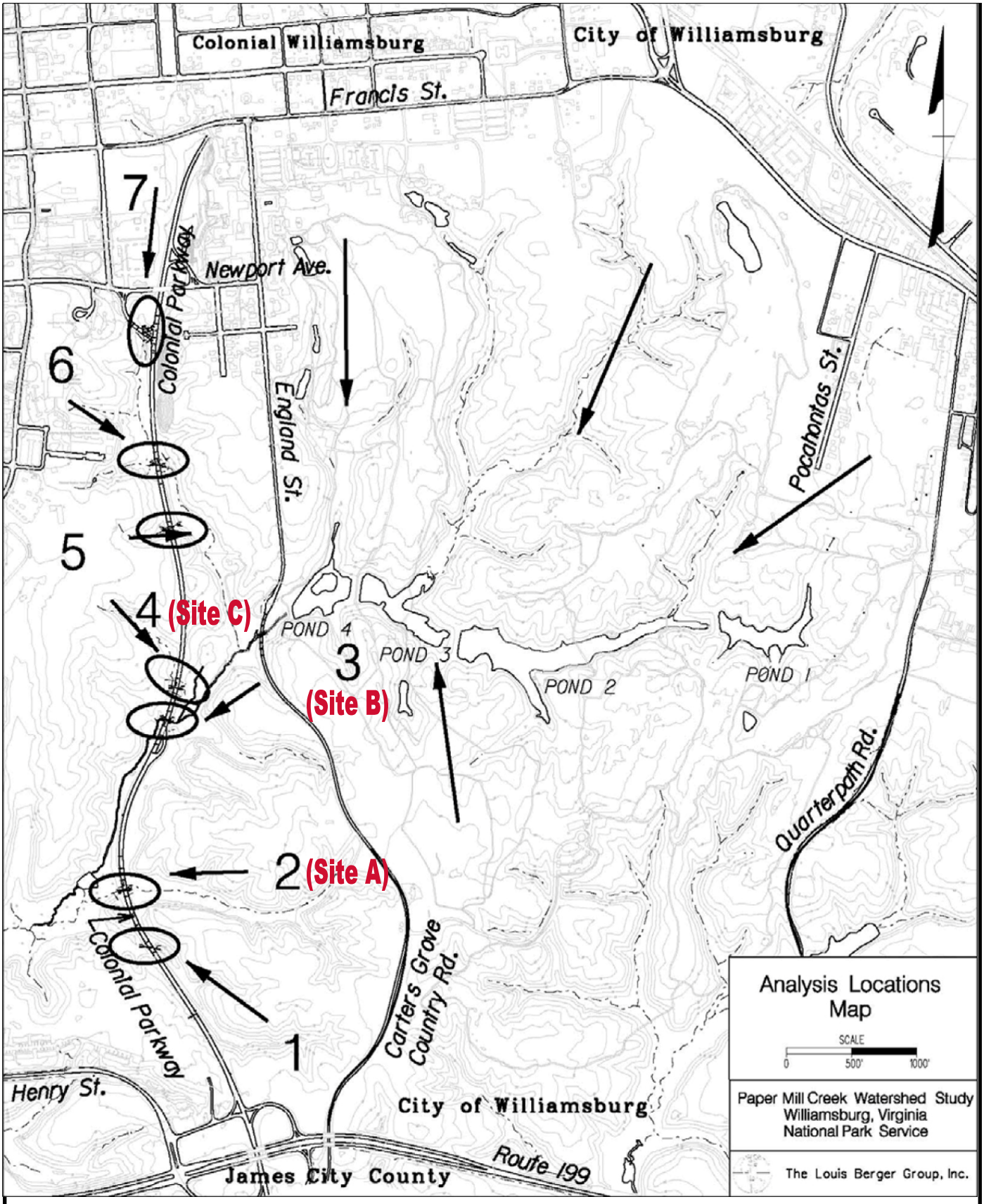
Drainage patterns in the Papermill Creek watershed generally follow existing topographic contours except at locations where the Parkway traverses contributing sub-drainage areas (NPS, 2005a). Three sub-areas on the west side of the Parkway must pass under the road to converge with the main flow from the watershed on the east side. Figure 10 depicts the sub-drainage areas within the watershed.

The City of Williamsburg owns and maintains the existing storm sewer systems in the northern portion of the watershed. These systems have experienced deterioration and erosion problems over time; however, the City has implemented some stormwater management improvements that have helped to mitigate erosion and improve water quality (NPS, 2005a).

In January 2005, a detailed survey of the Parkway culverts that convey flows within the Papermill Creek watershed was completed. These culverts are owned and maintained by NPS. The survey determined that the structural condition of the culvert system is good, but most of the culverts require cleaning and debris removal to improve flows. Silt and debris occupy one-third to nearly half of the capacity of the main culverts (NPS, 2005a). A summary of the culvert system is provided in Table 5. The locations of the culverts are shown in Figure 11.



				TITLE	WATERSHED DRAINAGE AREA MAP EXISTING CONDITION
REVISION NO		DES BY			
SCALE	NOT TO SCALE	DR BY	BR	7/18/05	Source: Papermill Creek Watershed Study
FILE	FILENAME.PPT	CHK BY	RT	7/18/05	PROJ NO 15292307
					FIGURE 10



CLIENT	National Park Service			
PROJ	Redesign Parkway Along the Papermill Creek Watershed			
REVISION NO		DES BY		
SCALE	NOT TO SCALE	DR BY	BR	7/18/05
FILE	FILENAME.PPT	CHK BY	RT	7/18/05

TITLE **ANALYSIS LOCATIONS MAP**

Source: Papermill Creek Watershed Study

PROJ NO 15292307

FIGURE **11**

Table 5: Parkway Culvert Inventory

Location	Type	Length (feet)	Drainage Area (acres)	Percent of Total Acreage
Site A	24-inch PVC 30-inch RCP	70	68.69	7.4%
Site B	Double 36-inch RCP	56	742.17	79.4%
Site C	15-inch RCP	61	12.49	14%

Source: NPS, 2005

A hydrology and hydraulics (H&H) analysis was completed as part of the watershed survey to evaluate the existing capacity and performance of the culverts located in the Papermill Creek watershed along the Parkway. In accordance with FHWA guidelines, the 25-year storm event was used as the design storm[1]. The results of the H&H analysis indicate that the culverts at Locations 3 and 4 do not convey flows associated with the 25-year storm event. Additionally, the culvert at Location 3, which drains the largest area of land, does not convey the 2-year storm event. A summary of existing culvert performance as determined by the H&H analysis is provided in Table 6.

Table 6: Culvert Performance for Existing Conditions

Location	Type	Conveys (yes/no)					
		2-Year Event	5-Year Event	10-Year Event	25-Year Event	50-Year Event	100-Year Event
Site A	24-inch PVC 30-inch RCP	Yes	Yes	Yes	Yes	No	No
Site B	Double 36-inch RCP	No	No	No	No	No	No
Site C	15-inch RCP	Yes	No	No	No	No	No

Source: NPS, 2005

The 2005 watershed study also included an analysis of the culvert system under expected future conditions. The City of Williamsburg Comprehensive Plan was used as the basis for predicting future development in the watershed. Under the predicted future conditions scenario, Locations 2, 3, and 4 would not convey the 25-year event. Also, culvert performance at Location 3, the most critical of the culverts, would worsen, and Locations 1 and 2 would be subject to increased flows. A summary of predicted future culvert performance as determined by the H&H analysis is provided in Table 7.

[1] Culverts and other hydraulic conveyance structures are designed using a particular storm event associated with a specific quantity of stormwater runoff.

Table 7: Culvert Performance for Predicted Future Conditions

Location	Type	Conveys (yes/no)					
		2-Year Event	5-Year Event	10-Year Event	25-Year Event	50-Year Event	100-Year Event
Site A	24-inch PVC 30-inch RCP	Yes	Yes	Yes	No	No	No
Site B	Double 36-inch RCP	No	No	No	No	No	No
Site C	15-inch RCP	Yes	No	No	No	No	No

Source: NPS, 2005

ENVIRONMENTAL CONSEQUENCES

Definition of Intensity Levels

For the purposes of analyzing potential impacts to hydrology and hydraulics (streamflow characteristics), the thresholds of change for the intensity of an impact are defined as follows:

Negligible: Streamflow characteristics (e.g., channel morphology, flow rate, erodibility, and sedimentation) would not be affected, or changes would be either non-detectable or if detected, would have effects that would be considered slight and local.

Minor: Changes in stream channel characteristics would be measurable, although the changes would be small and the effects would be localized. No mitigation measures associated with water quality or hydrology would be necessary.

Moderate: Changes in stream channel characteristics would be measurable and have both localized and regional scale impacts. Mitigation measures would be necessary and the measures would likely succeed.

Major: Changes in stream channel characteristics would be readily measurable and would have substantial consequences on a local and regional level. Mitigation measures to offset the adverse effects would be required to reduce impacts, though long-term changes to the stream channel would be expected.

SITE A

Alternative 1 - No Action

Under the No Action Alternative, hydraulic capacity of the culvert at Site A would not be increased. The culvert system would continue to restrict stormwater flows resulting in periodic flooding of the Parkway and potential safety risks to drivers. This altered flow regime could result in disturbances to the channel at Site A and locations downstream (e.g., scouring, bank incision, or altered channel depth and/or width). The No Action Alternative would result in moderate, long-term, adverse impacts to hydrology and hydraulics.

Cumulative: According to the 2005 watershed study, planned future development in the Papermill Creek watershed would lead to increased flows at Site A (NPS, 2005a). For the 25-year event, flows would increase by about 33 percent (from about 65 cubic feet per second [cfs] [existing condition] to 86 cfs [following development of Colonial Williamsburg Foundation Planning Area]). The culvert at this location would no longer be able to convey flows associated with the 25-year event. Flooding problems and channel disturbance would worsen under this future scenario. Cumulative adverse impacts to hydrology and hydraulics would occur.

Conclusion: The No Action Alternative would result in moderate, long-term, adverse effects to hydrology and hydraulics because the inadequate capacity of the Site A culvert would not be addressed, allowing flooding to continue. Cumulative adverse effects are expected.

Because there would be no major adverse impact to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's establishing legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment or park resources or values related to hydrology and hydraulics.

Alternative 2 - Replace Existing 24-inch Culvert with 30-inch RCP

Under Alternative 2, the capacity of the Site A culvert would be increased to convey design storm flows under anticipated future conditions. Bank stabilization and erosion control measures would also be implemented under this alternative. These measures would reduce flooding and channel disturbances, resulting in a long-term, beneficial impact on hydrology and hydraulics. All work would be completed in accordance with Virginia's Erosion and Sediment Control Law. Because this alternative does not include additions of impervious surface to the Parkway (which would increase runoff and flows to the watershed), NPS would not be required to implement any stormwater improvements under the Virginia Stormwater Management Act (NPS, 2005a).

Cumulative: Other past, current, and future development activities in the project area would increase stormwater runoff flooding in the watershed. Since Alternative 2 would improve drainage and help to control flooding, it is expected that this alternative would help alleviate the adverse cumulative impacts of future development in the project area.

Conclusion: Alternative 2 would result in long-term, beneficial impacts on hydrology and hydraulics, and no cumulative adverse impacts are expected; therefore, no impairment to park resources would occur.

Alternative 3 - Add Parallel 24-inch RCP

Under Alternative 3, the capacity of the Site A culvert would be increased to convey design storm flows under anticipated future conditions. Bank stabilization and erosion control measures would also be implemented under this alternative. These measures would reduce flooding and channel disturbances, resulting in a long-term, beneficial impact on hydrology and hydraulics. All work would be completed in accordance with Virginia's Erosion and Sediment Control Law. Because this alternative does not include additions of impervious surface to the Parkway (which would increase runoff and flows to the watershed), NPS would not be required to implement any stormwater improvements under the Virginia Stormwater Management Act (NPS, 2005a).

Cumulative: Other past, current, and future development activities in the project area would increase stormwater runoff flooding in the watershed. Since Alternative 3 would improve drainage and help control flooding, it is expected that this alternative would help alleviate the adverse cumulative impacts of future development in the project area.

Conclusion: Alternative 3 would result in long-term, beneficial impacts on hydrology and hydraulics, and no cumulative adverse impacts are expected; therefore, no impairment to park resources would occur.

SITE B

Alternative 1 - No Action

No Action Alternative

The culvert at Site B is the most critical of the Papermill Creek watershed culvert system because it conveys the majority of the stormwater flows. The Papermill Creek Watershed Study indicates that this culvert is

drastically undersized, creating a storage condition and build-up of headwater upstream (NPS, 2005a). At peak flow state, the basin outflow overtops the roadway.

Under the No Action Alternative, hydraulic capacity of the culvert at Site B would not be increased. The culvert system would continue to inadequately pass flows, resulting in periodic flooding of the Parkway and potential safety risks to drivers. This altered flow regime could result in disturbances to the channel at Site B and locations downstream. The No Action Alternative would result in moderate, long-term, adverse impacts to hydrology and hydraulics.

Cumulative: Planned future development in the watershed would increase stormwater runoff to Papermill Creek, putting additional pressure on the Parkway culvert system. For the 25-year event, flows would increase by about 9 percent (from about 767 cfs [existing condition] to about 836 cfs [following development of Colonial Williamsburg Foundation Planning Area]). Flooding problems and channel disturbance are expected to worsen under this future scenario, and cumulative adverse impacts to hydrology and hydraulics would occur.

Conclusion: The No Action Alternative would result in moderate, long-term, adverse effects to hydrology and hydraulics because the inadequate capacity of the Site B culvert would not be addressed, allowing flooding to continue. Cumulative adverse effects are expected.

Because there would be no major adverse impact to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's establishing legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment or park resources or values related to hydrology and hydraulics.

Alternative 2 – Replace Existing Culvert with CON-SPAN Structure

Under Alternative 2, the capacity of the Site B culvert would be increased to convey design storm flows under anticipated future conditions. Bank stabilization and erosion control measures would also be implemented under this alternative. These measures would reduce flooding and channel disturbances, resulting in a long-term, beneficial impact on hydrology and hydraulics. All work would be completed in accordance with Virginia's Erosion and Sediment Control Law. Because this alternative does not include any new construction or the addition of impervious surface to the Parkway (which would increase runoff and flows to the watershed), NPS would not be required to implement any stormwater improvements under the Virginia Stormwater Management Act (NPS, 2005a).

Cumulative: Other past, current, and future development activities in the project area would increase stormwater runoff flooding in the watershed. Since Alternative 2 would improve drainage and help to control flooding, it is expected that this alternative would help to alleviate the adverse cumulative impacts of future development in the project area.

Conclusion: Alternative 2 would result in long-term, beneficial impacts on hydrology and hydraulics, and no cumulative adverse impacts are expected; therefore, no impairment to park resources would occur.

Alternative 3 – Add Parallel Culvert System

Under Alternative 3, the capacity of the Site B culvert would be increased to convey design storm flows under anticipated future conditions. Bank stabilization and erosion control measures would also be implemented under this alternative. These measures would reduce flooding and channel disturbances, resulting in a long-term, beneficial impact on hydrology and hydraulics. All work would be completed in accordance with Virginia's Erosion and Sediment Control Law. Because this alternative does not include any new construction or the addition of impervious surface to the Parkway (which would increase runoff and flows to the watershed), NPS would not be required to implement any stormwater improvements under the Virginia Stormwater Management Act (NPS, 2005a).

Cumulative: Other past, current, and future development activities in the project area would increase stormwater runoff flooding in the watershed. Since Alternative 3 would improve drainage and help control flooding, it is expected that this alternative would help alleviate the adverse cumulative impacts of future development in the project area.

Conclusion: Alternative 3 would result in long-term, beneficial impacts on hydrology and hydraulics, and no cumulative adverse impacts are expected; therefore, no impairment to park resources would occur.

SITE C

Alternative 1 - No Action

Under the No Action Alternative, hydraulic capacity of the culvert at Site C would not be increased. The culvert system would continue to inadequately pass design storm flows, resulting in periodic flooding of the Parkway and potential safety risks to drivers. This altered flow regime could result in disturbances to the channel at Site C and locations downstream. The No Action Alternative would result in moderate, long-term, adverse impacts to hydrology and hydraulics.

Cumulative: The planned development within Colonial Williamsburg Foundation Planning Area would not greatly increase streamflows at Site C (NPS, 2005a); however, it is likely that other regional developments would put additional pressure on the Parkway culvert system. Flooding problems and channel disturbance are expected to worsen under this future scenario, and cumulative adverse impacts to hydrology and hydraulics would occur.

Conclusion: The No Action Alternative would result in moderate, long-term, adverse effects to hydrology and hydraulics because the inadequate capacity of the Site C culvert would not be addressed, allowing flooding to continue. Cumulative adverse effects are expected.

Because there would be no major adverse impact to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's establishing legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment or park resources or values related to hydrology and hydraulics.

Alternative 2 - Replace Existing Culvert with 24-inch RCP

Under Alternative 2, the capacity of the Site C culvert would be increased to convey design storm flows under anticipated future conditions. Bank stabilization and erosion control measures would also be implemented under this alternative. These measures would reduce flooding and channel disturbances, resulting in a long-term, beneficial impact on hydrology and hydraulics. All work would be completed in accordance with Virginia's Erosion and Sediment Control Law. Because this alternative does not include any new construction or the addition of impervious surface to the Parkway (which would increase runoff and flows to the watershed), NPS would not be required to implement any stormwater improvements under the Virginia Stormwater Management Act (NPS, 2005a).

Cumulative: Other past, current, and future development activities in the project area would increase stormwater runoff flooding in the watershed. Since Alternative 3 would improve drainage and help control flooding, it is expected that this alternative would help alleviate the adverse cumulative impacts of future development in the project area.

Conclusion: Alternative 2 would result in long-term, beneficial impacts on hydrology and hydraulics, and no cumulative adverse impacts are expected; therefore, no impairment to park resources would occur.

Alternative 3 – Install Parallel 24-inch RCP

Under Alternative 3, the capacity of the Site C culvert would be increased to convey design storm flows under anticipated future conditions. Bank stabilization and erosion control measures would also be implemented

under this alternative. These measures would reduce flooding and channel disturbances, resulting in a long-term, beneficial impact on hydrology and hydraulics. All work would be completed in accordance with Virginia's Erosion and Sediment Control Law. Because this alternative does not include any new construction or the addition of impervious surface to the Parkway (which would increase runoff and flows to the watershed), NPS would not be required to implement any stormwater improvements under the Virginia Stormwater Management Act (NPS, 2005a).

Cumulative: Other past, current, and future development activities in the project area would increase stormwater runoff flooding in the watershed. Since Alternative 3 would improve drainage and help control flooding, it is expected that this alternative would help alleviate the adverse cumulative impacts of future development in the project area.

Conclusion: Alternative 3 would result in long-term, beneficial impacts on hydrology and hydraulics, and no cumulative adverse impacts are expected; therefore, no impairment to park resources would occur.

FLOODPLAINS

AFFECTED ENVIRONMENT

According to the Flood Insurance Rate Map (FIRM), Community Panel Number 5102940005B, published by the Federal Emergency Management Agency (FEMA), the proposed project area, including Sites A, B, and C, is located within the 100-year floodplain (FEMA, 1994). The 100-year floodplain designates the area inundated during a storm having a 1.0 percent chance of occurring in any given year.

Executive Order (EO) 11988 (Floodplain Management) requires Federal agencies to minimize occupancy of and modification to floodplains. Specifically, the EO prohibits Federal agencies from funding construction in the 100-year floodplain unless there are no practicable alternatives.

NPS guidance (Procedural Manual 77-2) requires the preparation of a Statement of Finding (SOF) for actions within a regulatory floodplain. The SOF must describe the action, describe the flood risk, justify use of the floodplain, and describe flood mitigation plans. A copy of the completed SOF is included in Appendix D.

ENVIRONMENTAL CONSEQUENCES

Definition of Intensity Levels

For the purposes of analyzing potential impacts to water resources, the thresholds of change for the intensity of an impact are defined as follows:

Negligible: Floodplains would not be affected, or changes would be either non-detectable or if detected, would have effects that would be considered slight and local.

Minor: Changes in floodplains would be measurable, although the changes would be small and the effects would be localized. No mitigation measures associated with water quality or hydrology would be necessary.

Moderate: Changes in floodplains would be measurable and would be relatively local. Mitigation measures associated with water quality or hydrology would be necessary and the measures would likely succeed.

Major: Changes in floodplains would be readily measurable and would have substantial consequences, which would be measurable and widespread. Mitigation measures to offset the adverse effects would be required, extensive, and the success of the mitigation measures would not be guaranteed.

SITE A

Alternative 1 - No Action

Under the No Action Alternative, no measures would be taken to alleviate flooding in the Papermill Creek watershed. Flooding would continue to degrade roadways, negatively impacting driver safety and historic Parkway structures. However, no changes to the floodplain are anticipated and no construction would occur within the floodplain; therefore, the No Action Alternative would result in no floodplain impacts.

Cumulative Impacts: The implementation of the No Action Alternative would have no direct impacts to floodplains; therefore, no cumulative impacts would occur.

Conclusion: No direct or cumulative impacts to floodplains would occur under this alternative; therefore, no impairment to floodplains would occur.

Alternative 2 - Replace Existing 24-inch Culvert with 30-inch RCP

Under Alternative 2, construction would occur within the 100-year floodplain. Since the existing culvert system at Site A is located in the floodplain, it is not practicable to upgrade the system without performing work in the floodplain. During construction activities, negligible, short-term, localized impacts to the floodplain would occur as the result of the temporary movement of excavated fill material during culvert removal and installation.

Alternative 2 would decrease the risk to visitors and damage to the roadway associated with flooding by increasing the channel's capacity to convey floodwaters. Hydrologic and hydraulic analyses have concluded that the project would not impact the downstream channel. In the long-term, beneficial impacts at the local project site would occur with the reduction of the flood hazard.

Cumulative: The alternative is designed specifically to address the cumulative impacts of increased stormwater flows as a result of increases in regional development. Hydrology and hydraulic analysis show that the implementation of this alternative would reduce the flood hazard at the project site without adversely impacting downstream channels. Long-term, beneficial cumulative impacts are anticipated.

Conclusion: During construction activities, negligible, short-term, localized impacts to the floodplain would occur as a result of the temporary movement of excavated fill material during culvert removal and installation. Long-term, beneficial cumulative impacts are anticipated. The impacts to the floodplain would not result in impairment.

Alternative 3 - Add Parallel 24-inch RCP

Under Alternative 3, construction would occur within the 100-year floodplain. Since the existing culvert system at Site A is located in the floodplain, it is not practicable to upgrade the system without performing work in the floodplain. During construction activities, negligible, short-term, localized impacts to the floodplain would occur as the result of the temporary movement of excavated fill material during culvert removal and installation.

Alternative 3 would decrease the risk to visitors and damage to the roadway associated with flooding by increasing the channel's capacity to convey floodwaters. Hydrologic and hydraulic analyses have concluded that the project would not impact the downstream channel. In the long-term, beneficial impacts at the local project site would occur with the reduction of the flood hazard.

Cumulative: The alternative is designed specifically to address the cumulative impacts of increased stormwater flows as a result of increases in regional development. Hydrology and hydraulic analysis show that the implementation of this alternative would reduce the flood hazard at the project site without adversely impacting downstream channels. Long-term, beneficial cumulative impacts are anticipated.

Conclusion: During construction activities, negligible, short-term, localized impacts to the floodplain would occur as the result of the temporary movement of excavated fill material during culvert removal and

installation. Long-term, beneficial cumulative impacts are anticipated. The impacts to the floodplain would not result in impairment.

SITE B

Alternative 1 - No Action

Under the No Action Alternative, no measures would be taken to alleviate flooding in the Papermill Creek watershed. Flooding would continue to degrade roadways, negatively impacting driver safety and historic Parkway structures. However, no changes to the floodplain are anticipated and no construction would occur within the floodplain; therefore, the No Action Alternative would result in no floodplain impacts.

Cumulative Impacts: The implementation of the No Action Alternative would have no direct impacts to floodplains; therefore, no cumulative impacts would occur.

Conclusion: No direct or cumulative impacts to floodplains would occur under this alternative; therefore, no impairment to floodplains would occur.

Alternative 2 – Replace Existing Culvert with CON-SPAN Structure

Under Alternative 2, construction would occur within the 100-year floodplain. Since the existing culvert system at Site B is located in the floodplain, it is not practicable to upgrade the system without performing work in the floodplain. During construction activities, negligible, short-term, localized impacts to the floodplain would occur as the result of the temporary movement of excavated fill material during culvert removal and installation.

Alternative 2 would decrease the risk to visitors and damage to the roadway associated with flooding by increasing the channel's capacity to convey floodwaters. Hydrologic and hydraulic analyses have concluded that the project would not impact the downstream channel. In the long-term, beneficial impacts at the local project site would occur with the reduction of the flood hazard.

Cumulative: The alternative is designed specifically to address the cumulative impacts of increased stormwater flows as a result of increases in regional development. Hydrology and hydraulic analysis show that the implementation of this alternative would reduce the flood hazard at the project site without adversely impacting downstream channels. Long-term, beneficial cumulative impacts are anticipated.

Conclusion: During construction activities, negligible, short-term, localized impacts to the floodplain would occur as a result of the temporary movement of excavated fill material during culvert removal and installation. Long-term, beneficial cumulative impacts are anticipated. The impacts to the floodplain would not result in impairment.

Alternative 3 – Add Parallel Culvert System

Under Alternative 3, construction would occur within the 100-year floodplain. Since the existing culvert system at Site B is located in the floodplain, it is not practicable to upgrade the system without performing work in the floodplain. During construction activities, negligible, short-term, localized impacts to the floodplain would occur as the result of the temporary movement of excavated fill material during culvert removal and installation.

Alternative 3 would decrease the risk to visitors and damage to the roadway associated with flooding by increasing the channel's capacity to convey floodwaters. Hydrologic and hydraulic analyses have concluded that the project would not impact the downstream channel. In the long-term, beneficial impacts at the local project site would occur with the reduction of the flood hazard.

Cumulative: The alternative is designed specifically to address the cumulative impacts of increased stormwater flows as a result of increases in regional development. Hydrology and hydraulic analysis show that the implementation of this alternative would reduce the flood hazard at the project site without adversely impacting downstream channels. Long-term, beneficial cumulative impacts are anticipated.

Conclusion: During construction activities, negligible, short-term, localized impacts to the floodplain would occur as the result of the temporary movement of excavated fill material during culvert removal and installation. Long-term, beneficial cumulative impacts are anticipated. The impacts to the floodplain would not result in impairment.

Cumulative effects are expected. The impacts to the floodplain would not result in impairment.

SITE C

Alternative 1 - No Action

Under the No Action Alternative, no measures would be taken to alleviate flooding in the Papermill Creek watershed. Flooding would continue to degrade roadways, negatively impacting driver safety and historic Parkway structures. However, no changes to the floodplain are anticipated and no construction would occur within the floodplain; therefore, the No Action Alternative would result in no floodplain impacts.

Cumulative Impacts: The implementation of the No Action Alternative would have no direct impacts to floodplains; therefore, no cumulative impacts would occur.

Conclusion: No direct or cumulative impacts to floodplains would occur under this alternative; therefore, no impairment to floodplains would occur.

Alternative 2 - Replace Existing Culvert with 24-inch RCP

Under Alternative 2, construction would occur within the 100-year floodplain. Since the existing culvert system at Site C is located in the floodplain, it is not practicable to upgrade the system without performing work in the floodplain. During construction activities, negligible, short-term, localized impacts to the floodplain would occur as a result of the temporary movement of excavated fill material during culvert removal and installation.

Alternative 2 would decrease the risk to visitors and damage to the roadway associated with flooding by increasing the channel's capacity to convey floodwaters. Hydrologic and hydraulic analyses have concluded that the project would not impact the downstream channel. In the long-term, beneficial impacts at the local project site would occur with the reduction of the flood hazard.

Cumulative: The alternative is designed specifically to address the cumulative impacts of increased stormwater flows as a result of increases in regional development. Hydrology and hydraulic analysis show that the implementation of this alternative would reduce the flood hazard at the project site without adversely impacting downstream channels. Long-term, beneficial cumulative impacts are anticipated.

Conclusion: During construction activities, negligible, short-term, localized impacts to the floodplain would occur as a result of the temporary movement of excavated fill material during culvert removal and installation. Long-term, beneficial cumulative impacts are anticipated. The impacts to the floodplain would not result in impairment.

Alternative 3 – Install Parallel 24-inch RCP

Under Alternative 3, construction would occur within the 100-year floodplain. Since the existing culvert system at Site C is located in the floodplain, it is not practicable to upgrade the system without performing work in the floodplain. During construction activities, negligible, short-term, localized impacts to the floodplain would occur as a result of the temporary movement of excavated fill material during culvert removal and installation.

Alternative 3 would decrease the risk to visitors and damage to the roadway associated with flooding by increasing the channel's capacity to convey floodwaters. Hydrologic and hydraulic analyses have concluded that the project would not impact the downstream channel. In the long-term, beneficial impacts at the local project site would occur with the reduction of the flood hazard.

Cumulative: The alternative is designed specifically to address the cumulative impacts of increased stormwater flows as a result of increases in regional development. Hydrology and hydraulic analysis show that the implementation of this alternative would reduce the flood hazard at the project site without adversely impacting downstream channels. Long-term, beneficial cumulative impacts are anticipated.

Conclusion: During construction activities, negligible, short-term, localized impacts to the floodplain would occur as a result of the temporary movement of excavated fill material during culvert removal and installation. Long-term, beneficial cumulative impacts are anticipated. The impacts to the floodplain would not result in impairment.

WETLANDS

AFFECTED ENVIRONMENT

EO 11990 (Protection of Wetlands) requires Federal agencies to minimize the loss of wetlands and consider direct and indirect impacts on wetlands that may result from federally funded actions. Jurisdictional waters of the United States, including wetlands, are protected under Section 404 of the CWA. The USACE and U.S. Environmental Protection Agency (EPA) jointly define wetlands as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (USACE, 33 CFR 328.3 and EPA, 40 CFR 230.3). For purposes of compliance with EO 11990, the NPS uses "Classification of Wetlands and Deepwater Habitats of the United States" (FWS/OBS-79/31; Cowardin et al. 1979) as the standard for defining, classifying, and inventorying wetlands (NPS Director's Order (DO) 77-1: Wetland Protection; and Wetland Protection Procedural Manual 77-1).

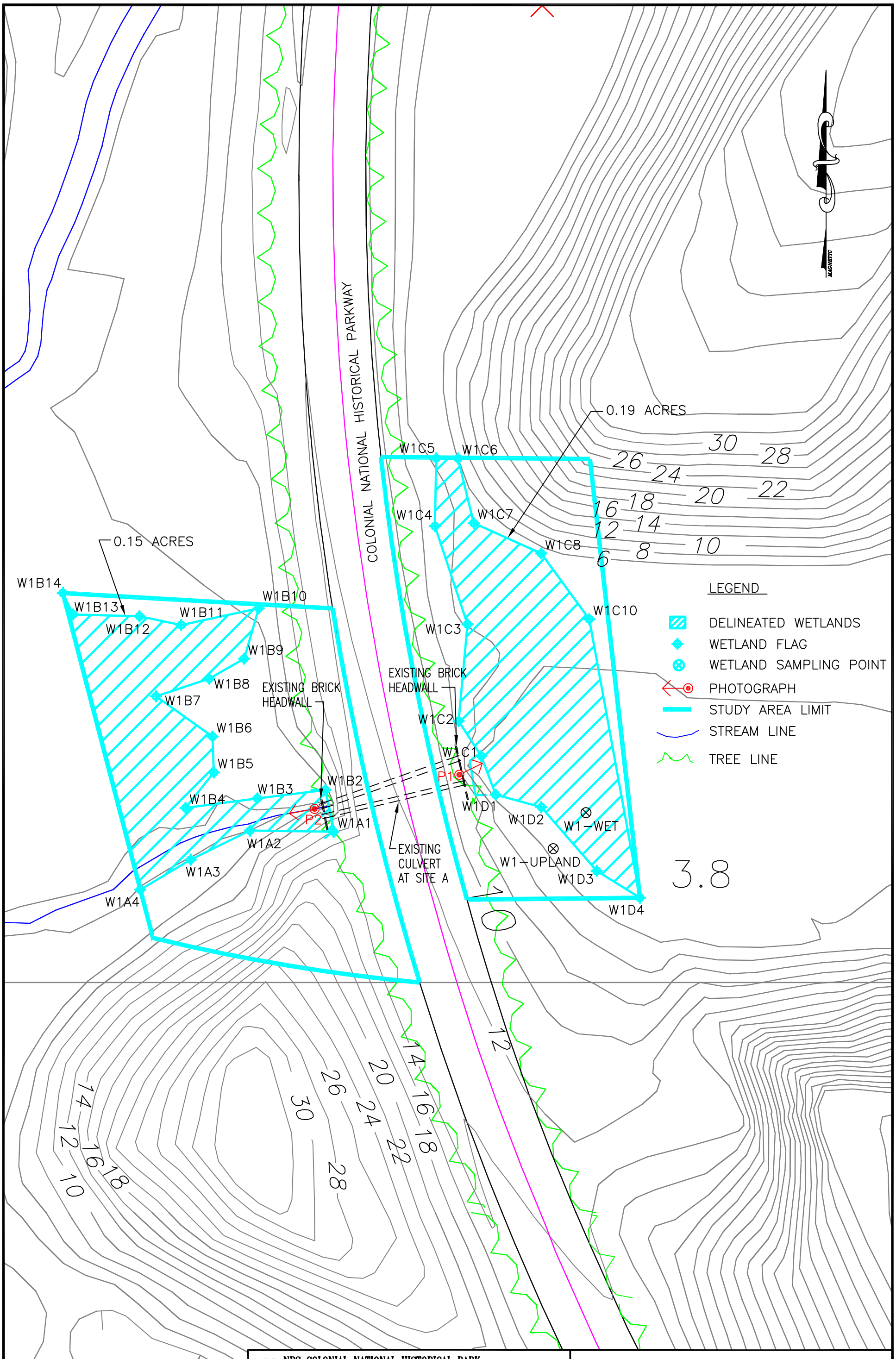
A SOF for Wetland Protection was not prepared for this project because minor culvert repairs qualify as exempt based on the Procedural Manual 77-1. However, the proposed action must still comply with conditions of Executive Order 11990 Wetland Protection and Director's Order 77-1 Wetland Protection.

NPS retained URS to delineate wetlands near the three project sites. On June 28, 2005, URS conducted a field delineation according to the USACE *Wetland Delineation Manual* (USACE, 1987) and the NPS Wetland Protection Procedural Manual #77-1. Palustrine forested broad-leaved deciduous seasonally flooded/saturated (PFO1A) wetlands were observed within each of the proposed project sites on both the upstream and downstream sides of the Parkway. The wetland vegetation composition at each of the three project sites was similar. Dominant tree species are red maple (*Acer rubrum*) and sycamore (*Plantanus occidentalis*); dominant understory shrubs include spicebush (*Lindera benzoin*) and American hornbeam (*Carpinus caroliniana*); rice cut-grass (*Leersia oryzoides*), lizard's tail (*Saururus cernuus*), and stinging nettle (*Urtica dioica*) are the dominant herbaceous layer species. The wetland/upland boundaries were flagged, and the positions of the flags were surveyed using a Trimble GeoExplorer global positioning system (GPS).

On June 29, 2005, USACE Regulatory Specialist, Cara Sydnor, conducted a site visit of the project site and reviewed the wetland boundary flagged by URS. In a letter dated June 30, 2005, the USACE confirmed that the wetland boundary flagged in the field was verified during the June 29, 2005 site visit. A copy of the Wetland Investigation Report was sent to USACE on December 16, 2005 to request a final JD. In a letter dated January 11, 2006, USACE issued a final JD confirming the boundaries of the wetland as stated in the Wetland Investigation Report (Appendix E).

In addition, URS conducted a function and values assessment of the forested wetlands in the vicinity of the project area. The wetlands functions and values were assessed according to "A Technique for the Functional Assessment of Nontidal Wetlands in the Coastal Plain of Virginia" (Virginia Institute of Marine Science [VIMS] Method) (Bradshaw, 1991). Eight functions and values are characterized by the VIMS Method: flood

storage and storm flow modification, nutrient retention and transformation, sediment trapping, toxicant trapping, sediment stabilization, wildlife habitat, aquatic habitat, and public use. The wetlands at Sites A, B, and C were rated "high" for flood storage and flow modification indicating their ability to retain flood waters and allow for ponding. The wetlands were also rated "high" for public use given their proximity to parking areas and interpretative placards making them visible to Parkway users. The remaining values were assigned scores of "moderate" to "low." The results of the function and values assessment are presented in Appendix E. Maps of the wetland areas are included as Figures 12a and 12b.



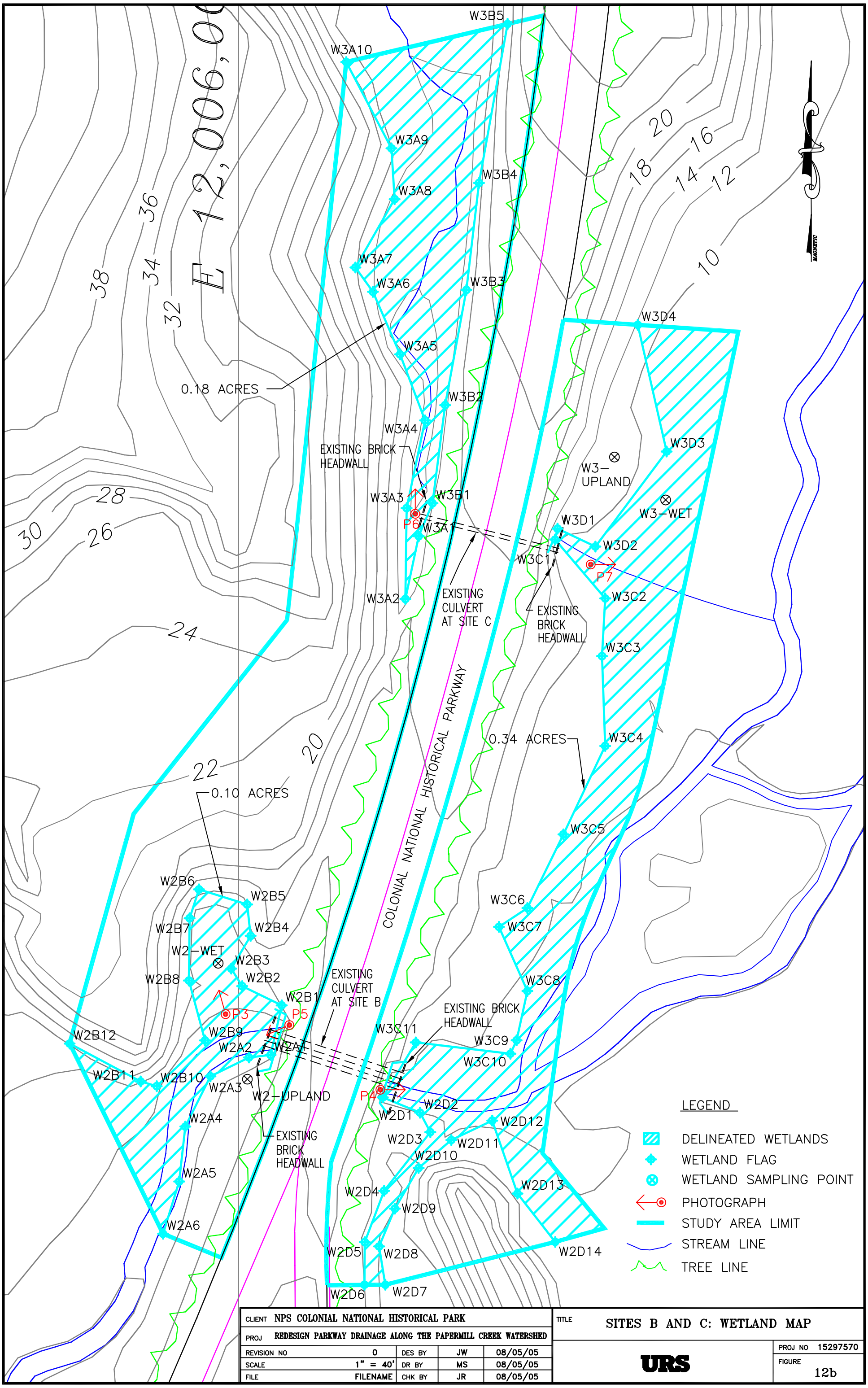
CLIENT	NPS COLONIAL NATIONAL HISTORICAL PARK			
PROJ	REDESIGN PARKWAY DRAINAGE ALONG THE PAPERMILL CREEK WATERSHED			
REVISION NO	0	DES BY	JW	08/05/05
SCALE	1" = 40'	DR BY	MS	08/05/05
FILE	FILENAME	CHK BY	JR	08/05/05

TITLE: SITE A: WETLAND MAP

URS

PROJ NO 15297570

FIGURE 12a



CLIENT	NPS COLONIAL NATIONAL HISTORICAL PARK			
PROJ	REDESIGN PARKWAY DRAINAGE ALONG THE PAPERMILL CREEK WATERSHED			
REVISION NO	0	DES BY	JW	08/05/05
SCALE	1" = 40'	DR BY	MS	08/05/05
FILE	FILENAME	CHK BY	JR	08/05/05

TITLE: SITES B AND C: WETLAND MAP

URS

PROJ NO 15297570

FIGURE 12b

ENVIRONMENTAL CONSEQUENCES

According to the NPS *Procedural Manual # 77-1: Wetland Protection*, NPS policy is to avoid adverse wetland impacts wherever practical. If wetland impacts are not avoidable, then NPS must minimize the wetland impacts to the extent practicable by designing or modifying the actions or facilities to minimize the wetland degradation or loss and then by using Best Management Practices or mitigation for activities in or affecting wetlands. After avoidance and minimization have been applied to the maximum extent practicable, remaining wetland degradation or loss must be offset through wetland compensation, which means that wetland restoration must, at a minimum, provide for a one-to-one wetland function replacement, as stated in the NPS No Net Loss of Wetland Policy.

Avoidance of wetland impacts is not practical, since the proposed improvements are water-dependent activities. The construction footprint of disturbance has been minimized to the greatest extent practicable for all three project sites. A SOF for Wetland Protection was not prepared for this project because minor culvert repairs qualify as an excepted action based on Procedural Manual 77-1.

Definition of Intensity Levels

The thresholds of change for the intensity of impacts on wetlands are defined as follows:

Negligible: No measurable or perceptible changes in wetland size, integrity, or continuity would occur.

Minor: The impact would be measurable or perceptible, but slight. A small change in size (less than 0.1 acre), integrity, or continuity could occur due to short-term, indirect effects such as construction related runoff. However, the overall viability of the resource would not be affected.

Moderate: The impact would be sufficient to cause a measurable change in the size, integrity, or continuity of the wetland or would result in a small (between 0.1 acre and 1.0 acre) but permanent loss or gain in wetland acreage.

Major: The action would result in a measurable change in all three parameters (size, integrity, and continuity) or a permanent loss of large wetland areas (greater than 1.0 acre). The impact would be substantial and highly noticeable.

SITE A

Alternative 1 - No Action

Under the No Action Alternative, the existing culverts would remain and would not be replaced or rehabilitated. No direct impacts to wetlands would occur because no construction-related land disturbance or fill would occur.

Cumulative – As development in the Williamsburg region continues, quantities of stormwater entering the Papermill Creek watershed are expected to increase. This would put increased pressure on creek channels and result in potentially higher velocity flows, with some increase in sedimentation and erosion. Area wetlands may experience continued, limited increase in siltation, with negligible to minor, long-term, adverse impacts.

Conclusion – No direct impacts to wetlands would occur as none would be filled or disturbed under the No Action Alternative. Over time, increases in sedimentation and erosion may result in a minor, adverse, long-term, cumulative fill of wetlands. The impacts to wetlands would not result in impairment.

Alternative 2 - Replace Existing 24-inch Culvert with 30-inch RCP

Under this alternative, minor short- and long-term impacts to wetlands would occur. The proposed improvement would necessitate construction directly in and adjacent to the stream channel on upstream and downstream sides of the culvert. Short-term impacts associated with this alternative include increased turbidity

downstream during construction. In addition, vegetation within and on the stream banks would be removed. The placement of riprap within and along the stream banks would result in negligible impacts to the wetland. Impacts to wetland vegetation are expected to be minor. It is estimated that the temporary construction area of disturbance would be about 960 sf (0.022 acres) with about 110 sf (0.0025 acres) of jurisdictional wetland impacted. The impacts would not change the wetland functions or values. Compensation would not be required for the culvert replacement; however, BMPs would be employed to minimize short-term, adverse impacts such as turbidity.

Cumulative – The temporary fill of 0.0025 acres of wetlands would have a negligible impact on the total cumulative wetland impacts from development in the Williamsburg region.

Conclusion – Because there would be no major adverse impacts to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's establishing legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of park resources or values related to wetlands.

Alternative 3 - Add Parallel 24-inch RCP

Under this alternative, minor short- and long-impacts to wetlands would occur. The proposed improvement would necessitate construction directly in and adjacent the stream channel on upstream and downstream sides of the culvert. Short-term impacts associated with this alternative include increased turbidity downstream during construction. In addition, vegetation within and on the stream banks would be removed. The placement of riprap within and along the stream banks would result in minor long-term impacts to the wetland. It is estimated that the temporary construction area of disturbance would be about 800 sf (0.018 acres) with about 30 sf (0.0007 acres) of jurisdictional wetland impacted. The impacts would not change the wetland functions or values. Compensation would not be required for the additional culvert construction; however, BMPs would be employed to minimize short-term, adverse impacts such as turbidity.

Cumulative – The temporary fill of 0.001 acres of wetlands would have a negligible impact on the total cumulative wetland impacts from development in the Williamsburg region.

Conclusion – Because there would be no major adverse impacts to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's establishing legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of park resources or values related to wetlands.

SITE B

Alternative 1 - No Action

Under the No Action Alternative, the existing culverts would remain and would not be replaced or rehabilitated. No direct impacts to wetlands would occur because no construction-related land disturbance or fill would occur.

Cumulative – As development in the Williamsburg region continues, quantities of stormwater entering the Papermill Creek watershed are expected to increase. This would put increased pressure on creek channels and result in potentially higher velocity flows with some increase in sedimentation and erosion. Area wetlands may experience continued, limited increase in siltation, with negligible to minor, long-term, adverse impacts.

Conclusion – No direct impacts to wetlands would occur, as none would be filled or disturbed under the No Action Alternative. Over time, increases in sedimentation and erosion may result in a minor, adverse, long-term, cumulative fill of wetlands. The impacts to wetlands would not result in impairment.

Alternative 2 – Replace Existing Culvert with CON-SPAN Structure

Under this alternative, minor short- and long-term impacts to wetlands would occur. The proposed improvement would necessitate construction directly in and adjacent the stream channel on upstream and downstream sides of the culvert. Short-term impacts associated with this alternative include increased turbidity downstream during construction. In addition, vegetation within and on the stream banks would be removed. The construction of an upstream and downstream headwall and the placement of riprap within and along the stream banks would result in minor long-term impacts to the wetland. . It is estimated that the temporary construction area of disturbance would be about 1,600 sf (0.037 acres) with about 1,000 sf (0.023 acres) of jurisdictional wetland impacted. The impacts would not change the wetland functions or values. Compensation would not be required for the culvert replacement construction; however, BMPs would be employed to minimize short-term, adverse impacts such as turbidity. .

Cumulative – The temporary fill of 0.023 acres of wetlands would have a negligible impact on the total cumulative wetland impacts from development in the Williamsburg.

Conclusion – Because there would be no major adverse impacts to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's establishing legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of park resources or values related to wetlands. The impacts to the Parkway would not result in impairment.

Alternative 3 – Add Parallel Culvert System

Under this alternative, minor short- and long-term impacts to wetlands would occur. The proposed improvement would necessitate construction directly in and adjacent the stream channel on upstream and downstream sides of the culvert. Short-term impacts associated with this alternative include increased turbidity downstream during construction. In addition, vegetation within and on the stream banks would be removed. The construction of an upstream and downstream headwall, and the placement of riprap within and along the stream banks would result in minor long-term impacts to the wetland. . It is estimated that the temporary construction area of disturbance would be about 6,000 sf (0.14 acres) with about 500 sf (0.011 acres) of jurisdictional wetland impacted. The impacts would not change the wetland functions or values. Compensation would not be required for the additional culvert construction; however, BMPs would be employed to minimize short-term, adverse impacts such as turbidity.

Cumulative – The temporary fill of 0.011 acres of wetlands would have a negligible impact on the total cumulative wetland impacts from development in the Williamsburg region

Conclusion – Because there would be no major adverse impacts to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's establishing legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of park resources or values related to wetlands.

SITE C

Alternative 1 - No Action

Under the No Action Alternative, the existing culverts would remain and would not be replaced or rehabilitated. No direct impacts to wetlands would occur because no construction-related land disturbance or fill would occur.

Cumulative – As development in the Williamsburg region continues, quantities of stormwater entering the Papermill Creek watershed are expected to increase. This would put increased pressure on creek channels and result in potentially higher velocity flows with some increase in sedimentation and erosion. Area wetlands may experience continued, limited increase in siltation, with negligible to minor, long-term, adverse impacts.

Conclusion – No direct impacts to wetlands would occur, as none would be filled or disturbed under the No Action Alternative. Over time, increases in sedimentation and erosion may result in a minor, adverse, long-term, cumulative fill of wetlands. The impacts to wetlands would not result in impairment.

Alternative 2 - Replace Existing Culvert with 24-inch RCP

Under this alternative, minor short- and long-term impacts to wetlands would occur. The proposed improvement would necessitate construction directly in and adjacent the stream channel on upstream and downstream sides of the culvert. Short-term impacts associated with this alternative include increased turbidity downstream during construction. In addition, vegetation within and on the stream banks would be removed. The construction of an upstream and downstream headwall and the placement of riprap within and along the stream banks would result in minor long-term impacts to the wetland. . It is estimated that the temporary construction area of disturbance would be about 800 sf (0.018 acres) with about 125 sf (0.003 acres) of jurisdictional wetland impacted. The impacts would not change the wetland functions or values. Compensation would not be required for the culvert replacement construction; however, BMPs would be employed to minimize short-term, adverse impacts such as turbidity. The impacts to the Parkway would not result in impairment.

Cumulative – The temporary fill of 0.003 acres of wetlands would have a negligible impact on the total cumulative wetland impacts from development in the Williamsburg region.

Conclusion – Because there would be no major adverse impacts to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's establishing legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of park resources or values related to wetlands.

Alternative 3 – Install Parallel 24-inch RCP

Under this alternative, minor short- and long-term impacts to wetlands would occur. The proposed improvement would necessitate construction directly in and adjacent the stream channel on upstream and downstream sides of the culvert. Short-term impacts associated with this alternative include increased turbidity downstream during construction. In addition, vegetation within and on the stream banks would be removed. The construction of an upstream and downstream headwall and the placement of riprap within and along the stream banks would result in minor long-term impacts to the wetland. . It is estimated that the temporary construction area of disturbance would be about 800 sf (0.018 acres) with about 125 sf (0.0029 acres) of jurisdictional wetland impacted. The impacts would not change the wetland functions or values. Compensation would not be required for the additional culvert construction; however, BMPs would be employed to minimize short-term, adverse impacts such as turbidity. The impacts to the Parkway would not result in impairment.

Cumulative – The temporary fill of 0.0029 acres of wetlands would have a negligible impact on the total cumulative wetland impacts from development in the Williamsburg region.

Conclusion – Because there would be no major adverse impacts to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's establishing legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant NPS planning documents, there would be no impairment of park resources or values related to wetlands.

VISITOR EXPERIENCE AND RECREATION RESOURCES

AFFECTED ENVIRONMENT

The enjoyment of park resources by visitors is part of the fundamental purpose of all park units, as discussed in the NPS *Management Policies* (2000c). NPS is dedicated to providing quality, park unit-appropriate activities for visitors to enjoy and to maintaining an atmosphere that is open, inviting, and accessible to all segments of society. Additionally, NPS strives to provide opportunities for activities that are uniquely suited and appropriate to the individual natural and cultural resources found in each park unit.

Tourism is the primary activity of Colonial NHP, with transportation being the primary activity along the Parkway. In 2000, 2,665 vehicles used the Parkway in the vicinity of the project area daily in the summer months, when park use is at its peak. The majority of these drivers used the Parkway as a commuter route between I-64 and the residential areas located along the Jamestown peninsula.

Located in the project area two parking overlooks with scenic vistas and interpretive signage and one pinic area. These are the only tourism resources in the project area. The northernmost parking overlook in the project area, known as the Great Oak Parking Overlook, is located to the north of Site C on the eastern side of the Parkway. This overlook is adjacent to the Parkway and was constructed in 1957-58. The area features a scenic vista of an oak tree and two interpretive signs.

The second parking overlook, known as the Papermill Creek Dam Parking Overlook, is located to the south of the Great Oaks Parking Overlook and Sites B and C and to the north of Site A on the eastern side of the Parkway. This overlook is adjacent to the Parkway and was constructed in 1957-58. The area features two interpretive signs, one about the Great Neck area and one about the historic dam that is located on the creek.

The pinic area, known as the Great Neck Picnic Area is located to the south of Site A on the western side of the Parkway. This picnic area is at the end of a looping access road and is currently closed to the public.

Analyses of the potential intensity of impacts on visitor experience and recreation resources were derived from available information on Colonial NHP and the professional judgment of park staff. The thresholds of change for the intensity of impacts on visitor experience and recreation resources are defined as follows:

Negligible: The impact would not be perceptible or would be barely perceptible by most visitors.

Minor: The impact would result in a noticeable change to a few visitors' experiences, but would result in little distraction or improvements in the quality of the experience.

Moderate: The impact would result in a change to a large number of visitors' experiences with a noticeable decrease or improvement in the quality of the experience. This includes impacts that result in a change in frustration level or inconvenience for a period of time.

Major: The impact would result in a substantial change to many visitors' experiences with a severe decrease or substantial improvement in the quality of the experience, such as the addition or removal of a recreational site.

SITE A

Alternative 1 - No Action

Under the No Action Alternative, Site A would continue to flood, making the Parkway, which is a tourist destination and commuter route, impassable during heavy rains and flooding. This will lead to a continued need to close portions of the roadway during heavy flooding, restricting use of Colonial NHP. This in turn will lead to a decrease in the visitor use and experience of the Parkway route as the road cannot be fully used at all times. If corrective measures are not taken to improve the drainage at Site A, moderate, long-term, adverse impacts to visitor experience and recreation resources would continue.

Cumulative Impacts – The increasing amounts of traffic along the Parkway and use of Colonial NHP as a transportation corridor by local residents would make continued closures of the roadway due to heavy rains and flooding a moderate, long-term, adverse impact.

Conclusion – If corrective actions are not taken to improve the drainage at Site A, moderate, long-term, adverse impacts to visitor experience and recreation resources would continue to occur because the roadway will continue to be closed during heavy rains and flooding. Adverse, cumulative impacts would occur. There would be no impairment to park resources or values.

Alternative 2 - Replace Existing 24-inch Culvert with 30-inch RCP

The replacement of the existing 24-inch culvert with a 30-inch RCP would enhance the visitor experience. With improved drainage capacity, there is less likelihood that the Parkway would need to be closed due to heavy rains and flooding making the portion of the roadway at Site A impassable.

Alternative 2 would have the potential for a moderate, short-term, adverse impact on visitor experience and recreation resources during the construction due to the need to remove a portion of the road surface, excavate to remove the existing pipe, and remove the existing headwall. However, construction activities would be scheduled to minimize impacts on traffic during peak hours and reduce traffic delays.

Cumulative Impacts – Upon completion of the construction phase of the project, Alternative 2 would have a moderate, long-term, beneficial impact on visitor experience and recreation resources, as the Parkway would be less prone to flooding and possible closures.

Conclusion – The replacement of the existing 24-inch culvert with a 30-inch RCP would have a moderate, long-term, beneficial impact; however, a moderate, short-term, adverse impact on visitor experience and recreation resources would occur during the construction phase of the project due to traffic delays on the Parkway. However, a long-term, beneficial effect would result, with no impairment to visitor experience and recreation resources.

Because there would be no major adverse impacts to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's enabling legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant planning documents, there would be no impairment of park resources or values related to visitor experience and recreation resources.

Alternative 3 - Add Parallel 24-inch RCP

The addition of a parallel 24-inch RCP adjacent to the existing 24-inch culvert would enhance the visitor experience. With improved drainage capacity, there is less likelihood that the Parkway would need to be closed due to heavy rains and flooding making the portion of the roadway at Site A impassable.

Alternative 3 would have the potential for a moderate, short-term, adverse impact on visitor experience and recreation resources during the construction due to the need to remove a portion of the road surface, excavate to install the new pipe, and modify the existing headwall. However, construction activities would be scheduled to minimize impacts on traffic during peak hours and reduce traffic delays.

Cumulative Impacts – Upon completion of the construction phase of the project, Alternative 3 would have a moderate, long-term, beneficial impact on visitor experience and recreation resources, as the Parkway would be less prone to flooding and possible closures.

Conclusion – The replacement of the existing 24-inch culvert with a 30-inch RCP would have a moderate, long-term, beneficial impact; however, a moderate, short-term, adverse impact on visitor experience and recreation resources would occur during the construction phase of the project due to traffic delays on the Parkway. However, a long-term, beneficial effect would result, with no impairment to visitor experience and recreation resources

Because there would be no major adverse impacts to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's enabling legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant planning documents, there would be no impairment of park resources or values related to visitor experience and recreation resources.

SITE B

Alternative 1 - No Action

Under the No Action Alternative, Site B would continue to flood, making the Parkway, which is the primary recreation resource at this site, impassable during heavy rains and flooding. This will lead to a continued need to close portions of the roadway during heavy flooding, restricting use of Colonial NHP. This in turn will lead to a decrease in the visitor use and experience of the Parkway route. If corrective measures are not taken to improve the drainage at Site B, moderate, long-term, adverse impacts to visitor experience and recreation resources would continue.

Cumulative Impacts – The increasing amounts of traffic along the Parkway and use of Colonial NHP as a transportation corridor by local residents would make continued closures of the roadway due to heavy rains and flooding a moderate, long-term, adverse impact.

Conclusion – If corrective actions are not taken to improve the drainage at Site B, moderate, long-term, adverse impacts to visitor experience and recreation resources would continue to occur because the roadway will continue to be closed during heavy rains and flooding. Adverse, cumulative impacts would occur. There would be no impairment to park resources or values.

Alternative 2 – Replace Existing Culvert with CON-SPAN Structure

The replacement of the existing culvert system with a CON-SPAN structure would enhance the visitor experience. With improved drainage capacity, there is less likelihood that the Parkway would need to be closed due to heavy rains and flooding making the portion of the roadway at Site B impassable.

Alternative 2 would have the potential for a moderate, short-term, adverse impact on visitor experience and recreation resources during the construction due to the need to close a portion of the Parkway in both directions to remove a portion of the road, excavate the existing culvert, and install a pre-cast concrete span. However, construction activities would be scheduled to minimize impacts on traffic during peak hours and reduce traffic delays.

Cumulative Impacts – Upon completion of the construction phase of the project, Alternative 3 would have a moderate, long-term, beneficial impact on visitor experience and recreation resources, as the Parkway would be less prone to flooding and possible closures.

Conclusion – The replacement of the existing 24-inch culvert with a 30-inch RCP would have a moderate, long-term, beneficial impact; however, a moderate, short-term, adverse impact on visitor experience and recreation resources would occur during the construction phase of the project due to traffic delays on the Parkway. However, a long-term, beneficial effect would result, with no impairment to visitor experience and recreation resources

Because there would be no major adverse impacts to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's enabling legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant planning documents, there would be no impairment of park resources or values related to visitor experience and recreation resources.

Alternative 3 – Add Parallel Culvert System

The addition of a parallel culvert system adjacent to the existing culvert system would enhance the visitor experience. With improved drainage capacity, there is less likelihood that the Parkway would need to be closed due to heavy rains and flooding making the portion of the roadway at Site B impassable.

Alternative 3 would have the potential for a moderate, short-term, adverse impact on visitor experience and recreation resources during the construction due to the need to remove a portion of the road surface, excavate to install the new pipe, and modify the existing headwall. However, construction activities would be scheduled to minimize impacts on traffic during peak hours and reduce traffic delays.

Cumulative Impacts – Upon completion of the construction phase of the project, Alternative 3 would have a moderate, long-term, beneficial impact on visitor experience and recreation resources, as the Parkway would be less prone to flooding and possible closures.

Conclusion – The replacement of the existing 24-inch culvert with a 30-inch RCP would have a moderate, long-term, beneficial impact; however, a moderate, short-term, adverse impact on visitor experience and recreation resources would occur during the construction phase of the project due to traffic delays on the Parkway. However, a long-term, beneficial effect would result, with no impairment to visitor experience and recreation resources

Because there would be no major adverse impacts to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's enabling legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant planning documents, there would be no impairment of park resources or values related to visitor experience and recreation resources.

SITE C

Alternative 1 - No Action

Under the No Action Alternative, Site C would continue to flood, making the Parkway, which is the primary recreation resource at this site, impassable during heavy rains and flooding. This will lead to a continued need to close portions of the roadway during heavy flooding, restricting use of Colonial NHP. This in turn will lead to a decrease in the visitor use and experience of the Parkway route. If corrective measures are not taken to improve the drainage at Site C, moderate, long-term, adverse impacts to visitor experience and recreation resources would continue.

Cumulative Impacts – The increasing amounts of traffic along the Parkway and use of Colonial NHP as a transportation corridor by local residents would make continued closures of the roadway due to heavy rains and flooding a moderate, long-term, adverse impact.

Conclusion – If corrective actions are not taken to improve the drainage at Site C, moderate, long-term, adverse impacts to visitor experience and recreation resources would continue to occur because the roadway will continue to be closed during heavy rains and flooding. Adverse, cumulative impacts would occur. There would be no impairment to park resources or values.

Alternative 2 - Replace Existing Culvert with 24-inch RCP

The replacement of the existing culvert with a 24-inch RCP would enhance the visitor experience. With improved drainage capacity, there is less likelihood that the Parkway would need to be closed due to heavy rains and flooding making the portion of the roadway at Site C impassable.

Alternative 2 would have the potential for a moderate, short-term, adverse impact on visitor experience and recreation resources during the construction due to the need to remove a portion of the road surface, excavate to remove the existing pipe, and remove the existing headwall. However, construction activities would be scheduled to minimize impacts on traffic during peak hours and reduce traffic delays.

Cumulative Impacts – Upon completion of the construction phase of the project, Alternative 3 would have a moderate, long-term, beneficial impact on visitor experience and recreation resources, as the Parkway would be less prone to flooding and possible closures.

Conclusion – The replacement of the existing 24-inch culvert with a 30-inch RCP would have a moderate, long-term, beneficial impact; however, a moderate, short-term, adverse impact on visitor experience and recreation resources would occur during the construction phase of the project due to traffic delays on the Parkway. However, a long-term, beneficial effect would result, with no impairment to visitor experience and recreation resources.

Because there would be no major adverse impacts to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's enabling legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant planning documents, there would be no impairment of park resources or values related to visitor experience and recreation resources.

Alternative 3 – Install Parallel 24-inch RCP

The addition of a parallel 24-inch RCP adjacent to the existing culvert would enhance the visitor experience. With improved drainage capacity, there is less likelihood that the Parkway would need to be closed due to heavy rains and flooding making the portion of the roadway at Site C impassable.

Alternative 3 would have the potential for a moderate, short-term, adverse impact on visitor experience and recreation resources during the construction due to the need to remove a portion of the road surface, excavate to install the new pipe, and modify the existing headwall. However, construction activities would be scheduled to minimize impacts on traffic during peak hours and reduce traffic delays.

Cumulative Impacts – Upon completion of the construction phase of the project, Alternative 2 would have a moderate, long-term, beneficial impact on visitor experience and recreation resources, as the Parkway would be less prone to flooding and possible closures.

Conclusion – The replacement of the existing 24-inch culvert with a 30-inch RCP would have a moderate, long-term, beneficial impact; however, a moderate, short-term, adverse impact on visitor experience and recreation resources would occur during the construction phase of the project due to traffic delays on the Parkway. However, a long-term, beneficial effect would result, with no impairment to visitor experience and recreation resources

Because there would be no major adverse impacts to a resource or value whose conservation is: 1) necessary to fulfill specific purposes identified in the park's enabling legislation; 2) key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or 3) identified as a goal in the park's GMP or other relevant planning documents, there would be no impairment of park resources or values related to visitor experience and recreation resources.

CULTURAL RESOURCES

AFFECTED ENVIRONMENT

Section 106 of the National Historic Preservation Act, as amended (16 USC 470 et seq.), Director's Order #28, *Cultural Resource Management Guideline* (NPS, 1998), and the NPS *Management Policies* (2001) all require that consideration be given to the impacts of a proposed project on historic properties that are listed on or eligible to be listed in the National Register of Historic Places (National Register). These policies and regulations require the NPS to consult with the State Historic Preservation Officer regarding the potential effects to properties listed on or eligible for the National Register.

Cultural resources are defined for this document as including archaeological resources, historic structures, and cultural landscapes. Each of these topics is discussed in further detail below.

Archaeological Resources

In addition to the policies and regulations cited above, Director's Order #28A, *Archeology* (2004) further discusses NPS' approach and commitment to the investigation, documentation, preservation, interpretation, and protection of archaeological resources located within park units. As a steward of America's heritage, NPS is charged with the preservation of the commemorative, educational, scientific, and traditional cultural values of archaeological resources for the benefit and enjoyment of present and future generations. Archaeological sites are irreplaceable resources, so it is important that management decisions and activities throughout the park system reflect a common commitment to the preservation of archaeological resources as important elements of our national heritage.

One archaeological site, the Papermill Dam, is located within the project area for the proposed drainage improvements project at Colonial NHP. Investigations were conducted in July 2005 at the portion of the Papermill Dam site located within the project area to determine if the proposed actions would disturb archaeological deposits. Examinations of the terrace at the base of the earthworks associated with the dam found fill only, with no artifacts recovered (NPS, 2005b).

In July 2005, NPS archaeologists completed the *Phase I Archeological Survey of Paper Mill Creek Drainage Culverts* for previously unknown archaeological sites located within the project area (NPS, 2005b). The Phase I archaeological investigation found no significant, or potentially significant, resources located within the project area. Therefore, no further archaeological work will be required within the project area.

Prehistoric and Historic Resources

In Director's Order #28, *Cultural Resource Management Guideline*, NPS defines a historic structure as a resource constructed specifically for serving some kind of human activity. Prehistoric structures are included under this definition, as well as under archaeology, because the technical aspects of their preservation are similar to those of historic structures. The project area contains one historic resource, the Parkway, which is part of the National Register-listed Colonial National Historic District. The Colonial National Historic District was listed on the National Register in October 1966, with documentation completed in August 2001.

The Parkway is an approximately 23-mile roadway built between 1931 and 1958 by the NPS and the Bureau of Public Roads to connect the historic communities of Yorktown, Williamsburg, and Jamestown. The road was constructed to improve access to these communities, which were seeing an increase in tourism beginning in the late 1920s. Construction on the Parkway occurred in two segments. The first segment from Yorktown to Williamsburg was constructed from 1930 to 1937; construction on the second segment from Williamsburg to Jamestown was delayed until 1956 to 1958. The entire route was planned in the 1930s, and only minimal changes to elements such as railings, construction methods, and vegetation, were made when the second segment was constructed after World War II.

The Parkway was designed as a curvilinear scenic route with parking overlooks at strategic points along the way. These parking overlooks were intended to provide scenic views of the York and James Rivers. The materials used to construct the roadway, drainage features, underpasses, overpasses, bridges, and headwalls are contributing features along the Parkway and were selected to complement the area. The concrete drainage features, underpasses, and overpasses were all clad with brick veneer with the architectural detailing of the brick bond and brick types reflecting the restoration work then being done in Williamsburg. The NPS continues to use the materials and design guidelines established when the Parkway was constructed in order to maintain the overall appearance of the roadway and visitor experience, as well as to minimize the potential for adverse effects to this National Register-listed resource.

SECTION 5. CONSULTATION and COORDINATION

The following agencies, organizations, and persons were contacted for information, assisted in identifying issues, developing alternatives, analyzing impacts, or identified compliance requirements:

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Chesapeake Bay Local Assistance Department*
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Virginia Department of Aviation*
Virginia Department of Conservation and Recreation*
Virginia Department of Environmental Quality
Virginia Department of Environmental Quality, Tidewater Regional Office*
Virginia Department of Forestry*
Virginia Department of Game and Inland Fisheries*
Virginia Department of Health*
Virginia Department of Historic Resources*
Virginia Department of Mines, Minerals, and Energy*
Virginia Department of Transportation*
Virginia Division of Air Program, Department of Environmental Quality*

Virginia Division of Natural Heritage, Department of Conservation and Recreation*
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