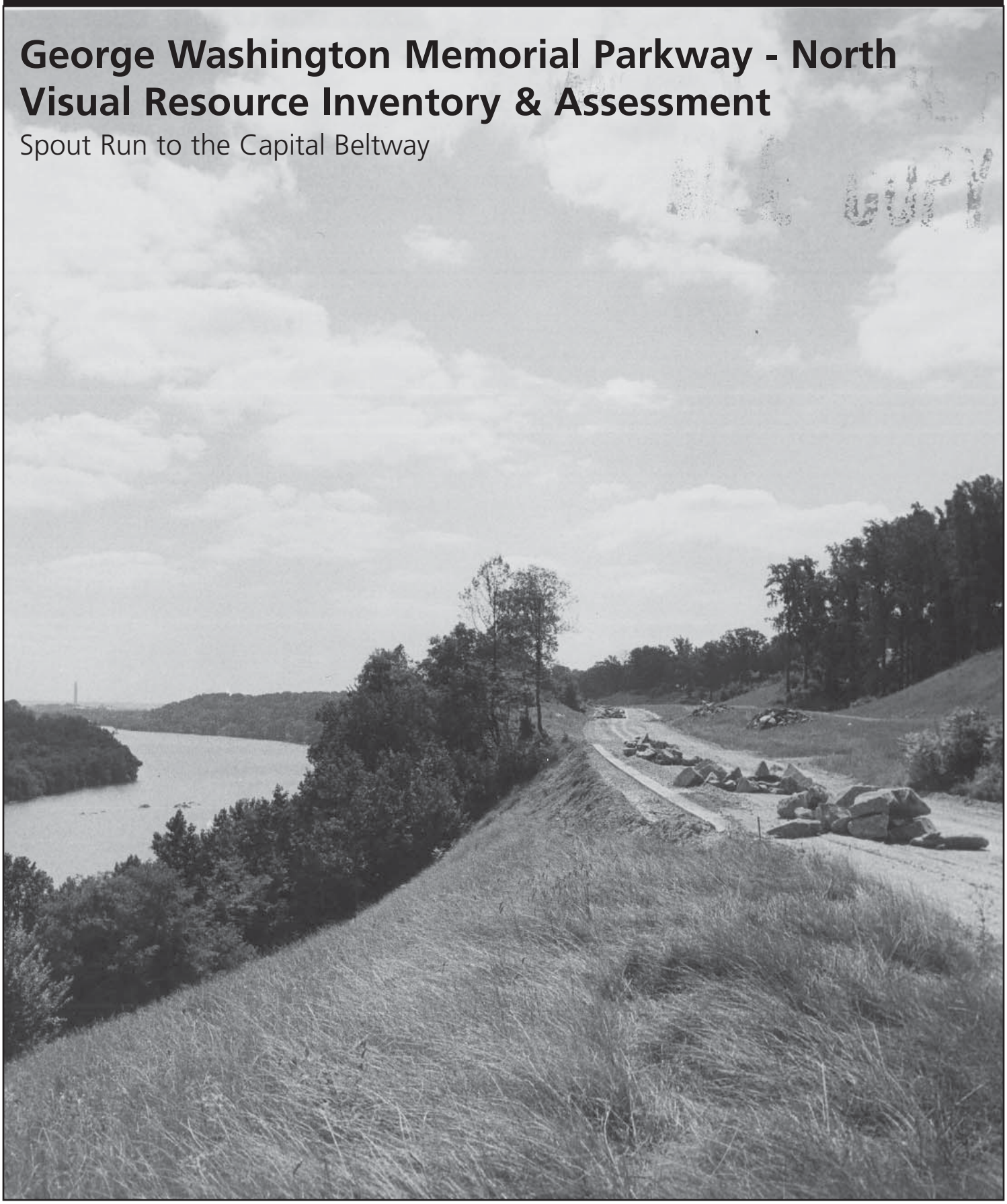
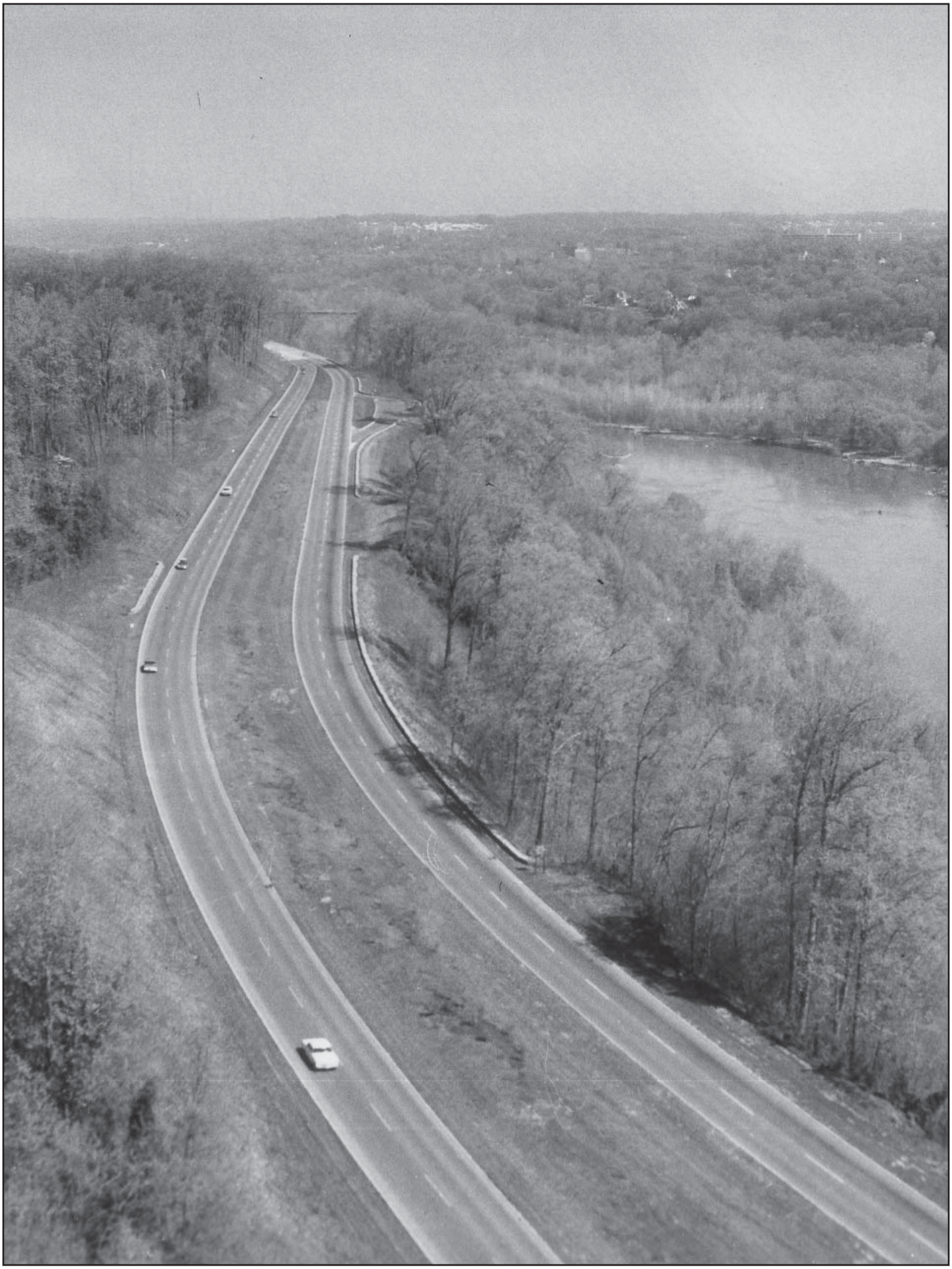
National Park Service
U.S. Department of the Interior

George Washington Memorial Parkway

George Washington Memorial Parkway - North Visual Resource Inventory & Assessment

Spout Run to the Capital Beltway





George Washington Memorial Parkway - North Visual Resource Inventory & Assessment

Spout Run to the Capital Beltway

George Washington Memorial Parkway
Turkey Run Park
McLean, VA 22101

U.S. Department of the Interior
Washington, DC

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Resource Stewardship and Science
Division of Cultural Resources, National Capital Region
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United States Department of the Interior Mission Statement: As the Nations's principal conservation agency, the Department of the Interior has responsibility for most of our nationally-owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

National Park Service Mission Statement: The National Park Service preserves unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education and inspiration of this and future generations. The Park Service cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout the country and world.

U.S. Department of the Interior
National Park Service
National Capital Region
Cultural Resources Program
Washington, DC

Cover Image: 1958 view showing guardwall construction along the recently graded northern section of the Parkway. Notice the expanisve, unobstructed view of the Potomac Gorge and monumental skyline. (Image courtesy of the NPS Museum Resource Center, Box 12a, PH12, PF13)

Title Page: 1962 aerial photograph of the recently constructed northern section of the George Washington Memorial Parkway, showing a road corridor flanked by riparian vegetation, with periodic vistas towards the river gorge and skyline (Image courtesy of the NPS Museum Resource Center, Box 12b, PH12, PF16 GWMP Folder 4)

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The development of the Visual Resource Inventory & Assessment was a cooperative effort between the National Park Service's National Capital Region Cultural Landscape Program and George Washington Memorial Parkway. Many individuals helped make the completion of this document possible.

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In preparation for this project, we applied and were accepted for inclusion as a pilot park in the NPS Call to Action initiative, specifically for Action Item 38: Enjoy the View. Consequently, the project benefitted from the state of the art scenery conservation work being done by the Air Quality Division of the Natural Resource Stewardship and Science Directorate. Specifically, this project benefitted immensely from the counsel and support of Mark Meyer, Renewable Energy Visual Resources Specialist; Ellen Porter, Natural Resources Specialist; and Susan Johnson, Chief of Policy, Planning, and Permit Review.

In closing, I want to acknowledge the precedent setting Visual Resources Management work conducted at other park units. Specifically, this project is deeply indebted to the trailblazing work done by Gary Johnson and Laura Rotegard at Blue Ridge Parkway; and Kevin McCardle, Tim Croissant, and Joy Fischer at Yosemite National Park.

Daniel Schaible

Table of Contents

Panoramic vista from Scenic Overlook #1, Northbound (2013, NCRO).

List of Illustrations

List of Figures

List of Tables

List of Drawings

Panoramic vista from Scenic Overlook #1, Southbound (2013, NCRO).

Executive Summary

The Visual Resource Inventory & Assessment (VRI&A) was prepared to provide additional data and support the ongoing planning process related to the proposed rehabilitation and safety improvements along the northern section of the George Washington Memorial Parkway, a nationally significant historic property. This project is being initiated by the National Park Service (NPS) in concert with the Federal Highway Administration (FHWA).

The project, a 3R rehabilitation[1] of the Parkway, spans roughly 10 miles, from the Spout Run intersection to the Parkway's northern terminus at I-495. While planning for this rehabilitation began nearly 10 years ago, proposed treatment options raised concerns related to potential scenery impacts to Parkway vistas as a result of proposed changes to guardwall height. These concerns were raised within the NPS and with historic preservation organizations and the general public. Further planning was put on hold as a review of the 3R rehabilitation project's needs and examination of other potential alternatives took place. In addition, an analysis and characterization of the scenic qualities of the Parkway was determined to be necessary to move the project forward. This study serves to help analyze and describe the significance of the Parkway vistas.

An essential aspect of the project was to locate as much information as possible on the planned scenic vistas historically located along the Parkway. Vista preservation along the Parkway is particularly important, as the enabling legislation for the George Washington Memorial Parkway (GWMP), the Capper-Cramton Act, describes the need to protect and preserve the Parkway's scenic resources "including the protection and preservation of the natural scenery of the Gorge and the Great Falls of the Potomac". In addition, the National Register of Historic Places nomination for the nationally significant GWMP states that "The landscape values for the George Washington Memorial Parkway have always been the preservation of scenic and aesthetic qualities associated with the Potomac River valley."[2] Furthermore, in 2005 the U.S. Department of Transportation designated the George Washington Memorial Parkway as an All-American Road in the National Scenic Byways Program, in recognition of "This sweeping grand gateway [with] sweeping views of our Nation's Capital."[3]

The purpose of this GWMP - North Visual Resource Inventory & Assessment is twofold: 1) to identify scenic vistas along the northern section of the Parkway; 2) to assess the relative rank and scenic value of the vistas.

1) The identification of scenic vistas was derived from primary and secondary research, interviews with Parkway personnel, and field reconnaissance. Both summer "leaf-on" and winter "leaf-off" vistas were identified. Following identification, the vistas were mapped, showing their spatial extents and direction.

2) The assessment of identified vistas produced a rank of the vista's relative value, taking into consideration scenic factors such as vividness and uniqueness as well as non-scenic factors such as duration and historicity. This rank will be used to develop treatment options and priorities, and to help inform potential changes to the height of the guardwalls (which will be further analyzed in the ongoing North Section Rehabilitation Environmental Assessment).[4] These assessments were done using the Visual Resource Assessment (VRA) framework, as developed by the NPS and implemented along the Blue Ridge Parkway and Yosemite's frontcountry roads and trails. The VRA framework is a transparent and replicable means of using numeric values to rank the relative scenic quality of numerous vistas.

As a result of this project, the GWMP was selected to be a pilot park for the National Park Service Call to Action, Action Item 38: Enjoy the View. In preparation for the centennial of the NPS in 2016, the Call to Action is a Agency-wide initiative that charts a path toward the NPS's second-century by taking concrete actions to advance its mission. Enjoy the View, Action Item 38, targets the protection of clean air and spectacular scenery by assessing air pollutants and preserving viewsheds. As a participant, this project has benefitted from consultation and review by the NPS leaders in Visual Resources Management: the Scenery Conservation Program and Air Quality Division of the Natural Resource Stewardship and Science Directorate.

It should be noted that this study represents

only a portion of the available historical documentation that should be referred to when conducting NEPA/Section 106 compliance for the proposed 3R rehabilitation of the north Parkway. Other existing sources which should be referenced include the GWMP National Register of Historic Places nomination, the GWMP Historic American Engineering Record documentation, and Cultural Landscape Inventory for the GWMP.

Overview of Related Legislative Mandates, Policy, and Park Plans

Rationale for managing scenic resources along the George Washington Memorial Parkway is grounded in congressionally legislated mandates and is repeated in current park plans. Below is an overview of some of the more salient arguments for managing scenic resources along the Parkway.

National Park Service Organic Act, 1916

The Act established the National Park Service and the organization's primary mission:

> *to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.*

The Act also includes the following text:

> *He* (Director of the National Park Service) *may also ... dispose of timber in those cases where in his judgement the cutting of such timber is required in order to control the attacks of insects or diseases or otherwise* ***conserve the scenery*** *or the natural or historic objects in any such park, monument, or reservation. He may provide ... for the destruction ... of such plant life as may be detrimental to the use of any said parks, monuments or reservations.*[5] (emphasis added)

Capper-Cramton Act, 1930, as amended in 1946

The George Washington Memorial Parkway was established by the signing of the Capper-Cramton Act on May 29, 1930. Specifically, this Act is the enabling legislation for the George Washington Memorial Parkway and calls for the preservation of its scenery:

> *funds shall be appropriated as required for the expeditious, economical, and efficient development and completion of ... the George Washington Memorial Parkway, to include the shores of the Potomac, and adjacent lands, ... and including* ***the protection and preservation of the natural scenery of the Gorge*** *and the Great Falls of the Potomac.*[6] *(emphasis added)*

National Historic Preservation Act of 1966 (NHPA) (16 USC 470)

Section 106 of the NHPA directs federal agencies to take into account the effects of any undertaking on historic properties. "Historic property" is defined as any district, building, structure, site, or object that is eligible for listing in the National Register of Historic Places because the property is significant at the national, state, or local level in American history, architecture, archeology, engineering, or culture. Section 106 also provides the Advisory Council on Historic Preservation and the State Historic Preservation Officer (SHPO) an opportunity to comment and assess the effects by the undertaking.[7] GWMP's Section 106 review process is governed by the 2008 Programmatic Agreement Among the National Park Service, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers.[8]

Director's Order #28: Cultural Resource Management, 1998

Director's Order #28 guides the NPS' management of cultural resources. It states that the stewardship of cultural resources is integral to the mission of the NPS and that:

> *It is charged to preserve them unimpaired for the enjoyment of future generations. If they are degraded or lost, so is the park's reason for being.*[9]

Of particular relevance to the treatment of cultural landscapes like the GWMP, Chapter 7 of DO 28 continues:

> *Cultural landscape management involves identifying the type and degree of change that can occur while maintaining the historic character of the landscape... In a landscape significant for its association with a specific style, individual, trend, or event, change may diminish its integrity and needs to be carefully monitored and controlled. In a landscape significant for the pattern of use that has evolved, physical change may be essential to the continuation*

of the use. In the latter case, the focus should be on perpetuating the use while maintaining the general character and feeling of the historic period(s), rather than on preserving a specific appearance.

George Washington Memorial Parkway Long-Range Interpretive Plan, 2005

This plan was prepared to provide continuity for the Parkway's interpretive programming and to identify ways for visitor experiences to be presented in unified and compelling ways. Of specific interest to scenery conservation and management, the plan states that **the mission** of the Parkway includes a mandate to "Protect and preserve a wide variety of individual cultural, natural, recreational, and scenic resources"[10] and that **a primary purpose** of the park is to "protect and manage the natural, cultural, and recreational resources and scenic values of the George Washington Memorial Parkway."[11]

George Washington Memorial Parkway Foundation Document, Dec. 2014

The GWMP Foundation Document has abundant references to the central importance of vistas and scenery conservation to the Parkway. It stresses that the vista's from the Parkway have suffered from deferred maintenance: "The vistas at the overlooks need to be restored and maintained to their original design"[12] and that "Many vistas are overgrown with vegetation and invasive species."[13] Furthermore, it establishes that there is a need to "identify the key views along the Parkway and analyze the viewsheds contained therein, including taking an inventory of landscape visual resources [to inform] a viewshed management plan."[14] In addition, the Foundation Document includes vistas as a fundamental resource to the GWMP:

The George Washington Memorial Parkway was designed to offer selected views of the Potomac River Gorge, monuments in Washington, D.C., and historic and commemorative features that line the parkway from Mount Vernon to the Great Falls of the Potomac. Many of these vistas and viewsheds are among the most iconic in the country and contribute to the parkway's role as a gateway into our nation's capital. Numerous sites and overlooks provide access to these vistas and views, which encourages visitors to stop and appreciate the scenery provided from the parkway.

Historical Context

Beginning in the latter part of the nineteenth century, business leaders, local, state and federal governments, and individual citizens saw the untapped potential that lay in the banks of the Potomac River. Some saw the land's potential to yield great profit by harnessing its mineral deposits and hydroenergy, others saw it as an opportunity to honor and memorialize founding father George Washington, while others saw this land as a place of great natural and scenic beauty that should be enjoyed by all.

In 1888, proponents of the latter options coalesced into the Mount Vernon Avenue Association, and began advocating for a national road along the Potomac that would lead to Mount Vernon and preserve the river scenery while memorializing George Washington.[15] By February of 1889, they persuaded Congress to appropriate $10,000 for a survey of potential routes for the national road, which was conducted by the Army Corps of Engineers. Despite these early successes, progress in establishing a national road was hard fought. Indeed, it took several decades to find influential government champions of the road concept. On May 28th, 1921:

> *Michigan Rep. Louis C. Cramton, a strong park advocate and chairman of the House subcommittee on parks and related appropriations, secured passage of a bill forbidding the Federal Power Commission from issuing permits for power development in the vicinity of Great Falls until the [National Capital Park and Planning Commission] and the power commission considered the matter further. Cramton also introduced legislation to create a parkway along both sides of the Potomac from Mount Vernon to Great Falls in cooperation with the states of Maryland and Virginia.*[16]

Despite his effort to create a Parkway that would extend on both sides of the river from Mount Vernon in the south up to the Great Falls in the north, Cramton's proposal initially only gained traction along the southern portion of the proposed road, which gave birth to the Mount Vernon Memorial Highway (MVMH). This section was constructed in the early 1930s and extended from Mount Vernon

Figure 1.0. 1949 photograph of the Mount Vernon Memorial Highway portion of the road, which was constructed in the late 1920s and early 1930s, well in advance of the northern portions of the GWMP. In historic photographs, this section of the Parkway is easily differentiated from the northern section by its wooden guardwall and street light, concrete paving, and its relatively tighter curves (Image courtesy of the NPS Museum Resource Center, George Washington Memorial Parkway images).

Figure 1.1. President Eisenhower officially opened the segment of GWMP between Spout Run and the CIA interchange on November 3, 1959, in a ribbon-cutting ceremony attended by NPS director Wirth, who is to the left of Eisenhower (Image courtesy of the NPS Museum Resource Center, Box 12a, PH12 PF13, GWMP).

to the Arlington Memorial Bridge.

The initial concept of a road along the Potomac River began decades before Cramton began advocating for the Parkway. The idea for the road most likely originated from the mind of M.B. Harlow, local businessman and treasurer for the City of Alexandria (1876-1893). According to Harlow, around 1883 he thought up the concept when friends and relatives visited and wanted to take a trip to Mount Vernon. He advocated for the construction of "a magnificent boulevard from the city of Washington to the tomb of the founder at Mount Vernon." The Highway would serve as a patriotic pilgrimage route and a tribute to Washington himself. Soon after, the Mount Vernon Avenue Association was formed to promote the creation of the roadway. But by the 1920s, the Mount Vernon Avenue Association had dissolved, unable to see their vision gain sufficient momentum to be constructed. However, this organization did manage to lay the groundwork for the project's completion a decade later.[17]

In 1924 the National Capital Park Commission (NCPC, later renamed the National Capital Park and Planning Commission, and today known as the National Capital Planning Commission) was created and given a congressional mandate to plan for the development of parks and parkways in the DC metropolitan area. They quickly endorsed the plans for the Mount Vernon Memorial Highway and soon became some of its most vocal proponents. This advocacy for the creation of the highway would later include its expansion further north to the Great Falls of the Potomac.[18] The close involvement and leadership that the NCP&PC would have on the development of the GWMP, particularly in regards to providing access to scenic vantages, is captured in a recollection of former NCP&PC commission member and NPS Director Conrad Wirth:

> *I want to include a word about some of my fellow commissioners. Frederick Law Olmsted, Jr., used to arrive several days in advance of commission meetings to study and review the staff plans and make whatever field investigations he thought necessary. I remember spending several days with him on the location plans for George Washington Memorial Parkway. He wanted to be sure the land to be included was adequate, that the parkway roads would take advantage of the vistas with the least possible damage to the rim of the Potomac River Gorge, and that it would provide necessary parking places with the least amount of damage to the scenic values. Olmsted would go into the field and walk the boundary lines. It was not enough for him to track them on the ground; he wanted to see from a height and would shinny up a tree to look in all directions. I would accompany him on these trips, carrying*

the plans. Climbing the trees, we had to carry the plans in our mouths, as a dog carries a bone.[19]

In 1928 Congress authorized the construction of the Mount Vernon Memorial Highway just as "the form and function of the modern motor parkway were becoming standardized."[20] The Bureau of Public Roads (BPR) saw the construction of the highway as part of their mission to promote modern highway design. The upcoming bicentennial of George Washington's birthday provided additional motivation for the endeavor.[21] However, there were greater goals for the Parkway beyond modernity and commemoration. From the earliest conception of the Parkway, planners and congressional backers stressed the importance of the landscape's scenic beauty, as reflected by the Senate Park Commission in 1902:

If it were desirable merely on account of the historic associations with Mount Vernon we might hesitate to refer to it in this connection, but as a matter of fact it would present such a series of beautiful views of the broad portion of the Potomac Valley as would give it a priceless recreative value for the future population of the District.[22]

In 1932 the Mount Vernon Memorial Highway was dedicated and opened for automobile usage. However, even before its dedication, plans were being made to extend the road further north and to incorporate the existing MVMH into the larger and yet to be built George Washington Memorial Parkway. Indeed, the Capper-Cramton Act, which passed in May of 1930, called for doing precisely that.

During their existence, the Mount Vernon Avenue Association focused almost entirely on what would become known as the southern portion of the Parkway. However they did recognize the natural beauty that of today's northern section, and referred to it as the "Virginia Palisades," stating in 1913 that this area "'should be saved from the dispoiler's [sic] bands who are now making terrible inroads on their beauty ... [The palisades] should be preserved and roads laid along their heights as additions to the beautiful chain of parks of the National Capital."[23] The scenic beauty of the proposed Parkway was one of the main drivers for its creation. In a letter written by NPS Director Arno Cammerer in the mid 1930s, he declares that the proposed GWMP would:

[P]rovide a fifty-mile circuit of the choicest scenery in greater Washington, every foot of it hallowed by memories of the Father of this Country.[24]

Later in the letter, speaking directly about the scenic quality of the northern portion of the Parkway, Director Cammerer continues

The upper stream, rushing along with frothing rapids over the half-submerged

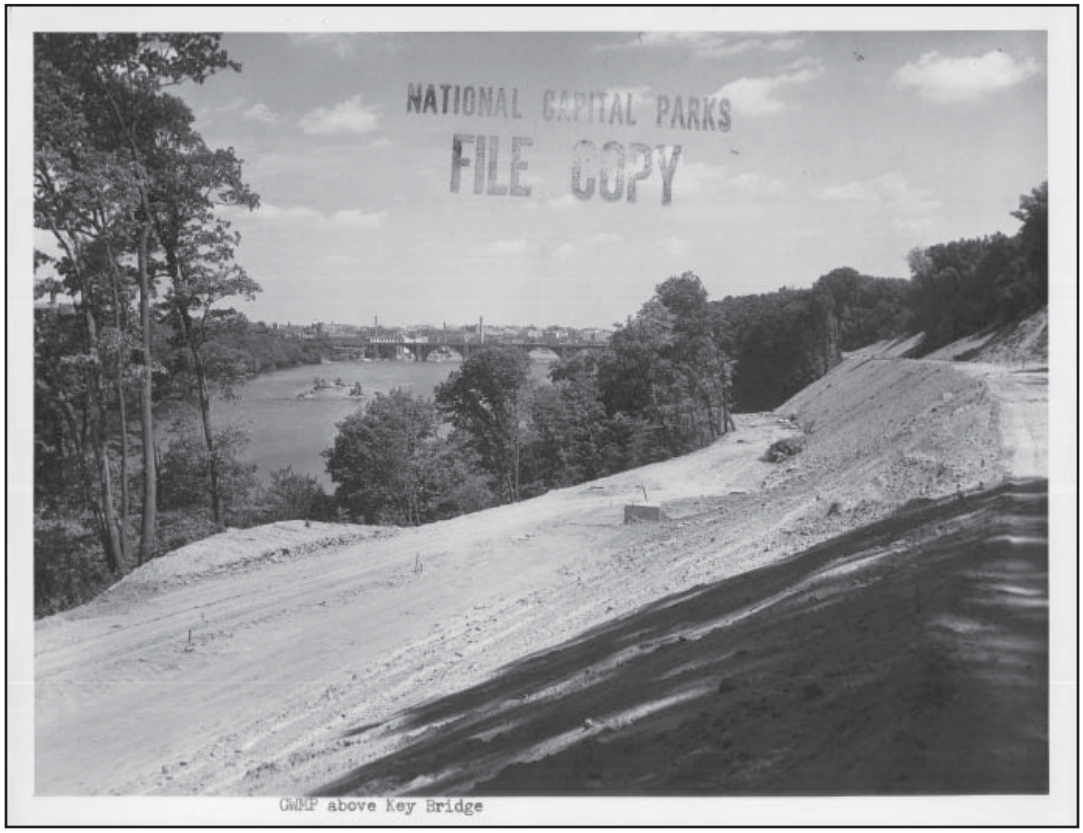


Figure 1.2. A 1957 photograph of the recently constructed grade-separated portion of the Parkway north of Spout Run. View opportunities from this vantage included Key Bridge and the Three Sisters Islands in the Potomac (Image courtesy of the NPS Museum Resource Center, Box 12A, PH12 PF13 GWMP).

Figure 1.3. A 1959 photograph shows the recently completed north parkway, highlighting the designed vistas that were created along the corridor. This vista is largely grown in with encroaching vegetation, and is now only visible as a filtered view in the winter months once trees have dropped their leaves. (Image courtesy of the NPS Museum Resource Center, Box 12A, PH12 PF13 GWMP).

rocks of the narrow gorge which confines it, present the picture of a tangled wildwood. Seemingly, these erected palisades and beckoning leafy bypaths are so remote from civilization that the recurrent glimpse of the Washington Monument's alabaster shaft, caught from time to time along the winding way, is a never failing surprise.[25]

The legislative effort for the development of the George Washington Memorial Parkway came from the combined efforts of Cramton and Senator Arthur Capper. They drafted a bill to create a roadway that would improve local transportation while also enhancing the area's historic, scenic, and recreational qualities.[26] Capper and Cramton argued that the parkway would be "an invaluable extension of the District's park system."[27] Despite passage of the Capper-Cramton Act in 1930, progress on constructing a parkway was slow from the 1930s until the end of the 1940s. This was partially due to the complexity of the project which stressed the importance of the parkway in terms of resource protection and historic preservation in addition to its ability to improve transportation infrastructure.[28]

One of the primary considerations for determining the actual alignment of the northern GWMP was access to scenery. As described by the NPS Chief of Parkways, Dudley C. Bayliss, in 1957, "Scenic considerations are of paramount importance in the selection of any parkway route ... anything that would afford visual or physical pleasure to the motorist or stimulate his interest in the parkway environment is taken into consideration," and "They are planned to reach the principal features of the Park rather than to serve as the most direct route from point to point."[29]

Construction of the George Washington Memorial Parkway between Spout Run and the Chain Bridge Road interchange (VA SR 123) began in 1956. Prior to the roadway construction, this area was largely uninhabited due to the rugged nature of the land. Those that had inhabited the area were mainly workers from a quarry that previously occupied portions of this area. The construction for this northern section of the Parkway in Virginia included a dual two-lane road separated by a near-continuous median, which varied in width throughout. For a portion of the Parkway, the northbound and southbound lanes followed different alignments and were not always parallel with one another. In addition they were often located at different elevations so as to minimize the construction impacts while maximizing the view potential from the Parkway.[30]

The Parkway was largely completed by 1965 and has received recognition for successfully preserving its adjacent scenic qualities. A Historic American Engineering Record (HAER) history of the Parkway summarized the achievements of this project:

The George Washington Memorial

> *Parkway has preserved a wide variety of scenic and natural resources along the Potomac River in Maryland, Virginia, and the District of Columbia. The Parkway's creation eliminated quarrying along the Potomac Palisades, helped defeat long-contemplated plans to exploit the hydroelectric potential of Great Falls, and protected an extensive stretch of the river from commercial and residential development.*[31]

In this way the George Washington Memorial Parkway largely achieved what was intended when the Capper-Cramton Act was passed over eighty years ago. In addition to providing a new route for local commuters, the GWMP provides access to scenic vistas that can be enjoyed by motorists along the Parkway.

Visual Resource Assessments

A Visual Resource Assessment (VRA) is a methodology for documenting and assessing the scenic quality of vistas. The result of a VRA is a numeric ranking of the scenic quality of vistas. This ranking can be used to compare the relative scenic quality of numerous vistas and help prioritize the management of parkway vistas.

The rankings are conducted by an individual or a team of individuals, where various criteria are used to analyze scenic qualities from numerous vistas. Individual scores are then combined and averaged, which creates a ranking of vistas from most to least scenic. Based on a numeric score, vistas are then categorized by scenic quality; in this case the categories of Superior, High, Medium, Low, and Very Low were used. While scores vary between individuals, there tends to be a general agreement on the scenic quality of vistas and an overall conformity of scores. The VRA methodology is useful in that it provides a transparent, objective, and replicable process for assessing and comparing the relative scenic quality of numerous vistas.

Vista Inventory Process

Parkway vistas were located initially by conducting field investigations. This field work established the location of contemporary vistas and roadside scenic overlooks (See Drawings 1.0, 1.1, and 1.2 for maps of GWMP Vista areas). Visual Resource Assessments were based on this inventory of contemporary vistas. These vista locations were recorded in the field as line features using a Trimble GPS device. Each vista was recorded as an individual line feature, starting at the beginning and recording a line until the end of the vista. This

Figure 1.4. Overall map of the George Washington Memorial Parkway extending from Mount Vernon in the South to the Capital Beltway. The Visual Resource Inventory and Assessment spans roughly the northern 10 miles of the Parkway, as indicated by the red arrows. The base map is provided by FHWA's America's Byways Program.

linear vista line data was then used to inform the location and extent of vista cones (See Drawings 1.0 and 1.1).

These contemporary vistas were then compared with the locations of historic vistas.[32] While historic and contemporary vista locations did not conform completely to each other, there was a strong correlation between the two groups.

While the entire northern Parkway study area is nearly 10 miles in length, almost all of the vistas are clustered in the study area's southern 3 miles. In fact, 37 of 38 vistas are located in the southern portion of the study area between the Spout Run interchange and Glebe Road Bridge. The reason for this high concentration of southern vistas is simple: the southern section of the Parkway in the study area is closest to and has views that look upon the Potomac River. Proximity to the Potomac is crucial for vistas within the study area because it provides a dynamic and aesthetic feature to look upon and an unobstructed opening to look out towards the river gorge and the prominent landmarks of the nation's capital.

VRA Research

The research process for the Visual Resource Inventory & Assessment included trips to two National Archives and Records Administration facilities (both the College Park and D.C. locations) and the Washingtoniana Collection of the D.C. Public Library. At these locations, the project team found historic photographs, maps, and assorted files and ephemera. In addition, records held by the park landscape architect (Kate Barrett) at the GWMP maintenance facility and the files held by the Cultural Resources Management Program (Matt Virta) at the GWMP Park headquarters at Turkey Run were also explored, as were files held at the NPS Museum Resource Center in Landover MD. Another resource that was utilized was the NPS Electronic Technical Information Center, the digital database for all planning, design, and construction drawings. Historic photographs, newspaper articles, construction blue prints, and promotional materials found at these locations proved to be vital resources in the research process.

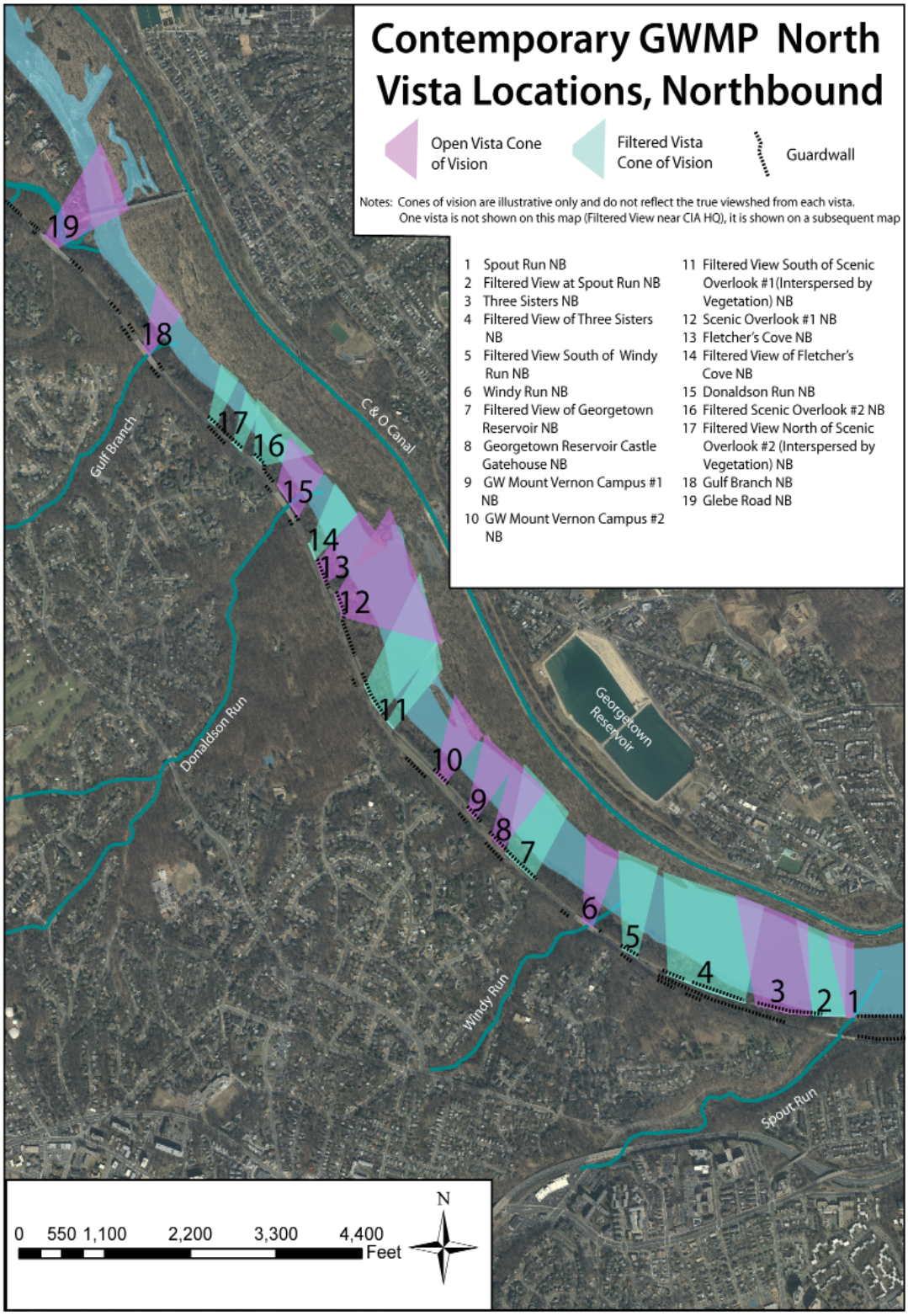
Newspaper articles helped establish the central importance of developing the Parkway to provide motorists access to the scenery of the Potomac Gorge and monumental DC skyline. Upon the northern parkway's opening in the late 1950s, numerous articles were written in local and national newspapers extolling the scenic splendor of the new Parkway with headlines such as "New George Washington Parkway Section Gives Autoists Novel Vistas"[33] and "New GW Parkway Route Unites History with Beauty."[34] A 1959 article in the New York Times calls particular attention to the scenic qualities the recently constructed Parkway has made accessible. It comments on the Parkway's "most spectacular and unexpected view of Washington of any of the highway approaches to the city, for it is a view from a height" and continues "for the first time, the public can see Washington from an extraordinary vantage point, with a swift river travelling between high green palisades with the spire of the Washington Monument and Lincoln Memorial rising in the distance."[35]

One of the most critical clues available was a set of undated maps that located vistas along the northern stretch of the Parkway. These maps (see Figure 1.5) have penciled in vista locations written on top of 1961 Parkway base maps (five in total) that are titled "Land Use and Maintenance Plans, Section 1, Boundary Channel to Capital Beltway". These maps were unique in that they were the only record that we found that located maintained vistas that potentially dated back to the Parkway's inception. However, as the hand-penciled notations were undated, the map's vintage was unknown. Thanks to assistance from GWMP Landscape Architect Kate Barrett, we were able to deduce that the penciled-over maps date to the early-1960s. Kate Barrett spoke with Ron Vail about the origin of this map. Mr. Vail is a long-tenured GWMP employee who was originally hired as an arborist to work with the GWMP tree crew in 1977. Mr. Vail in turn spoke with Hillard Ratliff who worked at the Parkway dating back to the early 1960s and who served as GWMP Chief of Maintenance from 1974-1994. Mr. Hillard recalled collaborating on the hand-penciled plan in the early 1960s just after the Parkway opened in 1961. He recalled preparing the plan with a group of people that included the GWMP Superintendent, the Chief of Maintenance, and a landscape architect. Therefore, this hand-penciled map depicts the location of vistas along the Parkway so that they could be maintained, dating to just after the northern Parkway opened.

Based on best available information and interviews with staff, it is likely that this draft map was an early iteration of what was intended to become a Parkway "Maintenance Plan."[36] In 1957, just as the northern GWMP was under construction, Dudley C. Bayliss, NPS Chief of Parkways, published an article titled *Planning our National Park Roads and Our National Parkways*, where he laid out the distinguishing characteristics of Park Roads and Parkways and spends considerable amount of time

discussing the importance of park scenery. Within this manual, he specifies that Parkways should develop Maintenance Plans "To obtain the maximum and continuing benefits of scenic locations of roads by selective cutting and thinning operations to help open up views or vistas." He further elaborates that the Maintenance Plan is the document that "defines the various areas and their treatment for mowing and vista maintenance." This map was likely a first attempt at the preparation of a formal Maintenance Plan for the northern GWMP; if a final version was ever completed its current location is unknown.

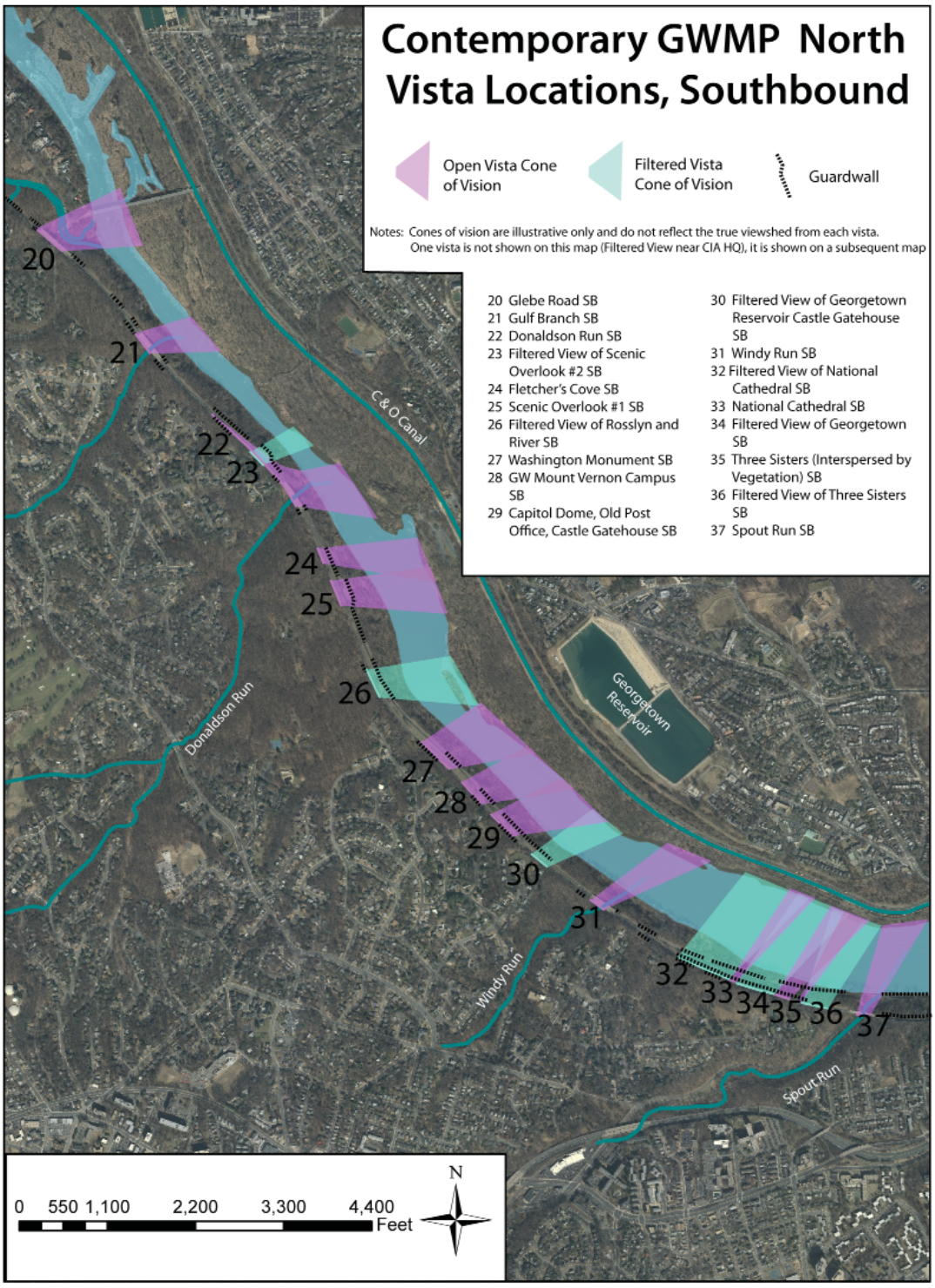
Unfortunately, this hand-penciled map left many questions unanswered as it would have required further refinement to be considered final. In many instances, the map features ambiguous notation and it is often unclear what the map is intended to convey. For instance, in two different locations the map appears to



Drawing 1.0. Northbound contemporary vista locations along the George Washington Memorial Parkway - North. This map includes both open vistas and filtered vistas. Southbound vistas were included on subsequent map to avoid clutter (NCRO 2013).

identify vistas where there are actually roadside berms where it would be impossible to have a vista (Figure 1.5 includes mark-ups to better convey some of the confusing aspects of this map). In a separate area, a vista is identified, then immediately preceded by a parenthetical comment to "disregard." Also, no legend is included in the map and it is difficult to determine the intended direction of the vistas (southbound or northbound) and the notation appears to be inconsistent. Ultimately, while this map proved to be a useful resource, more evidence was needed to corroborate and elaborate on the information it contained.

A second important resource was another document located with assistance from GWMP landscape architect Kate Barrett titled "North Parkway Vista's" and dated December 6, 1990 (see Figure 1.6). This is a list of the North Parkway vista's that required cyclic maintenance for vegetation pruning and removal in 1990. Since this document is only a list that describes the location of vistas but includes no map or actual spatial data, we took this list into the field to try to locate all of the maintained vistas from 1990 that fall within our study area. We used this data to see

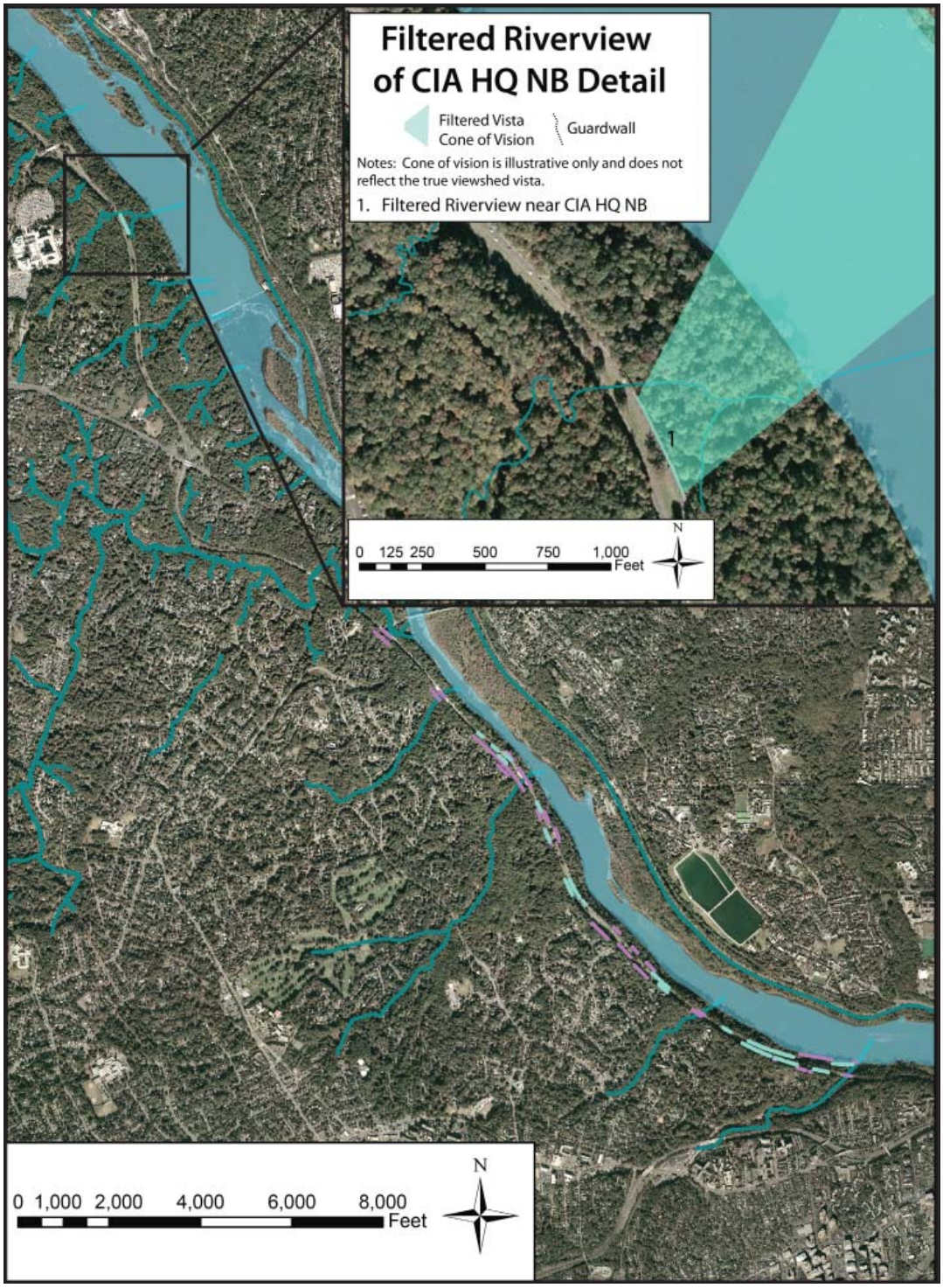


Drawing 1.1. Southbound contemporary vista locations along the George Washington Memorial Parkway - North. This map includes both open vistas and filtered vistas (NCRO 2013).

how the maintained vistas in 1990 compare to the vistas recorded in the early 1960s and to the Parkway's current vistas. It has been hypothesized that the 1990 "North Parkway Vista's" list was an attempt to formally record the location of maintained vistas, which had previously been passed along orally by several generations of Parkway maintenance employees, including Hillard Ratliff and Ron Vail.

In addition, historic photos were incredibly useful in determining historic vista locations. Fortunately, numerous photographs were found that depict vista conditions from the northern Parkway following its dedication in 1961. However, the historic photographic record is incomplete, and there are some sections of Parkway where no historic photographs could be located. Historic aerial photography helped fill in these voids, including a high-resolution aerial photograph from 1957 that was particularly useful as it shows vegetative cover along the northern Parkway during its construction.

Another useful tool for looking at and trying to determine historic vista locations are fill slope guardwalls (usually located on the northbound



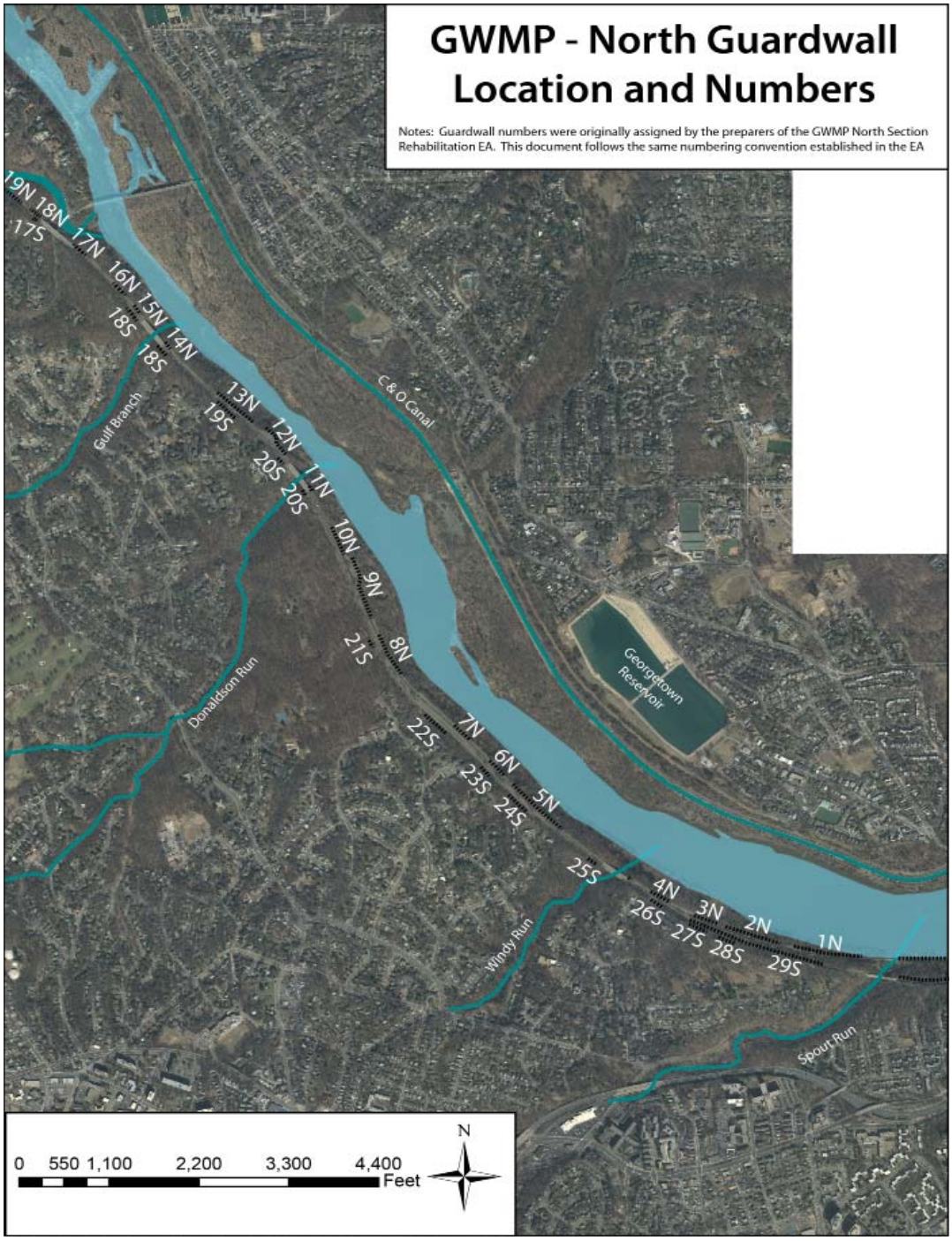
Drawing 1.2. Map of the far northern vista, Filtered Riverview near CIA HQ NB, shown in relation to the other vistas, all located substantially further south (NCRO 2013).

side, but southbound too in the grade-seperated portion of the Parkway) which often correlate with historic vistas. Guardwalls were typically sited adjacent to steeper slopes or areas that required substantial regrading (and thus clearing of all vegetation) during construction. Accordingly, many historic vistas were located to take advantage of the topographical relief and cleared vegetation associated with the slopes adjacent to guardwalls. The 1957 aerial photograph (see Appendix B) depicts very convincingly the association between guardwall location and their adjacent slopes that were cleared of vegetation. Furthermore, resources like the 1990 List of Maintained Vistas (Figure 1.6) lists guardwalls to identify where maintained vistas are located, reinforcing the association between guardwall and vista.

All of this historic vista data was assessed and compared in order to create a single composite map that reflects the historic vista conditions when the northern Parkway opened in 1961 (See Drawing 1.4). While this map may contain errors and omissions due to data gaps and inconsistencies, it provides a close approximation to what the vista conditions would have been when the northern Parkway opened.

Visual Resource Assessment Adaptation to the GWMP

NPS Regional staff has adapted the VRA



Drawing 1.3. Map showing the location and number of guardwalls within the study area. The numbering convention used for guardwalls was originally developed in the GWMP North Section Rehabilitation Environmental Assessment. Guardwall locations are often associated with vistas (NCRO 2013).

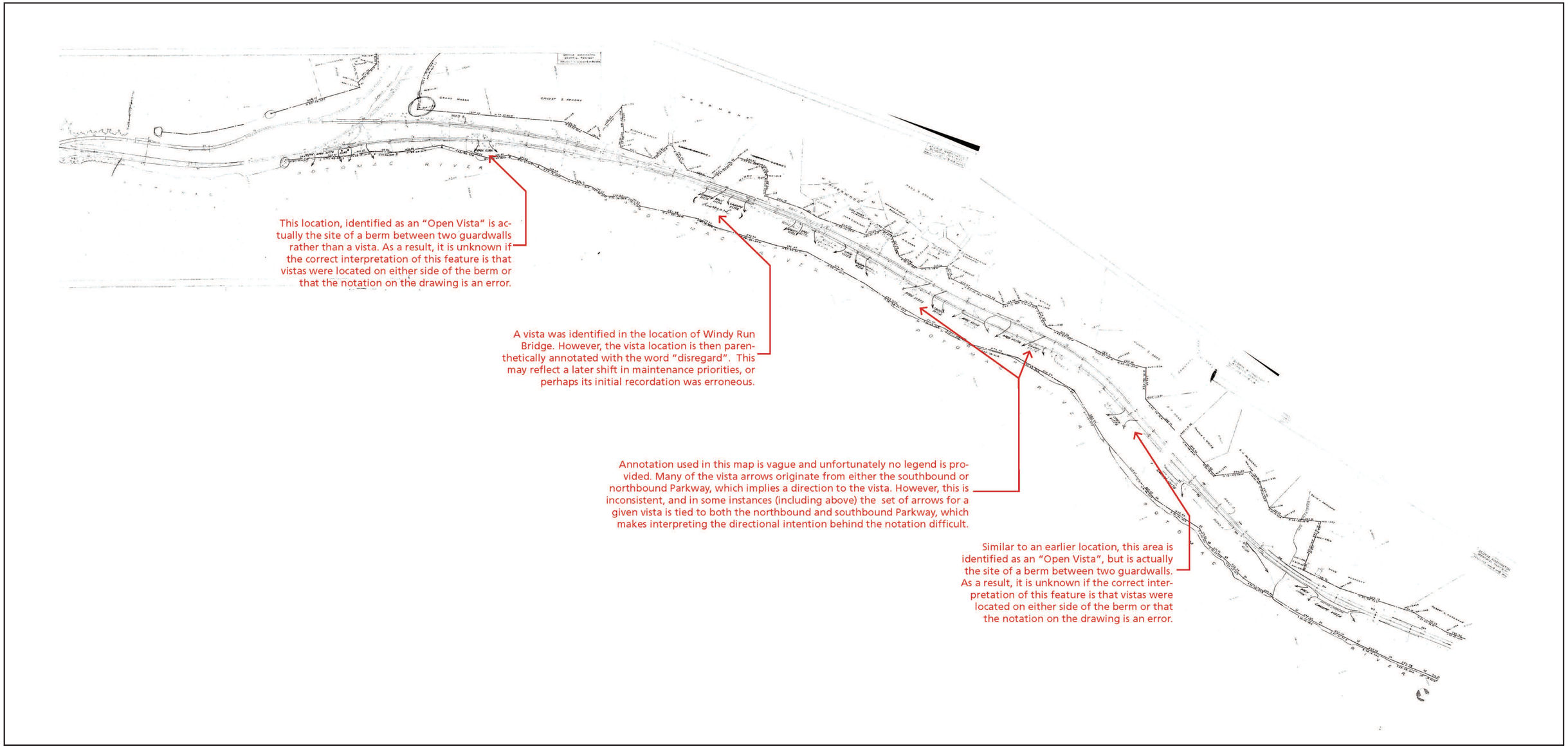
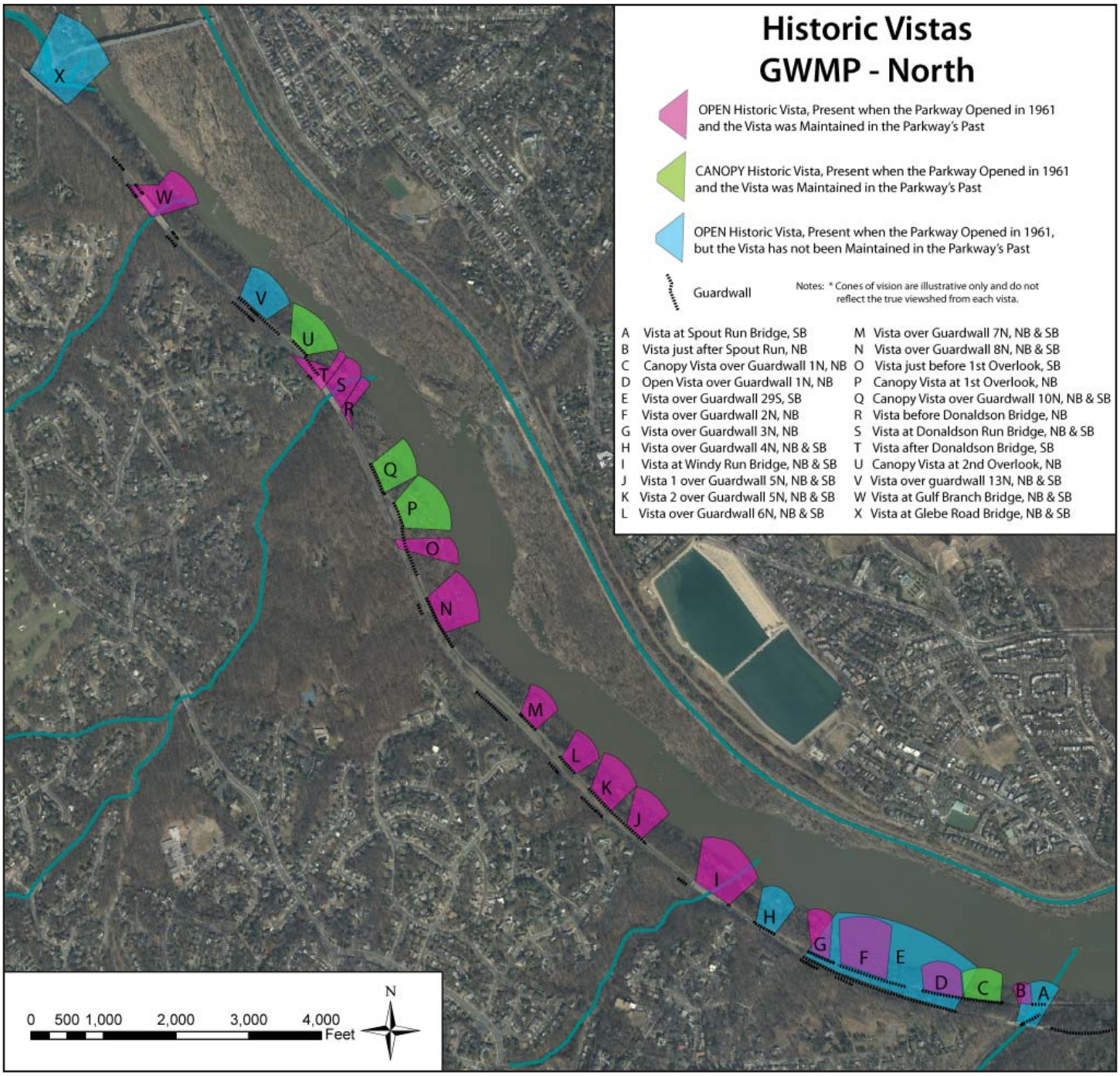


Figure 1.0. Circa early 1960s basemap titled "Land Use and Maintenance plans, Section 1, Boundary Channel to Capital Beltway" with an overlay of penciled-in vista locations. This set of maps originally consisted of five separate sheets, but they were overlaid and tiled together to form a single map for presentation purposes. In order to tile these five maps onto a single page, the orientation of the maps was altered, and now north points downward to the south-southeast. In addition, annotation was added in red to call attention to the difficulty we had interpreting these maps (Document courtesy of the GWMP Maintenance Files, Landscape Architect collection).

method to be used on the George Washington Memorial Parkway. Within the National Park Service, the VRA methodology was initially developed at Blue Ridge Parkway beginning in the 1990s, as staff there sought an approach to work with stakeholders to preserve scenic vistas and resources. Blue Ridge staff worked with researchers from academic institutions to refine the VRA process established by other federal land management agencies like the Bureau of Land Management (BLM) and the United States Forest Service (USFS). Other National Park Service units have also adapted Blue Ridge's VRA methodology, including Yosemite National Park and the Mississippi National River Recreation Area. Even more recently, a Scenery Conservation Program (SCP) was formed within the NPS in 2013 to standardize an approach for the inventory and evaluation of NPS scenic resources. The VRA approach decided upon for the George Washington Memorial Parkway - North Visual Resource Inventory & Assessment (GWMP VRI&A) is a hybrid model that incorporates elements of the Blue Ridge Parkway methodology, the more recent SCP methodology, and new criteria that is unique to this project (Historic Vista Modifier and Open Vista Modifier).

It should be noted that there are limitations in any Visual Resource Assessment methodology. There are inherent challenges to a model that endeavors to distill something as dynamic and indefinable as aesthetic beauty into a numeric

Drawing 1.4. Depiction of the historic vista conditions along the Northern Parkway from c. 1961. Based on the best available information, it is the most accurate representation of historic vistas along the Northern Parkway completed to date. For further analysis of historic vistas, refer to Appendix B: Historic Vista Modifier Data Analysis.



December 6, 1990

North Parkway Vista's

The following list gives area labels or names to the vistas located in the North Parkway Grounds operations. Some of the areas were originally identified as shoreline maintenance but are now being considered as vistas for the first time. They are listed in order beginning with the southern most terminus first.

1. Pepco Plant
2. Washington Sailing Marina, between Daingerfield entrance and Oil Docks area
3. Gravelly Point, Roaches Run to Boundary Channel inlet (humpback bridge)
4. Columbia Island (riverside), Boundary Channel inlet north to T.R.I. bridge
5. Columbia Island Marina parking lot area
6. T.R.I. entrance and parking lot area
7. Key bridge, Key bridge area north to beginning of wood line
8. Spout Run area, area just before and after Spout Run watershed area
9. Area between Spout Run and Windy Run
10. Windy Run bridge area (Tree Crew)
11. Vista's over the stonewalls
12. " " " "
13. " " " "
14. " " " "
15. Just before 1st overlook s/b view
16. 1st overlook
17. Open vista before Donaldson Run bridge (N/B view)
18. Open vista after Donaldson Run bridge
19. Gulf Branch S/B view (Tree Crew) - OK HOLE

2ND OVERLOOK
6:30 - 10:00

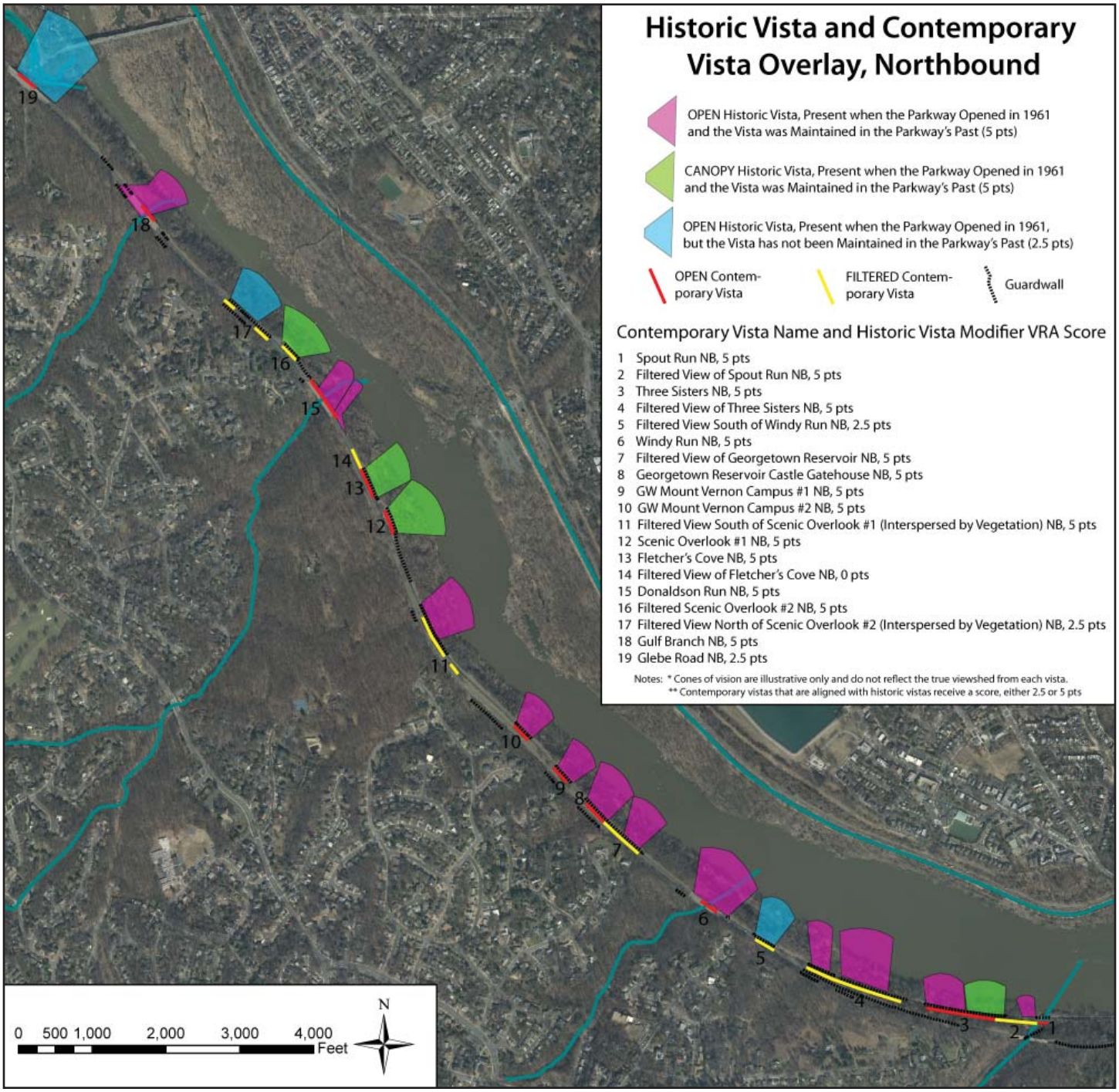
4 vies s/b

Figure 1.6. The 1990 list of maintained vistas, titled "North Parkway Vista's". The final dozen vistas (8-19) are located within our project area. This list of maintained vistas was given great consideration and played a large role in determining historic vista locations (Document courtesy of the active GWMP Maintenance Files, Landscape Architect collection).

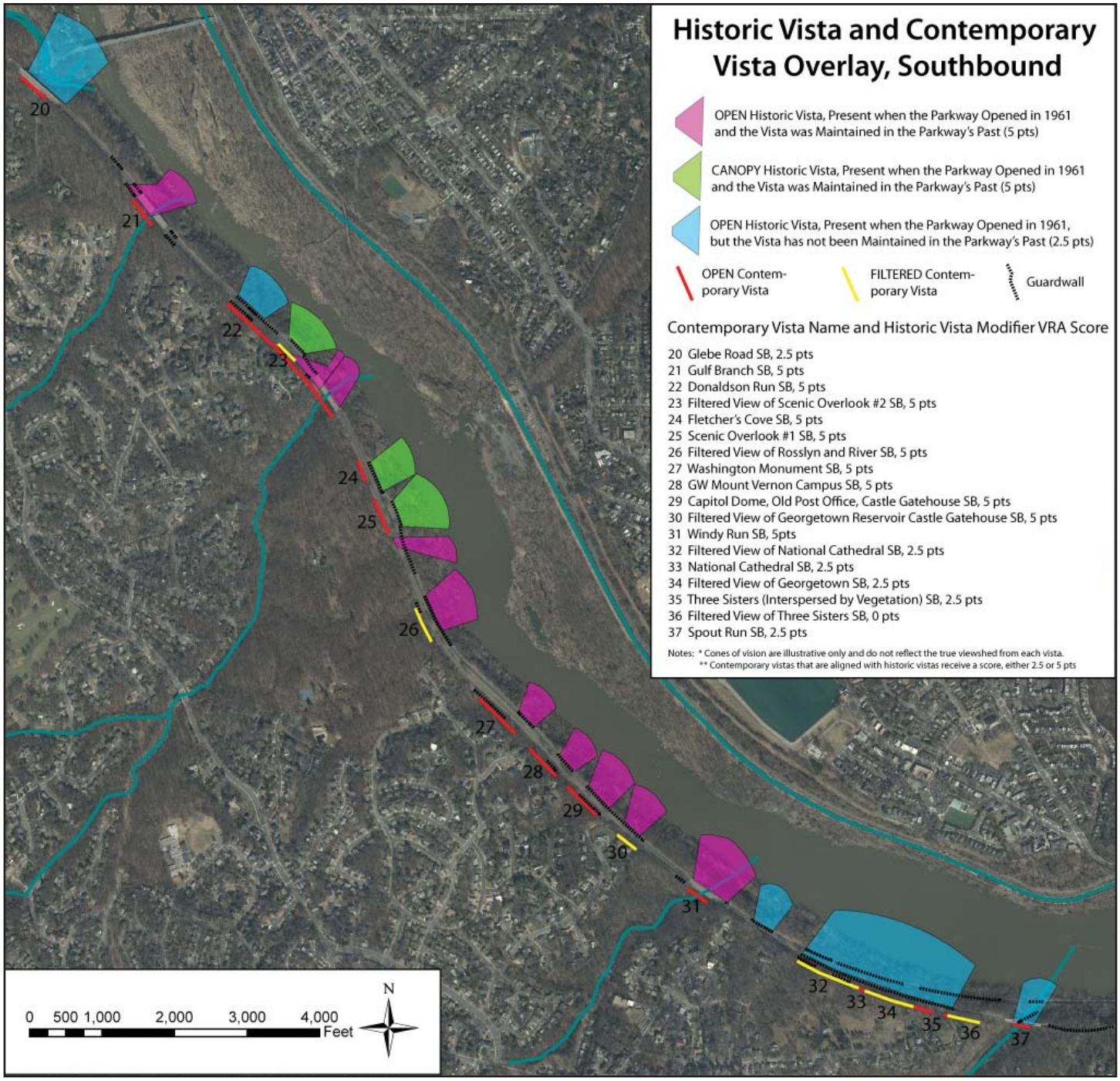
value. As was discovered, these challenges were compounded in trying to implement Visual Resource Assessments along the GWMP in these four ways:

- While the VRA process is transparent, objective, and replicable, the actual assessments are subjective and vary between individuals.
- Some historic vistas are now obstructed by vegetation making assessment of these vistas impossible during the spring and summer before fall leaf senescence;
- The impossibility of using sophisticated VRA criteria in a moving vehicle at Parkway speeds, so assessment values were derived from the adjacent Parkway shoulder rather than the travel lane. This difference in location distorts the vertical and horizontal vista frame of parkway motorists, and allows much more time to be spent at Parkway vistas then would be possible in a moving vehicle ; and
- The inability of a VRA methodology to capture the experiential quality of driving the Parkway, including the overall sequence of spaces and vistas along the Parkway.

Drawing 1.5. Depiction of historic vista conditions along the GWMP - North overlaid with contemporary northbound vistas. Contemporary vistas that are adjacent to historic vistas that were maintained in the Parkway's past score 5 points. If they are adjacent to historic vistas that were not maintained in the Parkway's past they score 2.5 points. For further analysis of historic vistas, refer to Appendix B: Historic Vista Modifier Data Analysis.



Drawing 1.6. Depiction of historic vista conditions along the GWMP - North overlaid with contemporary southbound vistas. Contemporary vistas that are adjacent to historic vistas that were maintained in the Parkway's past score 5 points. If they are adjacent to historic vistas that were not maintained in the Parkway's past they score 2.5 points. For further analysis of historic vistas, refer to Appendix B: Historic Vista Modifier Data Analysis.



Visual Resource Assessment Criteria

The VRA approach implemented at GWMP had two primary phases of work; the "Scenic Quality Phase" and the "Modification Phase."

The first step, referred to as the Scenic Quality Phase, involved conducting VRA field work with the seven member VRA team. This field work focused exclusively on the scenic quality of contemporary vistas using defined scenic quality criteria. The Scenic Quality Phase assessed vistas using the following scenic quality criteria: Vividness; Uniqueness; Desired Landscape Elements; Undesired Landscape Elements; and Visual Harmony. This phase was conducted in the field and individual numeric scores were arrived at by each member of the VRA team for each vista. These seven individual scores for each vista were then averaged to produce the overall scenic quality subtotal score for each vista. The scenic quality subtotal score has a potential point range of 0-18 points, with higher scoring vistas having greater assessed scenic value.

The second step, referred to as the Modification Phase, looked at qualities other than scenic value. This phase is separate from the earlier Scenic Quality Phase for several reasons. First, the Modification Phase scores are not directly related to the scenic quality of the vistas, rather they relate to other important considerations about each vista, such as its duration of visibility and historicity. Secondly, these scores were not made by the VRA team, rather they were made by the VRI&A preparers and GWMP cultural resources personnel because they required research (historic vista modifier) or are inherently objective and a single, universally assigned value for each vista was appropriate (duration of vista modifier, open vista modifier).

A partial score sheet template for Vividness can be found at Table 1.0, and a partial overall VRA score sheet template at Table 1.1.

Scenic Quality Phase, 0-18 pts

VIVIDNESS, 0-6 pts – The breathtaking quality that makes a scene memorable. It is measured in the presence and amount of the following landscape composition elements:

Expansiveness: Is the vista open, and unconfined laterally? An ocean is expansive – being on the floor of the Grand Canyon is not. Measured as width, the scene can be open on one side = .5 points or both sides = 1 full point.

Framing: Even if it is expansive, do you feel like there are edges, sides to the vista? Do you feel comfortable that you are enclosed enough to be anchored? Trees and landforms create frames. One side landform = .25 points, plus trees = .5 points. Two side enclosed with ¾ of parts = .75 points. Both landform and trees, both sides = 1 full point.

Focal Point: Does the vista pull your eye to just one spot? Or does your eye jump around. Focal points can be mountains or a historic building or a colorful object. This can also be a focal line, with a vanishing point that captures your attention. Up to 1 full point.

Depth: Does the vista fall away in layers from front to back? You need to be able to see from foreground through to a background, before you can count this in. Three to five layers = .5 points. More than 5 layers = 1 full point.

Variety: Is there color and texture in the vegetation and landform? Islands within the river tend to add positive variety. Do structures add colors that fit into the colors of the landscape? Too much variety can add to clutter and tension in the scene. Is the scene interesting? Plant and vegetation patterns =.5 points, land-

Table 1.0. Sample portion of the Vividness Score Sheet, which was utilized to capture scores while conducting the VRAs.

GWMP Vividness Score Sheet

NB or SB	Summer or Fall	Name	VIVIDNESS						Total (0-6 pts)
			Expansive	Framing	Focal Point	Depth	Variety	Ephemeral	
NB	Summer	Spout Run							
NB	Summer	Three Sisters							
NB	Summer	Windy Run							
NB	Summer	Georgetown Reservoir Castle Gatehouse							

form =.5 points. Both= 1 full point.

Ephemeral Image: Is there life in the scene? Is wildlife present, dramatic cloud formations, opportunities for sunsets/sunrises, better than average spring or fall seasonal color, photogenic or engaging recreation like boating or fishing? Are these opportunities present in the fore mid- and background. Up to 1 full point.

UNIQUENESS, 0-3 pts – Rarity of the type of vista

3 pts: One of a kind; icon vista sought out by artists as source of inspiration, historically significant, first of this type of vista to be encountered.
2 pts: One of three similar vistas
1 pt: One of four to seven similar vistas
0 pts: Abundant, common to all areas, more than eight

DESIRED LANDSCAPE ELEMENTS, 0-3 pts – Are most or all of the key landscape character elements plainly visible? For GWMP, desired landscape elements include vistas of the Potomac River and Gorge that include features like moving water, river banks, rock outcroppings, and an intact, native riparian corridor, vistas of DC's monumental and charismatic skyline that include built elements like bridges, monuments, and college campuses, and vistas that include attractive features associated with the GWMP such as stone guardwalls and guidewalls.

3 pts: Most or all important landscape elements are plainly visible
1.5 pts: Some important landscape elements are present, but some are missing
0 pts: No important landscape elements are visible

UNDESIRED LANDSCAPE ELEMENTS, 0-3 pts – Are landscape character elements that are inconsistent with the identified desired character plainly visible? For GWMP, undesired landscape elements may include incompatible development or utility infrastructure like a high density subdivision or telecommunications infrastructure, invasive vegetation, polluted or degraded resources like damaged guardwalls or deteriorated railings on bridges, evidence of erosion, poor condition of park infrastructure etc.

3 pts: Only a few minor inconsistent landscape elements are visible
1.5 pts: Some inconsistent landscape character elements are plainly visible
0 pts: Many inconsistent landscape elements are plainly visible

VISUAL HARMONY, 0-3 pts – Do the visible elements of the landscape seem to be arranged in a recognizable and composed sequence or pattern that makes them seem to fit well together? Do the visual elements of the landscape appear to be at an appropriate scale with respect to each other? For example, do some elements appear so large or small in size that they make the rest of the vista seem unbalanced?

3 pts: The elements of the vista appear to have a clearly evident sequence, composition, and/or pattern that make them fit well together, and no elements appear to be out of scale by being too large or too small.
1.5 pts: The elements of the vista have a weakly evident sequence, pattern, and/or composition and the size and scale of elements has little effect on the balance of the vista.
0 pts: There is no evident sequence, composition, and/or pattern; visual elements seem haphazard and random and one or more elements appear to be too large or too small and are out of scale, making the vista seem unbalanced.

Table 1.1. Sample portion of the Visual Resource Assessment Score Sheet, which was used to record scores while conducting the VRAs.

GWMP VRA Score Sheet

NB or SB	Summer or Fall	Mile Points	Name	Visual Resources Assessment Scores					Total (0-18 pts)
				Vividness (0-6 pts)	Uniqueness (0-3 pts)	Desired Landscape Elements (0-3 pts)	Undesired Landscape Elements (0-3 pts)	Visual Harmony (0-3 pts)	
SB	Fall	19.859-19.807	Filtered View of Scenic Overlook #2						
SB	Fall	19.277-19.184	Filtered View of Rosslyn & River						
SB	Fall	18.699-18.606	Filtered View of Georgetown Reservoir, Castle Gatehouse--						

Modification Phase, 0-9 pts

HISTORIC VISTA MODIFIER, 0-5 pts – Was a given vista present when the northern Parkway opened in 1961? Is there documentation demonstrating that the vista has been maintained at some point in the Parkway's past?

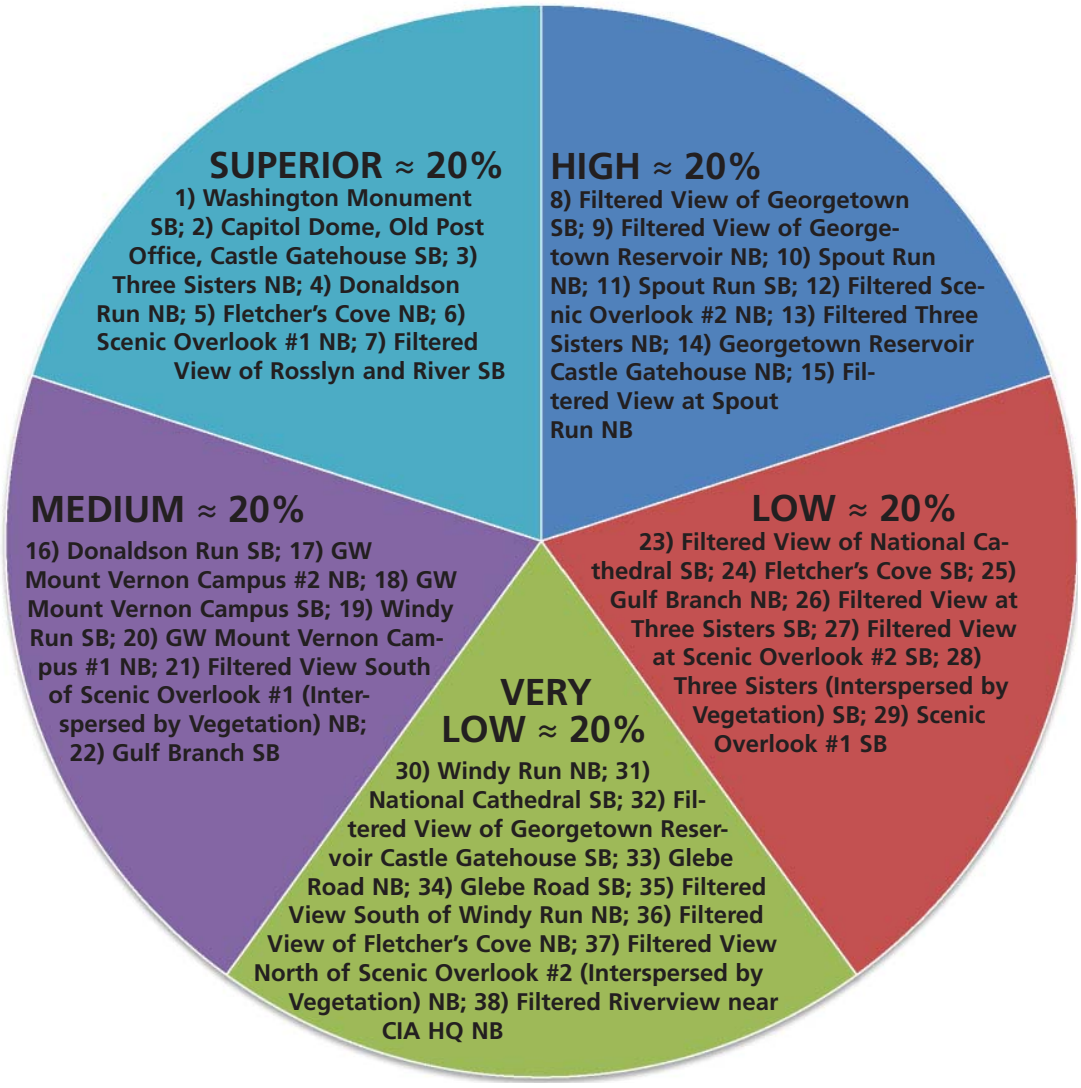
It should be noted that historic vistas were located using the best data available and reflect many hours of analysis and comparison. Of the many sources that we relied upon to reach historic vista determinations, we generally looked for conformity of data and tried to corroborate various data sets with each other. For a breakdown of this process and an accounting of the historic vista modifier score assigned for each vista, please go to Appendix B: Historic Vista Modifier Analysis.

5 pts: The vista was present when the northern Parkway opened in 1961 AND there is evidence demonstrating that the vista was maintained in the Parkway's past
2.5 pts: The vista was present when the northern Parkway opened in 1961, BUT there is no evidence demonstrating that the vista has been maintained in the Parkway's past
0 pts: The vista was not present when the northern Parkway opened in 1961 AND there is no evidence demonstrating that the vista has been maintained in the Parkway's past

DURATION OF VISTA MODIFIER, 0-3 pts – How long is the vista visible? The longer, the more important and noticeable the vista is. This is graduated to the speed of travel. Along the northern GWMP, the posted speed is 50 mph.

3 pts: Long: greater than 6 seconds, including all overlooks
2 pts: Moderate: 4-6 seconds
1 pt: Short: 2-4 seconds
0 pts: Fleeting glimpse: less than 2 seconds

Each vista was individually assessed for its duration based on the length of time the vista is visible. For a breakdown of the scores assigned each vista, please go to Appendix C: Duration of Vista Modifier Analysis.



Drawing 1.7. Chart showing all the inventoried vistas along the northern portion of the GWMP, along with the "Scenic Class" they rank into, either Superior, High, Medium, Low, or Very Low. For a complete list, along with aggregate scores for each vista, refer to the VRA Final Scores and Scenic Classes for the GWMP, on pages 24-25 (NCRO 2013).

VRA Team			
Name	**Title**	**Agency/Admin Unit**	**Experience (years)**
Gregory Anderson	Cultural Resource Specialist	National Park Service, George Washington Memorial Parkway	6
Andrew Banasik	Chief, Resources Management	National Park Service, Monocacy National Battlefield	15
Kate Barrett	Landscape Architect	National Park Service, George Washington Memorial Parkway	25
Robert F. Clark	Volunteer, Mount Vernon Trail Patrol	National Park Service, George Washington Memorial Parkway	6 (NPS volunteer)
Jeff Gowen	Landscape Architect	National Park Service, National Mall & Memorial Parks	4
Myles McMorrow	GWMP Volunteer	National Park Service, George Washington Memorial Parkway	2 (NPS volunteer)
Kimberly McCool	Project Manager	Federal Highway Administration/Eastern Federal Lands Highway Division	20
Isbel Ramos-Reyes	Highway Safety Engineer and Technology Coordinator	Federal Highway Administration/Eastern Federal Lands Highway Division	4

Table 1.2. List of GWMP VRA participants, eight members (including alternate).

OPEN VISTA MODIFIER, 0-1 pts – Is the vista open or filtered? Open vistas score an additional point because these vistas can be seen year round whereas filtered vistas are only visible during the non-growing portion of the year.

1 pt: The vista is classified as open.
0 pts: The vista is classified as filtered.

VRA Methodology and Data Collection

The VRA process for GWMP began with assembling an inter-disciplinary and inter-agency team of eight assessors from divergent professional backgrounds (see Table 1.2). This team included National Park Service (NPS) GWMP personnel, non-GWMP NPS personnel, Federal Highway Administration (FHWA) personnel, and GWMP volunteers and interested parties. An inclusive approach was used in forming the GWMP VRA team to capture a broad range of perspectives and diversity of opinion.

In order to provide each vista with an identifying feature to distinguish it from other vistas, all of the vistas were given a name and view number. The view numbers are organized sequentially starting northbound at Spout Run bridge and then continuing southbound back to Spout Run Overpass Bridge (See Drawings 1.0, 1.1, and 1.2). These names were typically based on the location of the vista (Spout Run SB, Glebe Road Bridge NB), a named focal point that is within the vista (Fletcher's Cove NB, Three Sisters SB) or, in some cases, the vista's location in relation to a different vista (Filtered View North of Scenic Overlook #2).

Field assessments were made twice (summer and fall) to capture the difference between the Parkway vistas during the growing season where leaves were on the trees ("leaf-on"), and the dormant season where leaves had fallen

Figure 1.7. Photograph showing the VRA team conducting assessments along the GWMP. Assessments would typically take about 5 minutes to conduct per vista (2013, NCRO).

("leaf-off"). In addition, separate assessments were made from both the northbound and southbound sides of the Parkway.

Vistas are categorized as either "open vistas" that are visible year round, or "filtered vistas" that are only visible during the "leaf-off" portions of the year. During the winter "leaf-off" field work, assessments were only made for the filtered vistas, because the open vistas (which can be seen year-round) were already recorded during the "leaf-on" assessments. Not surprisingly, there are more vistas during the winter when compared to the summer. The "leaf-on" summer inventory included 25 total vistas: 12 vistas northbound and 13 vistas southbound. For the "leaf-off" inventory, there were an additional eight vistas that were inventoried northbound and five additional vistas southbound. Therefore, there are 38 total vistas that were inventoried and assessed (20 northbound and 18 southbound).

Each vista's spatial location was inventoried and documented by a Geographic Information System (GIS) specialist. Since the vista openings follow the alignment of the Parkway and are linear, the vistas were recorded as "line" type feature classes. This contemporary vista data was then imported into ArcMap geospatial software and overlaid with other available geospatial data. For documentary purposes, photographs were also taken from each vista. These guidelines ensured that data collected in the field was accurate and consistent.

GWMP VRA METHODOLOGY NOTES

1. Of the eight VRA categories, three were derived from the Blue Ridge Parkway VRA Methodology (Vividness, Uniqueness, Duration of Vista), three were derived from the NPS Scenery Conservation Program (Desired Landscape Elements, Undesired Landscape Elements, Visual Harmony), and two are unique to the GWMP VRI&A (Historic Vista and Open Vista).

2. The majority of the VRA categories were assessed in the field by the VRA team members. The three "Modifier" categories, however, required additional analysis that was conducted in the office. These categories (Duration of Vista, Historic Vista, and Open Vista) were scored by the GWMP VRI&A preparers rather than the VRA team.

Table 1.3. Checklist developed to illustrate the VRA methodology used at the GWMP.

GWMP VRA METHODOLOGY CHECKLIST

1. Conduct preliminary fieldwork to inventory contemporary vistas.
2. Record the linear extent of each vista using a GPS unit.
3. Document each vista with individual and panoramic photographs.
4. With interdisciplinary VRA team, conduct the Scenic Quality Phase field work, scoring each vista on the northbound and southbound sides of the Parkway. Have VRA facilitators available during this process to answer questions and provide clarification. Record scores on provided VRA worksheets. Allow individual team members the opportunity to fine tune their scores before submitting them, if needed. Provide panoramic photographs of each vista to VRA team to assist in potential VRA score fine tuning.
5. Combine individual scores from the VRA team members and average.
6. Begin the Modification Phase. During this phase, single scores are given for non-scenic vista criteria to each vista. These scores are assigned by the SVI&A preparers rather than the VRA team, and are then combined with the Scenic Quality Phase subtotal score. This process will produce a final score for each vista.
7. Now that the final score for each vista is attained, compare and contrast the range of scores for each vista. Remember, higher scoring vistas have greater scenic value than lower scoring vistas.
8. Band the vistas into a useful number of scenic classes. We chose five scenic classes: Superior; High; Medium; Low; and Very Low. Use these scenic classes to inform treatment recommendations regarding vista and vegetation management

VRA Final Scores and Scenic Classes for GWMP

Direction	Open or Filtered	Mile Points	Vista # and Name	Scenic Quality Sub-total 0-18pts	Historic Vista Modifier 0-5 pts	Duration Modifier 0-3 pts	Open View Modifier 0-1 pts	Final Score 0-27 pts	Scenic Class
SB	Open	19.073-18.953	(#27) Washington Monument SB	13.878	5	3	1	22.878	Superior
SB	Open	18.821-18.645	(#29) Capitol Dome, Old Post Office, Castle Gatehouse SB	13.631	5	3	1	22.631	Superior
NB	Open	17.878-18.019	(#3) Three Sisters NB	12.771	5	3	1	21.771	Superior
NB	Open	19.668-16.769	(#15) Donaldson Run NB	12.05	5	3	1	21.628	Superior
NB	Open	19.503-19.563	(#13) Fletcher's Cove NB	14.192	5	1	1	21.192	Superior
NB	Open	19.424-19.473	(#12) Scenic Overlook #1 NB	12.064	5	3	1	21.064	Superior
SB	Filtered	19.277-19.184	(#26) Filtered Rosslyn and River SB	13.121	5	2	0	20.121	Superior
SB	Filtered	18.108-18.053	(#34) Filtered Georgetown SB	14.392	2.5	3	0	19.892	High
NB	Filtered	18.630-18.726	(#7) Filtered Georgetown Reservoir NB	11.764	5	3	0	19.764	High
NB	Open	17.769-17.805	(#1) Spout Run NB	13.407	5	0	1	19.407	High
SB	Open	17.826-17.778	(#37) Spout Run SB	14.225	2.5	1	1	18.725	High
NB	Filtered	19.808-19.852	(#16) Filtered Scenic Overlook #2 NB	10.385	5	3	0	18.385	High
NB	Filtered	17.923-18.018, 18.037-18.196	(#4) Filtered Three Sisters NB	10.378	5	3	0	18.378	High
NB	Open	18.730-18.771	(#8) Georgetown Reservoir Castle Gatehouse NB	11.285	5	1	1	18.285	High
NB	Filtered	17.808-17.882	(#2) Filtered Spout Run NB	10.035	5	3	0	18.035	High
SB	Open	19.815-19.674	(#22) Donaldson Run SB	8.712	5	3	1	17.712	Medium
NB	Open	18.944-18.970	(#10) GW Mt. Vernon Campus #2 NB	10.521	5	1	1	17.521	Medium
SB	Open	18.900-18.851	(#28) GW Mt. Vernon Campus SB	9.131	5	2	1	17.131	Medium
SB	Open	18.525-18.459	(#31) Windy Run SB	10.043	5	1	1	17.043	Medium
NB	Open	18.830-18.860	(#9) GW Mt. Vernon Campus #1 NB	9.95	5	1	1	16.95	Medium

Direction	Open or Filtered	Mile Points	Vista # and Name	Scenic Quality Sub-total 0-18pts	Historic Vista Modifier 0-5 pts	Duration Modifier 0-3 pts	Open View Modifier 0-1 pts	Final Score 0-27 pts	Scenic Class
NB	Filtered	19.872-19.982, 20.007-20.037	(#11) Filtered South of Scenic Overlook #1 (Interspersed by Vegetation) NB	8.285	5	3	0	16.285	Medium
SB	Open	20.259-20.166	(#21) Gulf Branch SB	8.2	5	2	1	16.2	Medium
SB	Filtered	18.239-18.130	(#32) Filtered National Cathedral SB	10.307	2.5	3	0	15.807	Low
SB	Open	19.579-19.548	(#24) Fletcher's Cove SB	8.756	5	1	1	15.756	Low
NB	Open	20.176-20.212	(#18) Gulf Branch NB	8.692	5	1	1	15.692	Low
SB	Filtered	17.981-17.959	(#36) Filtered Three Sisters SB	13.664	0	2	0	15.664	Low
SB	Filtered	19.859-19.815	(#23) Filtered Scenic Overlook #2 SB	8.521	5	2	0	15.521	Low
SB	Open	18.014-17.998, 17.955-17.946	(#35) Three Sisters (Interspersed by Veg.) SB	10.968	2.5	1	1	15.468	Low
SB	Open	19.497-19.423	(#25) Scenic Overlook #1 SB	6.068	5	2	1	14.068	Low
NB	Open	18.451-18.476	(#6) Windy Run NB	6.871	5	1	1	13.871	Very Low
SB	Open	18.126-18.110	(#33) National Cathedral SB	10.187	2.5	0	1	13.687	Very Low
SB	Filtered	18.699-18.606	(#30) Filtered Georgetown Reservoir Castle Gatehouse SB	7.657	5	1	0	13.657	Very Low
NB	Open	20.490-20.586	(#19) Glebe Road NB	9.1	2.5	1	1	13.6	Very Low
SB	Open	20.599-20.487	(#20) Glebe Road SB	7.425	2.5	2	1	12.925	Very Low
NB	Filtered	18.322-18.366	(#5) Filtered South of Windy Run NB	8.478	2.5	1	0	11.978	Very Low
NB	Filtered	19.543-19.593	(#14) Filtered Fletcher's Cove NB	10.642	0	1	0	11.642	Very Low
NB	Filtered	19.808-19.852	(#17) Filtered North of Scenic Overlook #2 (Interspersed by Vegetation) NB	6.685	2.5	2	0	11.185	Very Low
NB	Filtered	22.784-22.854	Filtered Riverview near CIA HQ NB	6.264	0	3	0	9.264	Very Low

VRA Score Analysis

Based on the VRA model implemented along the northern portion of the GWMP, the potential scoring range for the vistas assessed is 0-27 points. The actual range of scores for the vistas was a high score of 22. 878 (Washington Monument SB) and a low score of 9.264 (Filtered Riverview Near CIA HQ NB).

Northbound vs Southbound Vistas

There are several fundamental differences between northbound vistas and southbound vistas along the GWMP that have the potential to impact VRA scores. Northbound vistas are closer to the Potomac River and therefore are more likely to feature broader and deeper vistas upon the river and its surrounding gorge. Northbound vistas also have the advantage of not having to look through oncoming traffic to see the vistas towards the Potomac. While southbound vistas have the disadvantage of being further from the Potomac and having to look through oncoming traffic, they have the advantage of featuring many more or the prominent monuments and landmarks of the nation's capital.

1. **There are slightly more northbound vistas than southbound vistas**. In total there are 20 northbound vistas and 18 southbound vistas, for a sum total of 38 vistas.
2. **The average score for northbound vistas and southbound vistas is very close.** The average score for a northbound vista is 16.794. The average score for a southbound vista is 16.938. As such, southbound vistas average score was .144 points higher than southbound vistas, a near statistical tie. Analysis of these numbers suggests that although the southbound vistas scored slightly higher because they have more vistas containing elements of DC's charismatic skyline, that this was largely offset by the northbound vistas advantages including lack of obstructions and proximity to the river.
3. **A notable majority of the top tiered vistas are northbound vistas**. Of the 15 vistas that rank in either the Superior or High scenic classes, 10 are northbound vistas and only 5 are southbound vistas.

Open vs Filtered Vistas

There are categorical differences between open vistas and filtered vistas. An open vista is a vista that is unobstructed by vegetation. In most cases, open vistas are a result of vegeta-

Figure 1.8. Representative photograph of a superior scenic class vista: Washington Monument SB. Superior vistas tend to be those that feature an open view toward the Potomac Gorge and often include a complimentary built feature, such as a monument, bridge, or college campus (2013, NCRO).

Figure 1.9. Representative photograph of a high scenic class vista: Spout Run NB. High scenic class vistas tend to have good exposure and connectivity to the Potomac, but may or may not have a complimentary built feature (2013, NCRO).

tion thinning to create openings through the forested landscape, or by a dramatic variation in topography (such as a bridge crossing). Conversely, a filtered vista is one that is seen through the foliage. Filtered vistas can generally only be seen during the leaf-off portion of the year (fall or winter) and are often incidental and not the result of a vegetation management action.

Open vistas have many scenic advantages over filtered vistas. The fact that they offer unobstructed views towards the Potomac resulted in relatively higher scores for open vistas. In addition, since many of the open vistas have required vegetation management to maintain, it follows that they may feature more captivating and vivid scenery. Lastly, since the open vistas can be seen year round and the filtered vistas can only be seen for a fraction of the year, the open vistas received an additional point during the Modification Phase of the VRA process (see the Open View Modifier, page 19).

1. **There are significantly more open vistas than filtered vistas.** In total there are 23 open vistas and only 15 filtered vistas.
2. **The average score for open vistas is statistically higher than filtered vistas**. The average score for an open vista is 17.617. The average score for a filtered vista is 15.705. As such, open vistas average score is 1.912 points higher than filtered vistas.

As anticipated, open vistas scored better on average than filtered vistas. However, the difference between the two averages (roughly 2 points) was closer than may have been expected. The relative closeness between the open and filtered average scores may be attributed to a combination of factors, including the fact that the open views and filtered views were assessed separately (in summer and fall respectively), and as such the filtered views may have received scores that were relatively higher than if they had been assessed in tandem with the open views. In addition, since the filtered vistas are seen through the trees canopy and receive little to no vegetation management, they are typically longer then open vistas and scored higher in the Duration of Vista Modifier Category. Excluding the two overlooks, the average length and Duration of Vista Modifier score for a filtered vista was 471 feet and 2.28 points respectively, while the averages for an open vista were 357 feet and 1.54 points. This difference in vista lengths resulted in filtered vistas scoring roughly .75 more in the Duration of Vista score then open vistas, which accounts for some of the closeness in scores between the two vista types.

Lastly, the open vistas may have scored better had they been assessed in the winter. Although the vistas themselves are characterized as "open", the overall vista aperture is wider in the winter and the vista edges are more transparent, a distinction that may have resulted in higher scores for the open vistas had they been assessed in the winter. If done over again, it would be recommended to conduct both open and filtered VRAs during the leaf-off seasons.
3. **A notable majority of the top tiered vistas are open vistas.** Of the 15 vistas that rank in either the Superior and High scenic classes, 9 are open vistas and 6 are filtered vistas.

Dynamic vs Stationary Vistas

As a circulation corridor, the overwhelming majority of the vistas along the northern section of the GWMP are dynamic rather than stationary; that is they are intended to be experienced while travelling in a moving vehicle. Only 2 out of 38 vistas within the study area are stationary; Scenic Overlook #1 and Scenic Overlook #2. As the overlook vistas are both few in number and require a substantial investment in infrastructure and maintenance, it would be anticipated that vistas from these locations would score well in comparison to the dynamic vistas in this section of the GWMP.

It should be noted that while both Scenic Overlook #1 and Scenic Overlook #2 were intended to be open vistas, Scenic Overlook #2 has a substantial amount of deciduous brush and vine growth that has grown up in its foreground. This overgrowth now heavily limits views during the spring and summer. As such, Scenic Overlook #2 was assessed as a filtered vista, as the view from this overlook is currently obstructed by vegetation during the growing season. Had the vista at Scenic Overlook #2 been more open as intended, it is likely that this vista would have scored higher.

1. **The average score for a stationary vista is dramatically higher than for dynamic vistas**. The average score for a stationary vista is 19.724. The average score for a dynamic vista is 16.216. As such, stationary vistas average score was 3.508 points higher than dynamic vistas. While the data admittedly draws from a small pool of stationary vistas, it does support the notion that stationary vista locations were selected for their superlative scenic characteristics.

2. **Both of the stationary vistas scored in the Superior or High scenic classes**. Scenic Overlook #1 ranked in the Superior Class and Scenic Overlook #2 in the High Class.

Summary & Additional Research

The VRA process implemented along the GWMP produced a range of scores with enough variation to inform objective management of scenic vistas. It has also been demonstrated that certain vista elements, such as the directionality of the vista or the time of year of the vista, have a correlation to the likelihood that a vista will be high or low scoring. However, the results of the VRA show that a diversity of vista types were high scoring. In the final tally, a representative cross section of vistas scored well enough to place within the Superior or High scenic classes, including vistas that are both northbound and southbound, open and filtered, and dynamic and stationary.

While this report provides a solid inventory and assessment of the scenic characteristics along the northern GWMP, additional work remains that would benefit visual resource management along the Parkway. Recommendations for additional visual resources work and research include the following:

- This report provides an inventory and assessment for the visual resources for the northern 1/3 of the GWMP. Additional

Figure 1.10. Representative photograph of a medium scenic class vista: Donaldson Run SB. Medium and low scenic class vistas tend to have diminishing visual connectivity to the river, are often partially obstructed, and generally do not feature any complimentary built features (2013, NCRO).

visual resource inventory and assessment work should focus on the GWMP from Mount Vernon to Spout Run.

- Based on the findings of this report, treatment recommendations should be made to restore and maintain the higher ranking vistas. Vista restoration should be based on reestablishing historic vista conditions.
- Historic images along the Parkway were incomplete, with some sections of the Parkway entirely unrepresented. Additional research to locate images depicting historic vista conditions along the Parkway would help inform vista restoration.
- Completion of a Cultural Landscape Report (CLR) for the GWMP from the Memorial Circle to the Capital Beltway would provide comprehensive treatment recommendations for the property.

Endnotes

1. As defined by FHWA, 3R projects (Resurfacing, Restoration, Rehabilitation or often simply referred to as "rehabilitation") focus primarily on the preservation and extension of the service life of existing roadways while allowing for safety improvements.
2. National Park Service, *George Washington Memorial Parkway National Register of Historic Places Registration Form* (1995).
3. U.S. Department of Transportation, "*America's Byways*", http://www.fhwa.dot.gov/byways/byways/60807
4. As defined within Park Road Standards (NPS, 1984, pg. 32) a guardwall is a "barrier intended to redirect an errant vehicle, thus preventing it from hitting a roadside or median hazard." Guidewalls, on the other hand, are "intended only to delineate the roadway, or to warn of roadside hazards."
5. National Park Service Organic Act, as cited in the *Scenic Vista Management Plan for Yosemite National Park Environmental Assessment*, (2010), I-5.
6. U.S. House of Representatives. Seventy-first Congress. *H.R. 26, Capper-Cramton Act*. Washington, Government Printing Office, 1930,
7. *The National Historic Preservation Act of 1966, as Amended*. http://www.achp.gov/nhpa.html
8. *Programmatic Agreement among the NPS, ACHP, and the National Conference of SHPOs* (2008). http://www.nps.gov/policy/106agreement.pdf
9. *Director's Order #28: Cultural Resources Management*, (1998). http://www.nps.gov/history/history/online_books/nps28/28contents.htm
10. Harpers Ferry Center, *George Washington Memorial Parkway Long-Range Interpretive Plan*, (2005), 13.
11. Harpers Ferry Center, *Long-Range Interpretive Plan*,13.
12. National Park Service, *DRAFT George Washington Memorial Parkway Foundation Document*, (Dec. 2013), 55.
13. National Park Service, *DRAFT Foundation Document*, 58.
14. National Park Service, *DRAFT Foundation Document*, 44.
15. National Park Service, *George Washington Memorial Parkway, HAER No. VA-69*, (Historic American Engineering Record, 1993), 29, 40, 51.
16. NPS, *HAER No. VA-69*, 52.
17. NPS, *HAER No. VA-69*, 65-66.
18. Davis, *Mount Vernon Memorial Highway*, 349.
19. Wirth, *Parks, Politics, and the People*, Chapter 2. http://www.cr.nps.gov/history/online_books/wirth2/index.htm
20. NPS, *HAER No. VA-69*, 50.
21. Davis, *Mount Vernon Memorial Highway*, 796.
22. Arno B. Cammerer, *The George Washington Memorial Parkway*, (circa mid-1930s).
23. Cammerer, *The George Washington Memorial Parkway*, (circa mid 1930s)
24. Davis, *Mount Vernon Memorial Highway*, 788-89.
25. Davis, *Mount Vernon Memorial Highway*, 801.
26. Davis, *Mount Vernon Memorial Highway*, 823.
27. Dudley C. Bayliss, *Planning our National Park Roads and Our National Byways*, (Traffic Quarterly Vol. 11, Eno Foundation for Highway Traffic Control, Inc., 1957), 15, 4.
28. Davis, *Mount Vernon Memorial Highway*, 842.
29. NPS, *HAER No. VA-69*, 12.
30. The location of historic vistas was determined from analyzing many sources of information, including historic maps, historic photographs, historic aerial photography, and interviews with GWMP Tree Crew Personnel. Once established, the approximate location of historic vistas was entered as linear shapefiles into GIS. Once entered into GIS, the location of historic vistas could be easily compared to the location of contemporary vistas.
31. Dudley C. Bayliss, *Planning our National Park Roads and Our National Byways*, (Traffic Quarterly Vol. 11, Eno Foundation for Highway Traffic Control, Inc., 1957), 6,7.
32. The location of historic vistas was determined from analyzing many sources of information, including historic maps, historic photographs, historic aerial photography, and interviews with GWMP Tree Crew Personnel. Once established, the approximate location of historic vistas was entered as linear shapefiles into GIS. Once entered into GIS, the location of historic vistas could be easily compared to the location of contemporary vistas.
33. Guinn, Muriel, *New George Washington Parkway Section Gives Autoists Novel Vistas* (Washington Post and Times Herald), November 14, 1958: B1.

34. Templeman, Eleanor Lee, *New GW Route Unites History with Beauty* (Washington Post and Times Herald), November 27, 1958: B16.

35. Brown, Nona. *Washington Parkway's View of Washington* (New York Times), October 29, 1959: 1.

36. Dudley C. Bayliss, *Planning our National Park Roads and Our National Byways*, (Traffic Quarterly Vol. 11, Eno Foundation for Highway Traffic Control, Inc., 1957), 6,7.

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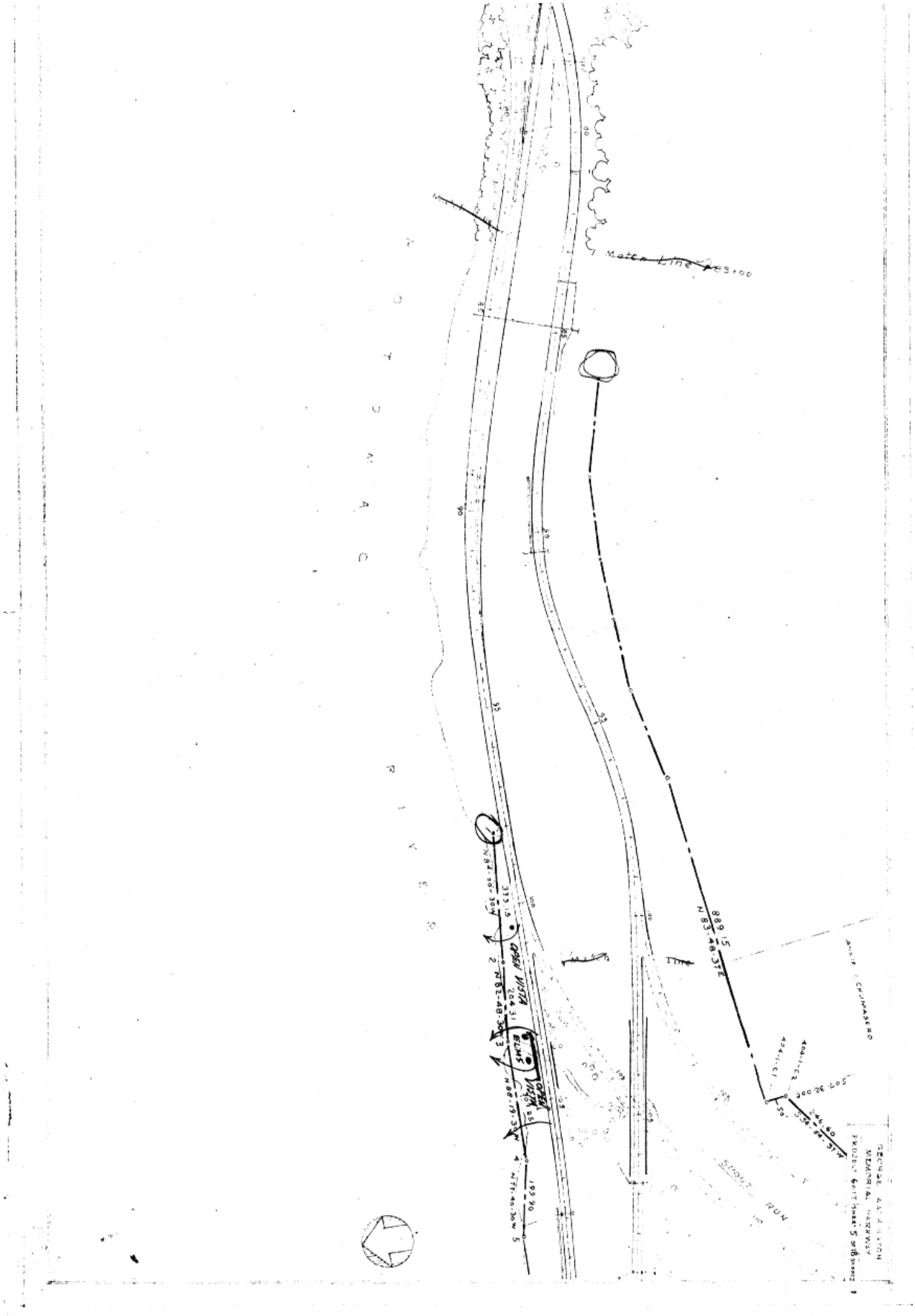
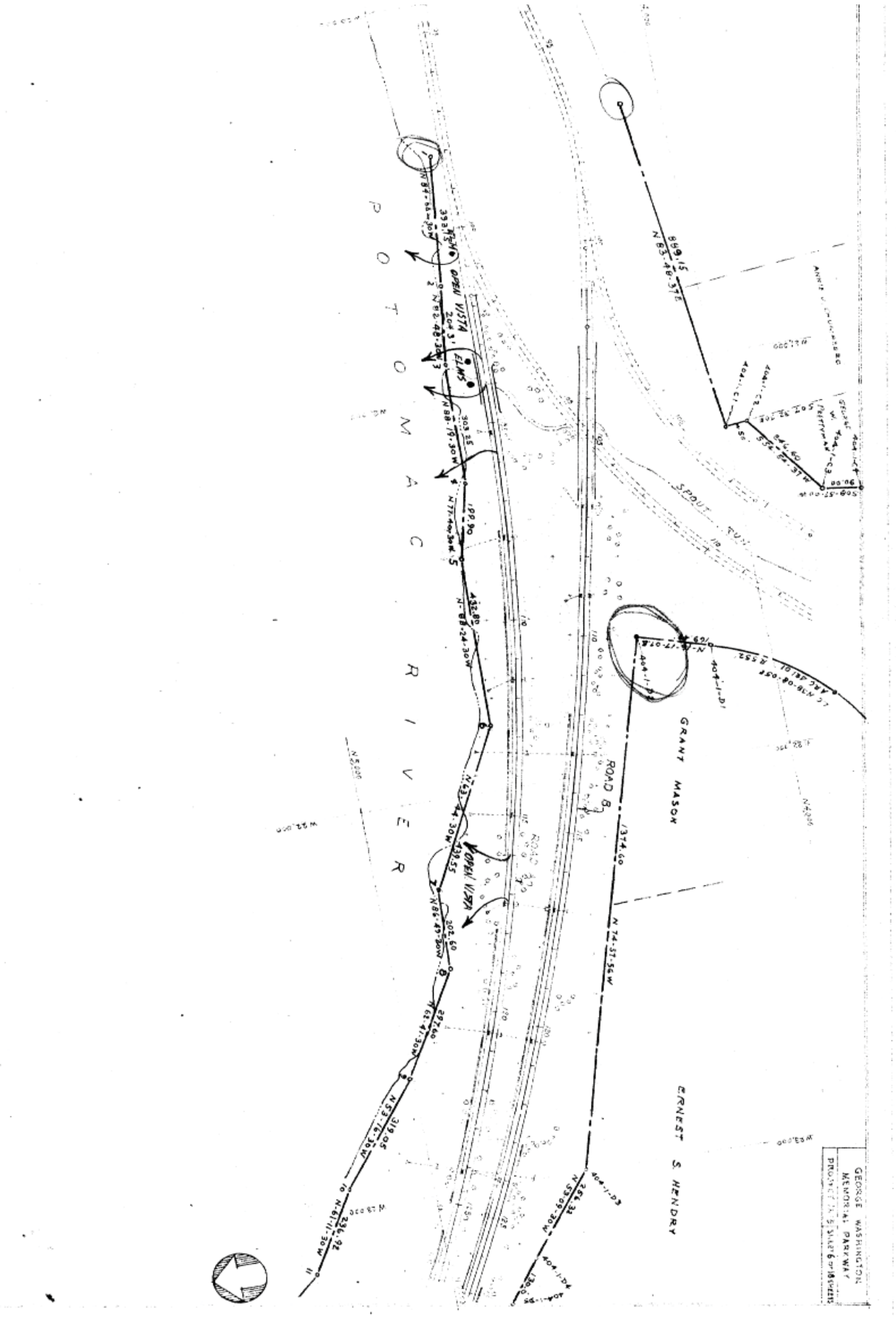
Appendix A

1961 Basemap Titled “Land Use and Maintenance Plans, Section 1, Boundary Channel to Capital Beltway” With an Overlay of Penciled-In Vista Locations; Five Maps in All

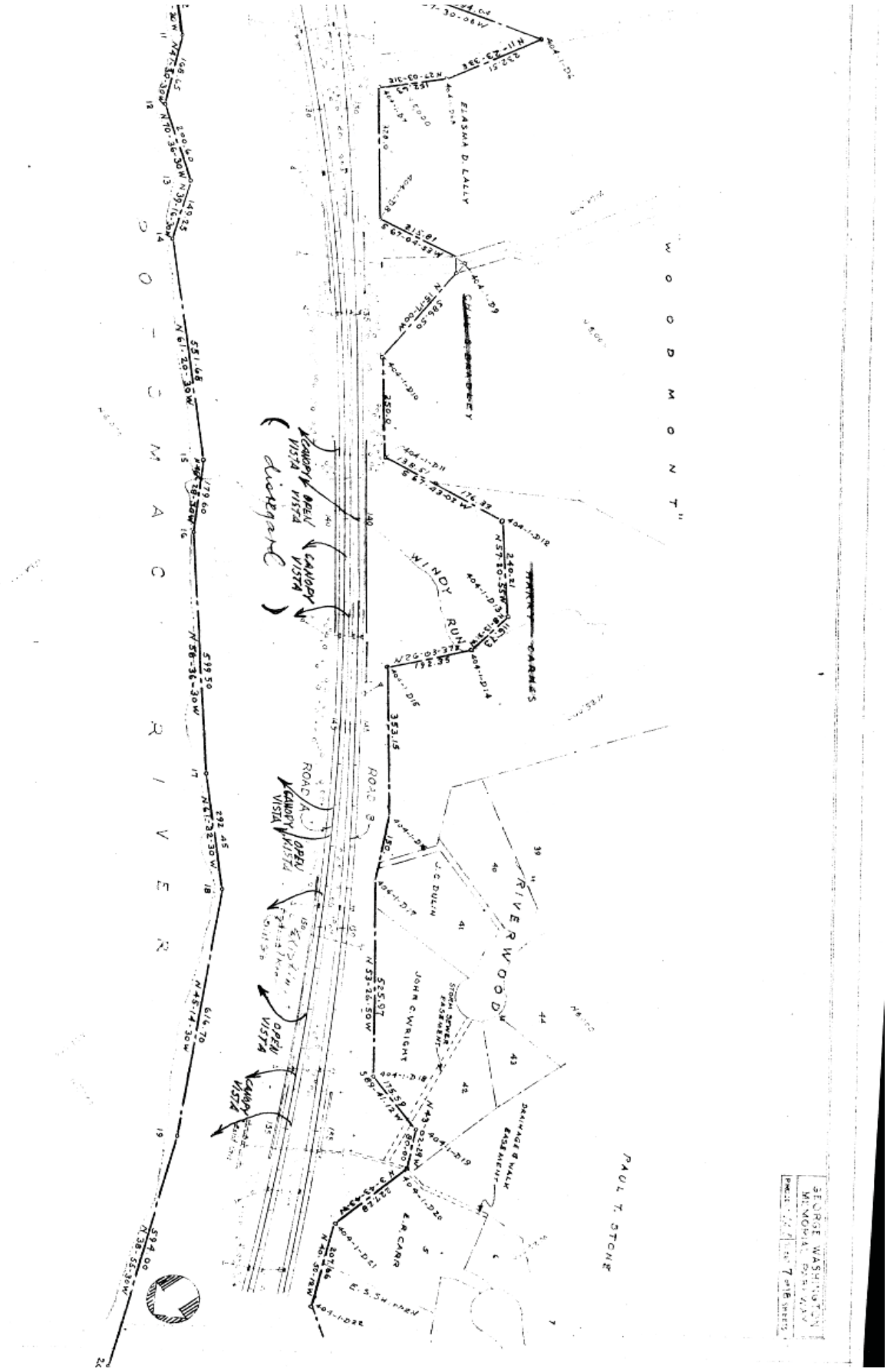
Appendix A: 1961 Vista Locations Basemap



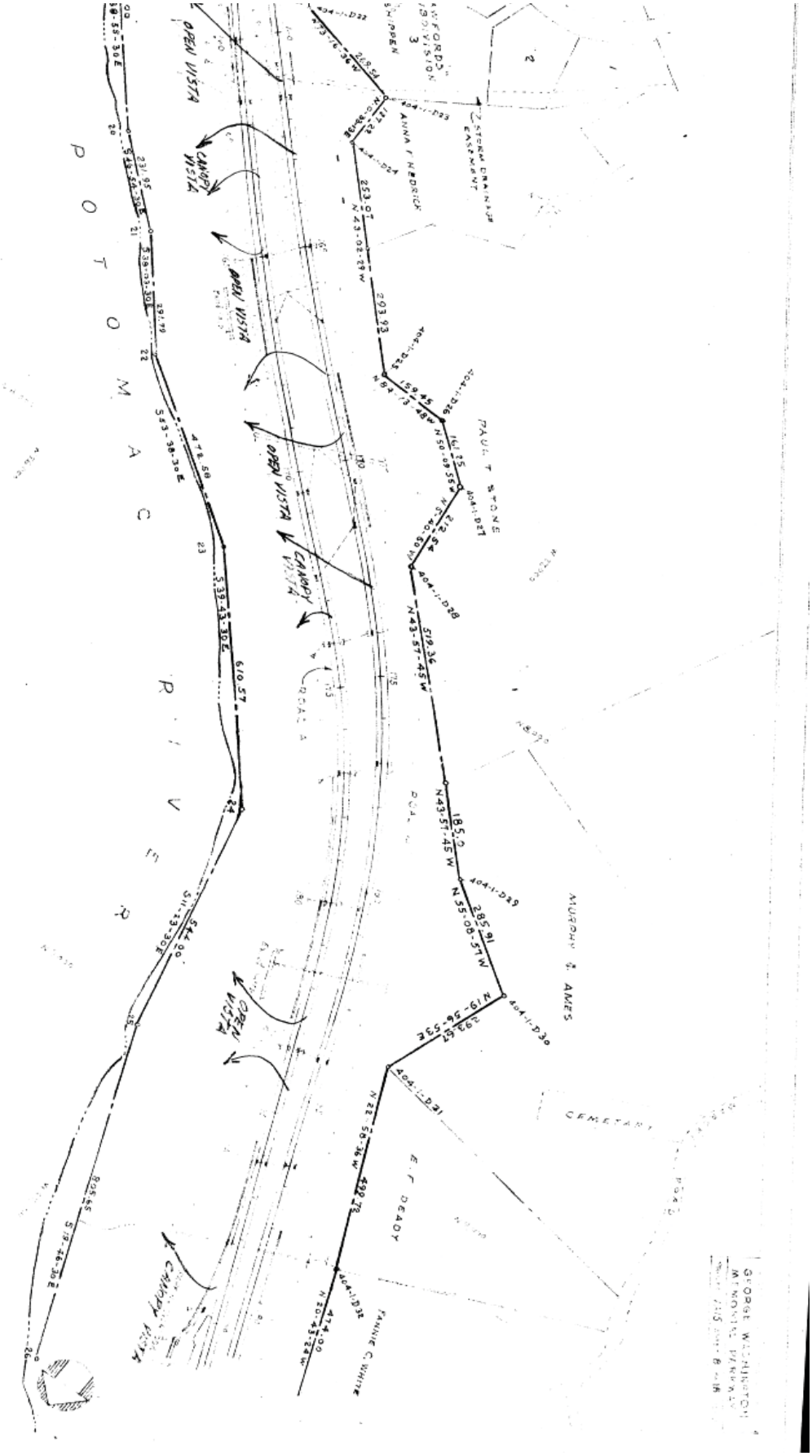
Appendix A: 1961 Vista Locations Basemap



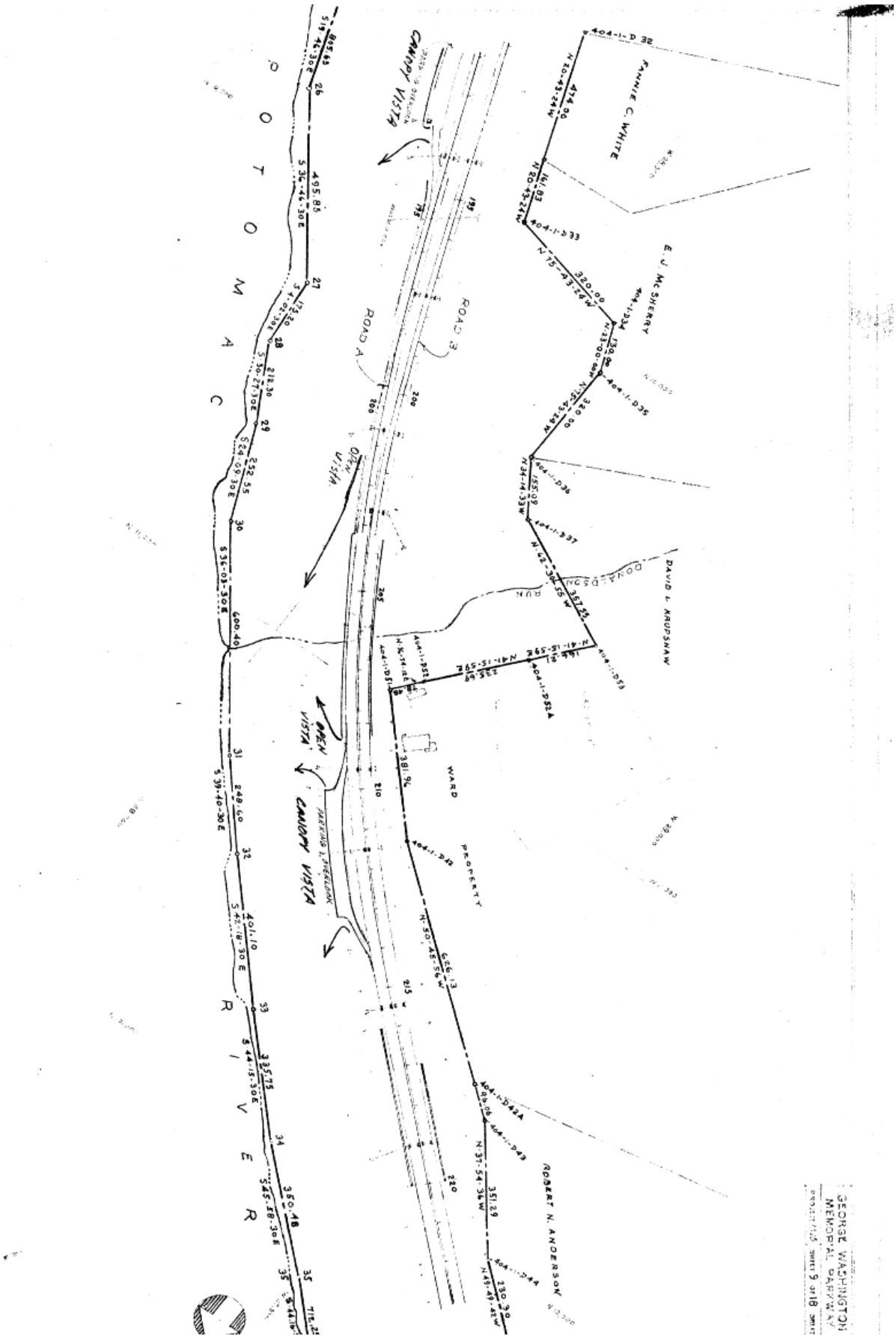
Appendix A: 1961 Vista Locations Basemap



Appendix A: 1961 Vista Locations Basemap



Appendix A: 1961 Vista Locations Basemap



Appendix B

Historic Vista Modifier Data Analysis

Appendix B: Historic Vista Modifier Data Analysis

Historic Vista Modifier Data Table

#	Open or Canopy	Historic Vista Name	Assoc. with guard wall	Assoc. with bridge	Evidence of Maintenance	Evidence that Corroborates Vista Location	Notes
A	Open	Vista at Spout Run, SB	no	yes	no	Elevation Change at Bridge!; VRI&A; PP-2, PP-4, PP-5, PP-6!; AP-4!	Although there is no evidence of vista maintenance in this location, maintenance was likely never necessary due to the elevation change associated with the bridge.
B	Open	Vista just after Spout Run	no	yes	yes	LU&MP1961!; NPV1990:8!; PP-1, PP-2!, PP-4, PP-5; AP-1, AP-2	Evidence of a historic vista in this location is corroborated by numerous sources.
C	Canopy	Canopy Vista over Guardwall 1N	yes	no	yes	LU&MP1961?; NPV1990:9?; PP-2!, PP-4; AP-1!, AP-2, AP-3, AP-4!	This vista was clearly maintained to prevent vegetation from encroaching onto the hillside that leads up to the vista and allowing for a canopy vista through the ribbon of trees along the Potomac. Supporting evidence for the vista in the 1961 and 1990 inventories is ambiguous; however there is strong supportive evidence in historic photographs and aerials.
D	Open	Open Vista over Guardwall 1N	yes	no	yes	LU&MP1961?; NPV1990:9?; PP-2!, PP-4; AP-1, AP-2!, AP-3, AP-4!	Guardwall 1N transitions from a canopy vista to an open vista as it moves north. This open vista was clearly maintained to prevent vegetation from encroaching upon the hillside and remains open today. Supporting evidence for vista maintenance in 1961 and 1990 inventories is ambiguous; however there is strong supportive evidence in historic photographs and aerials.
E	Open	Vista over Guardwall 29S, SB	yes	no	no	PP-2, PP-7!, PP-8!, PP-9, PP-10!, PP-11, PP-12; AP-1!, AP-2!,	Upon Parkway dedication in 1961, the southbound grade-divided area along guardwall 29-S offered a sweeping vista of the Potomac, Georgetown University, and Key Bridge. However, there is no evidence this vista was maintained and the aerial photograph from 1968 (AP-3) suggests that by this year vegetation had become established downslope of the vista and it has likely been obstructed ever since. This vista may have been left to grow in with vegetation out of consideration of the slope failures that occurred in this area, evidenced in many historic photographs.
F	Open	Vista over Guardwall 2N	yes	no	yes	LU&MP1961?; NPV1990:9?; PP-7, PP-8!, PP-9, PP-10!, PP-11!, PP-12; AP-1!, AP-3!, AP-4	Supporting evidence for the maintenance of this vista in the 1961 and 1990 inventories is ambiguous; however there is strong supportive evidence in historic photographs and aerials. The northern portion of Guardwall 2N clearly had an open vista (PP-8 and PP-7) while the southern terminus of the guardwall was obstructed by mature trees (PP-11, PP-12). In addition, aerial photography up until 1974 depicts vegetation management along the slopes leading up to this vista, demonstrating vista maintenance.

Legend:
- !- Clear, Supporting Evidence for Historic Vista Location
- ?- Ambiguous, Questionable Evidence for Historic Vista Location
- PP- Period Photographs (see pgs. 47-59, Appendix B)
- AP- Aerial Photographs (see pgs. 61-64, Appendix B)
- LU&MP1961- Land Use and Maintenance Plans, Section 1, 1961
- NPV1990:11- North Parkway Vistas, 1990. The number behind the colon corresponds to the bullet number from the vista inventory.
- CLI- Cultural Landscape Inventory, GWMP – North, 2009
- VRI&A- Visual Resources Inventory & Assessment, GWMP-North, 2014

Appendix B: Historic Vista Modifier Data Analysis

#	Open or Canopy	Historic Vista Name	Assoc. with guard wall	Assoc. with bridge	Evidence of Maintenance	Evidence that Corroborates Vista Location	Notes
G	Open	Vista over Guardwall 3N	yes	no	yes	LU&MP1961?; NPV1990:9?; PP-7!, PP-9, PP-11; AP-1!, AP-2, AP-4	Supporting evidence for the maintenance of this vista in the 1961 and 1990 inventories is ambiguous. However, there is evidence in the historic record to support there being a vista adjacent to guardwall 3N. The best historic photograph of the vista located was PP-7, which depicts a vista in this area with mature trees overlapping both ends of the guardwall. Aerial photography extending all the way to 1974 shows cleared vegetation in this area.
H	Open	Vista over Guardwall 4N	yes	no	no	LU&MP1961?; NPV1990:9?; AP-1!; CLI; VRI&A	The only clear evidence that we have that there was once a vista in this location comes from the 1957 aerial (AP-1). Aerial photographs from later years suggest that this vista was not maintained and filled in with vegetation. Vistas adjacent to this guardwall were documented in the CLI (2009) and the VRI&A (2014) as filtered vistas. In addition, long-time GWMP facilities maintenance staff Anthony Migliaccio and Ron Vail was consulted and neither could recall this vista ever being maintained.
I	Open	Vista at Windy Run Bridge	no	yes	yes	Elevation Change at Bridge!; LU&MP1961?; NPV1990:10!; AP-1!; CLI; VRI&A	A maintained vista at Windy Run is called for in both the 1961 and 1990 inventories. However, the 1961 inventory has the parenthetical comment "disregard" following the identified vista, which suggests that as some later point GWMP decided to no longer maintain this vista. In spite of some encroachment along the vista's perimeter, the elevation change of this bridge crossing still affords an open vista out towards the Potomac.
J	Open	Vista 1 over Guardwall 5N	yes	no	yes	LU&MP1961!; NPV1990:11!, PP-13, PP-14!, PP-15!; AP-1!, AP-3!; CLI	This striking SB vista was featured in many historic photographs, offering relatively up-close glimpse of the Three Sisters, Key Bridge, Washington Monument, and Capitol Dome. Unfortunately, the vista has become overgrown with vegetation. Historic photographs, particularly PP-14 and PP-15, fully capture the entire breadth of the vista, bound to the north by a stand of established vegetation that rises above Guardwall 5N.
K	Open	Vista 2 over Guardwall 5N	yes	no	yes	LU&MP1961!; NPV1990:11!; PP-15, PP-16!, PP-17; AP-1!, AP-3!; CLI; VRI&A	This is the second, northern vista along Guardwall 5N. This historic vista's location is corroborated by many sources and clearly depicted in PP-16.
L	Open	Vista over Guardwall 6N	yes	no	yes	LU&MP1961; NPV1990:12!; PP-18; AP-1!, AP-2, AP-3!; CLI; VRI&A	Only one historic photograph was located for this historic vista, and only then from a considerable distance. There is enough other corroborating evidence to support a vista in this location, including several aerial photographs and the 1990 inventory bullet 12 which identifies a "vista over the stonewall" in this location.

Legend:
- !- Clear, Supporting Evidence for Historic Vista Location
- ?- Ambiguous, Questionable Evidence for Historic Vista Location
- PP- Period Photographs (see pgs. 47-59, Appendix B)
- AP- Aerial Photographs (see pgs. 61-64, Appendix B)
- LU&MP1961- Land Use and Maintenance Plans, Section 1, 1961
- NPV1990:11- North Parkway Vistas, 1990. The number behind the colon corresponds to the bullet number from the vista inventory.
- CLI- Cultural Landscape Inventory, GWMP – North, 2009
- VRI&A- Visual Resources Inventory & Assessment, GWMP-North, 2014

Appendix B: Historic Vista Modifier Data Analysis

#	Open or Canopy	Historic Vista Name	Assoc. with guard wall	Assoc. with bridge	Evidence of Maintenance	Evidence that Corroborates Vista Location	Notes
M	Open	Vista over Guardwall 7N	yes	no	yes	LU&MP1961!; NPV1990:13!; PP-18!; AP-1, AP-2, AP-3!, AP-4; CLI; VRI&A	This wide-open historic vista is captured in PP-18, and corroborated by a suite of additional sources.
N	Open	Vista over Guardwall 8N	yes	no	yes	LU&MP1961?; NPV1990:14!; PP-19!; AP-1!, AP-3	This vista is captured in the oblique aerial photograph PP-19, depicting an open vista along Guardwall 8N's northern periphery with established vegetation at its southern extent. The 1961 vista inventory labels an "open vista" at the location of a raised berm between Guardwalls 8N and 9N. This is almost certainly an error, and likely intended to signify a vista to the south, north, or in both directions from the berm.
O	Open	Vista just before 1st Overlook, SB	no	no	yes	LU&MP1961?; NPV1990:15!; PP-19; AP-1!, AP-3,	This vista was difficult to locate and has limited supporting evidence. There is no historic photograph that clearly depicts this vista and the 1961 inventory does not identify a vista in this specific location. Bullet 15 of the 1990 vista inventory, however, does call for a SB vista "just before 1st overlook". In addition, aerial photography shows what appears to be a clearing adjacent to the road that connects to a natural depression that was likely utilized for a SB vista. This clearing and depression appear to be visible in AP-1 and AP-3. The identification of this vista is based on best available data
P	Canopy	Canopy Vista at 1st Overlook	yes	no	yes	LU&MP1961!; NPV1990:16!; AP-4; CLI; VRI&A	While the overlook is not well represented in historic photographs and it is difficult to appreciate from aerial photographs (because it is a canopy view seen through mature stands of trees) it is clearly a historic vista as the guardwall and parking that define the overlook are original features to the Parkway. Furthermore, the Vista is featured in both the 1961 and 1990 vista inventories.
Q	Canopy	Canopy Vista over Guardwall 10N	yes	no	yes	AP-1!; CLI; VRI&A	This historic vista was difficult to confirm. However, there is evidence that suggests that a vista in this location was historically present. Namely, the 1957 aerial photograph (AP-1) shows cleared vegetation on the likely regraded slope adjacent to this vista. Furthermore, conversations with long-time GWMP facilities maintenance staff Anthony Migliaccio and Ron Vail included recollection of maintaining this vista via vegetation thinning and removal. In addition, an open vista is still present over Guardwall 10, which suggests that there has been some maintenance at this location to prevent tree encroachment.
R	Open	Vista before Donaldson Bridge, NB	no	yes	yes	LU&MP1961!; NPV1990:17!; PP-19, PP-20!, PP-21, PP-22;	Experientially, this vista is combined with the subsequent vistas that look out over Donaldson Run Bridge; a tall, curving platform that provides sweeping views of the Potomac. However, this vista is

Legend:
- !- Clear, Supporting Evidence for Historic Vista Location
- ?- Ambiguous, Questionable Evidence for Historic Vista Location
- PP- Period Photographs (see pgs. 47-59, Appendix B)
- AP- Aerial Photographs (see pgs. 61-64, Appendix B)
- LU&MP1961- Land Use and Maintenance Plans, Section 1, 1961
- NPV1990:11- North Parkway Vistas, 1990. The number behind the colon corresponds to the bullet number from the vista inventory.
- CLI- Cultural Landscape Inventory, GWMP – North, 2009
- VRI&A- Visual Resources Inventory & Assessment, GWMP-North, 2014

Appendix B: Historic Vista Modifier Data Analysis

#	Open or Canopy	Historic Vista Name	Assoc. with guard wall	Assoc. with bridge	Evidence of Maintenance	Evidence that Corroborates Vista Location	Notes
						AP-1	distinguished from the others in that it is directionally a NB vista, and that it is individually called out in the 1990 vista inventory.
S	Open	Vista at Donaldson Run Bridge	no	yes	yes	Elevation Change at Bridge!; LU&MP1961!; PP-19, PP-20!, PP-21! PP-22!; CLI; VRI&A	The Donaldson Run Bridge is the longest and tallest of the bridges along the northern Parkway. These qualities endow the Bridge crossing with exceptional vistas out towards the Potomac. The vista over this central portion of the bridge is visible both NB and SB, and requires minimal maintenance due to the elevation change.
T	Open	Vista over Donaldson Bridge SB	no	yes	yes	LU&MP1961!; NPV1990:18!; PP-20, PP-21, PP-22!; PP-23!; AP-1, AP-3!; CLI; VRI&A	This SB vista extends over the top of much of Guardwall 12N towards Donaldson Run Bridge, creating a much longer vista for SB motorists compared to what would be experienced by crossing the bridge alone. This SB vista is specifically called out in the 1990 vista inventory and is visible in many historic photographs.
U	Canopy	Canopy Vista at 2nd Overlook	yes	no	yes	LU&MP1961!; NPV1990:18.5; PP-20, PP-21, PP-22!, PP-23; AP-1; CLI; VRI&A	Aside from being the vista at a historic designed overlook, this vista is further corroborated by the 1961 and 1990 vista inventories and historic photographs.
V	Open	Vista over Guardwall 13N	yes	no	no	AP-1!;	The only clear evidence that we have that there was once a vista in this location comes from the 1957 aerial (AP-1), which shows a large, regraded area downslope of the vista. Aerial photographs from later years suggest that this vista wasn't maintained and filled in with vegetation. The vista in this area was documented in the VRI&A (2014) as a filtered vista, having grown in with vegetation years earlier. In addition, long-time GWMP facilities maintenance staff Anthony Migliaccio and Ron Vail was consulted and neither could recall this vista ever being maintained.
W	Open	Vista at Gulf Branch Bridge	no	yes	yes	Elevation Change at Bridge!; NPV1990:19!; PP-24!; AP-1!; CLI; VRI&A	While this vista is not included in the 1961 inventory (the map does not extend this far north) it is specifically called out in the 1990 list of maintained vistas. Furthermore, the elevation differential at this bridge crossing makes this a natural location for a vista.
X	Open	Vista at Glebe Road Bridge	no	yes	no	Elevation Change at Bridge!; PP-25!; AP-1; CLI; VRI&A	The vista from the Glebe Road Bridge crossing offers the best view of Chain Bridge from the Parkway, as evidenced in PP-25. However, no record of vista maintenance has been located for this vista, perhaps because its elevation did not require it.

Legend:
- !- Clear, Supporting Evidence for Historic Vista Location
- ?- Ambiguous, Questionable Evidence for Historic Vista Location
- PP- Period Photographs (see pgs. 47-59, Appendix B)
- AP- Aerial Photographs (see pgs. 61-64, Appendix B)
- LU&MP1961- Land Use and Maintenance Plans, Section 1, 1961
- NPV1990:11- North Parkway Vistas, 1990. The number behind the colon corresponds to the bullet number from the vista inventory.
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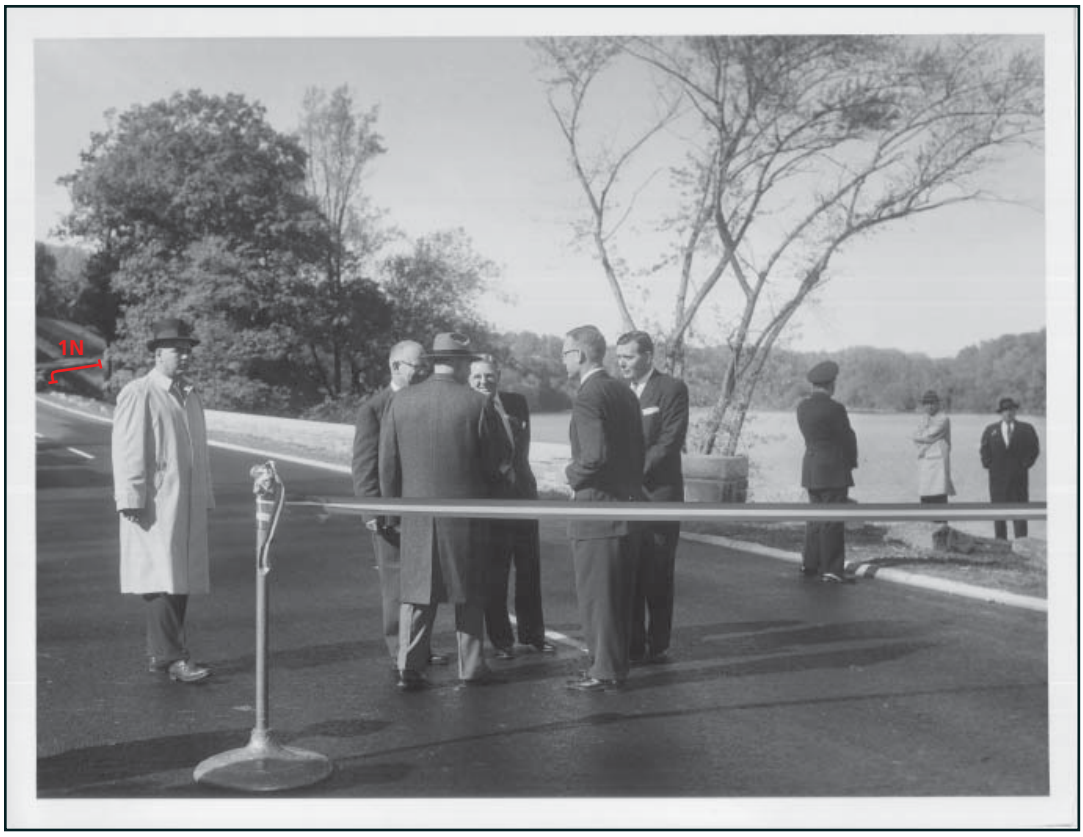
- VRI&A- Visual Resources Inventory & Assessment, GWMP-North, 2014

APPENDIX B: PERIOD PHOTOGRAPHS (PP)



PP-1. President Eisenhower at the ribbon-cutting dedication of the northern Parkway. Open vista conditions can be seen at and just after the Spout Run Bridge as can a dense stand of vegetation near the beginning of the 1N guardwall. (Image courtesy of the NPS Museum Resource Center, Box 12a, PH12 PF13, GWMP; Photo by Abbie Rowe, National Park Service) 1959.

PP-2. Aerial photograph believed to be from the early 1960s due to the lack of vegetation in the grade-divided median adjacent to guardwall 29S. This image very clearly depicts the once open SB vista along guardwall 29S, as well as the open vista immediately following Spout Run Bridge, and the canopy vista that transitions into an open vista adjacent to guardwall 1N. (Image courtesy of the GWMP CRM Program Archives, GWMP General Views 1960-1969 Folder) 1960-1969.

APPENDIX B: PERIOD PHOTOGRAPHS (PP)

PP-3. 1994 HAER photograph that appears to depict additional vegetation growth along the southern canopy section of the vista adjacent to guardwall 1N, However, the northern open section of this vista appears to be open as is seen in PP-2. (Image courtesy of HAER, VA-69-200) 1994.

PP-4. 1994 HAER aerial photograph depicting the vista opening immediately following the Spout Run Bridge, as well as open vista conditions at the northern terminus of the 1N guardwall. By this time the grade divided median has grown in substantially since the 1960s (See picture PP-2) and guardwall 29S is not visible through the encroaching trees. (Image courtesy of HAER, VA-69-87) 1994.

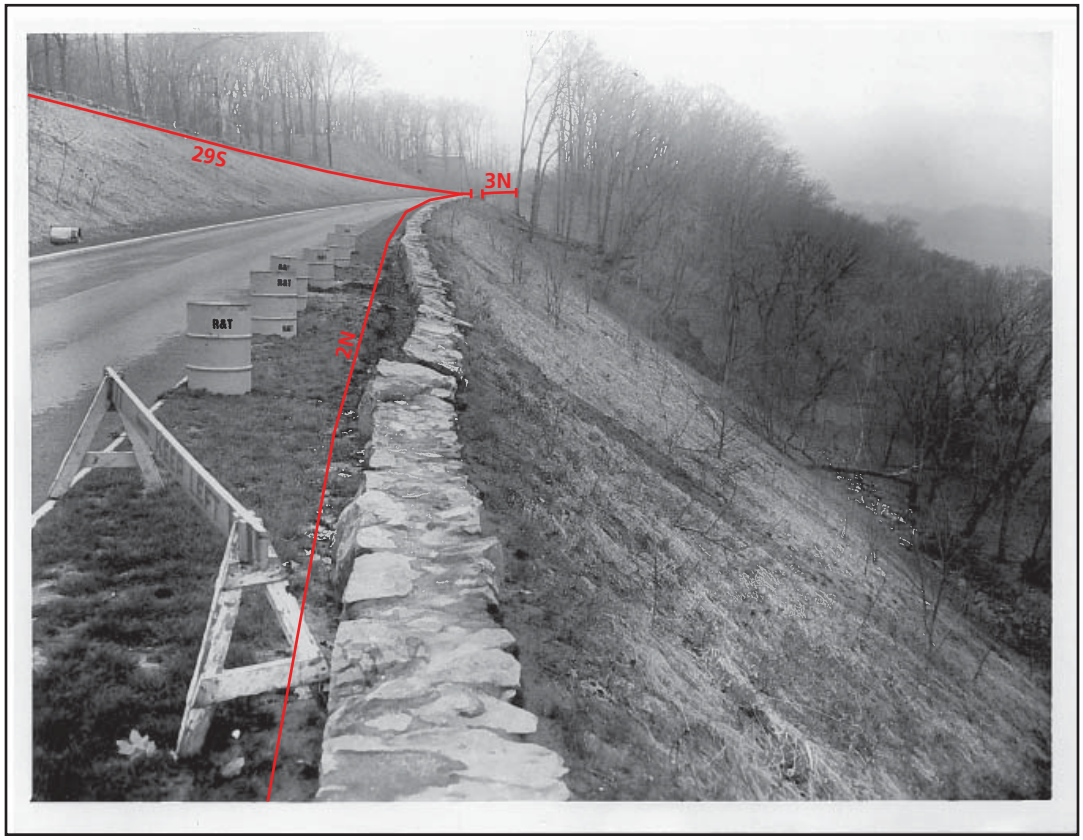
APPENDIX B: PERIOD PHOTOGRAPHS (PP)

PP-5. 1994 image depicting open vista conditions associated with the Spout Run Bridge crossings, both NB and SB. (Image courtesy of HAER, VA-69-198) 1994.

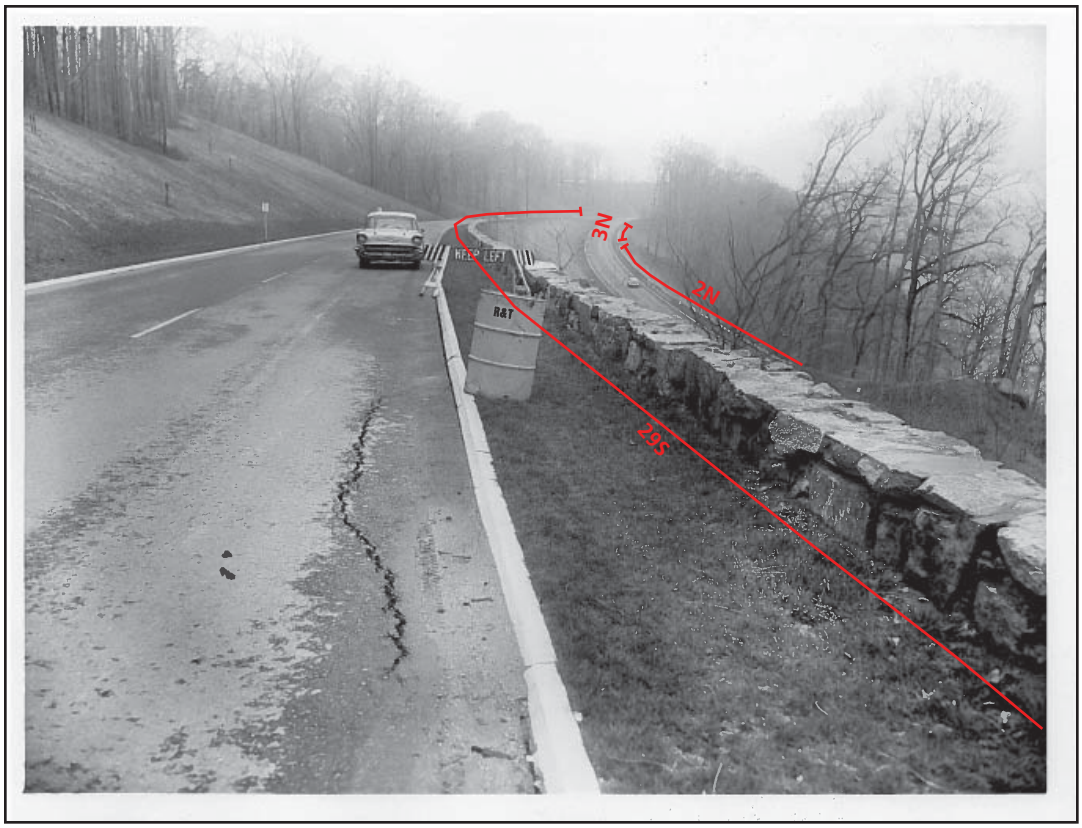
PP-6. Construction of the Spout Run SB bridge, showing that existing vegetation was retained on either side of the ravine, creating a relatively short vista opening at this bridge crossing (Image courtesy of the NPS Museum Resource Center, Box 12b, PH12 PF14, GWMP Folder 2) 1958.

APPENDIX B: PERIOD PHOTOGRAPHS (PP)

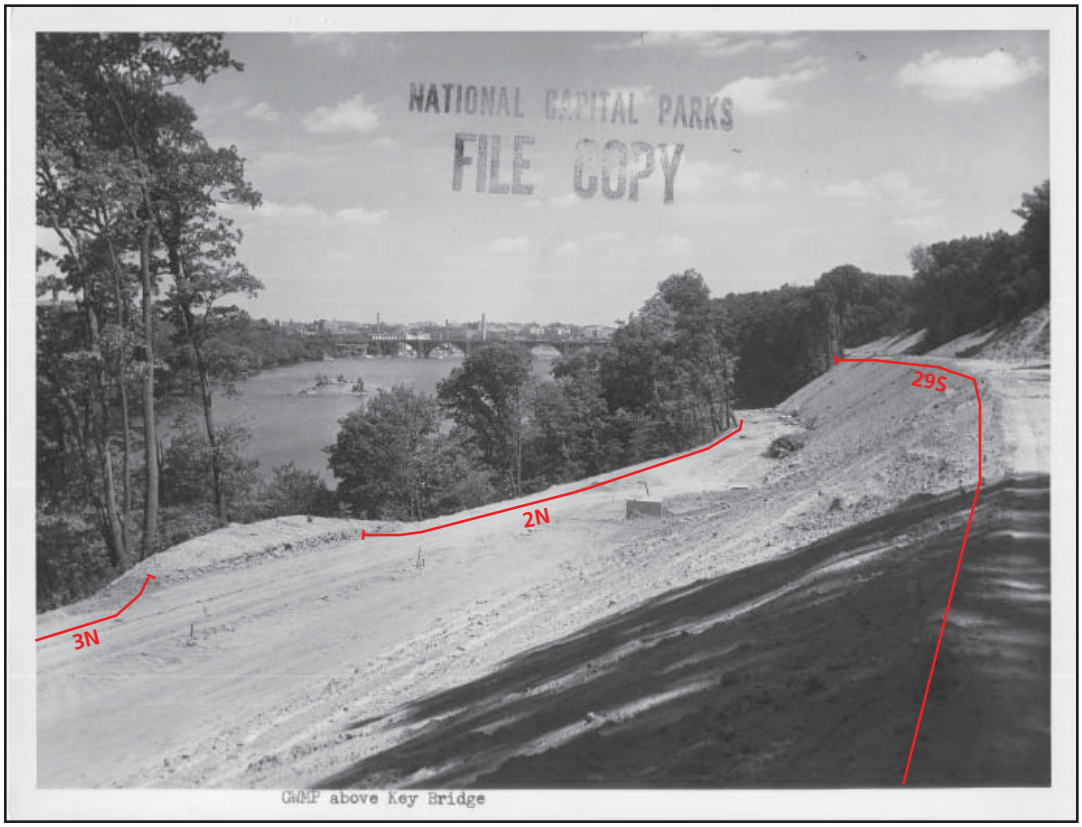
PP-7. Historic conditions along the 29S guardwall were open, in stark contrast to the vegetation that has now become established in the median. Also depicted are the open conditions adjacent to the northern portion of guardwall 1N and the established vegetation along the southern portion of guardwall 2N. (Image courtesy of the GWMP CRM Program Archives, GWMP General Views 1960-1969 Folder) 1961.



PP-8. 1961 image clearly depicting largely open conditions along the northern portion of the 2N guardwall. This area has now become established with vegetation, which may have been deliberately allowed to help address the roadbed slumping that is evidenced in this photograph. This photograph also suggests open vista conditions adjacent to guardwall 3N as seen in the distance. (Image courtesy of the NPS Museum Resource Center, Box 12a, PH12 PF12, GWMP) 1961.

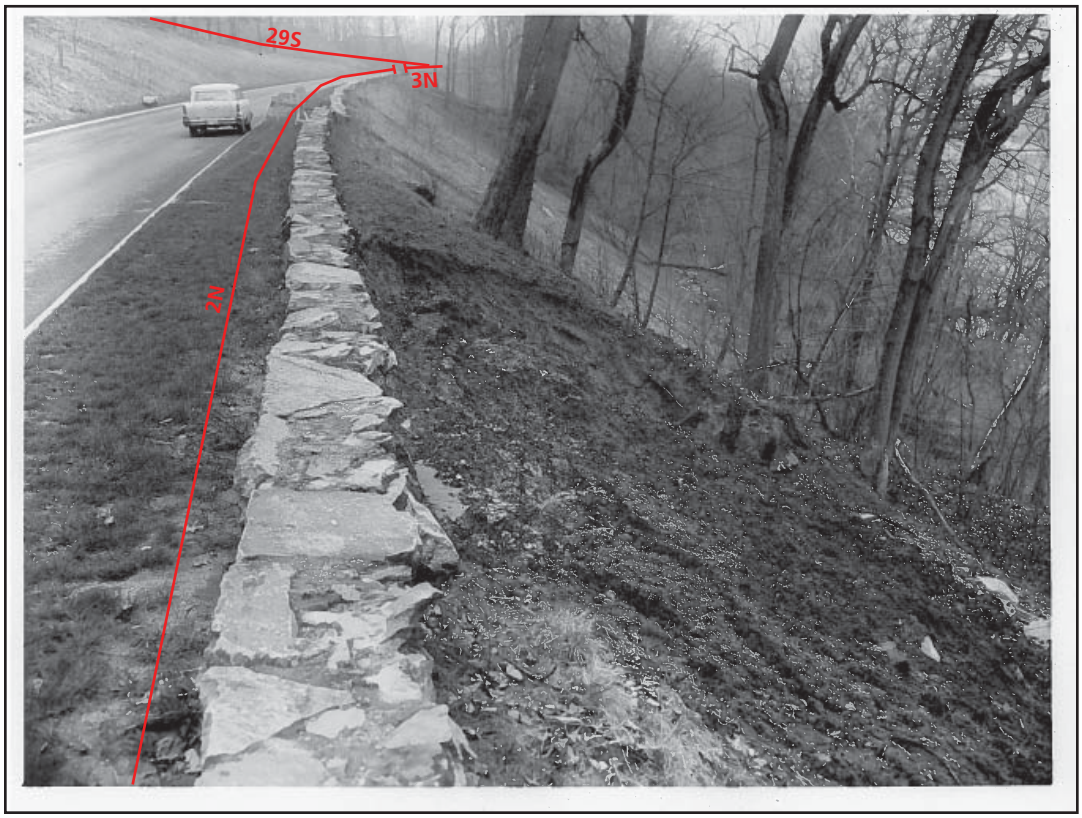


PP-9. 1961 image from the SB Parkway, showing additional slumping in this area. Open vistas can be seen adjacent to the three guardwalls depicted in this image. (Image courtesy of the GWMP CRM Program Archives, GWMP Construction/Repairs 1960-1969 Folder) 1961.



PP-10. Although this photo precedes the construction of guardwalls, the grading and topography along this section infer where the future guardwalls would be constructed. This image depicts the open conditions adjacent to guardwall 29S as well as the open conditions along the northern portions of guardwall 2N. (Image courtesy of the NPS Museum Resource Center, Box 12a, PH12 PF13, GWMP; Photo by Abbie Rowe, National Park Service) 1957.

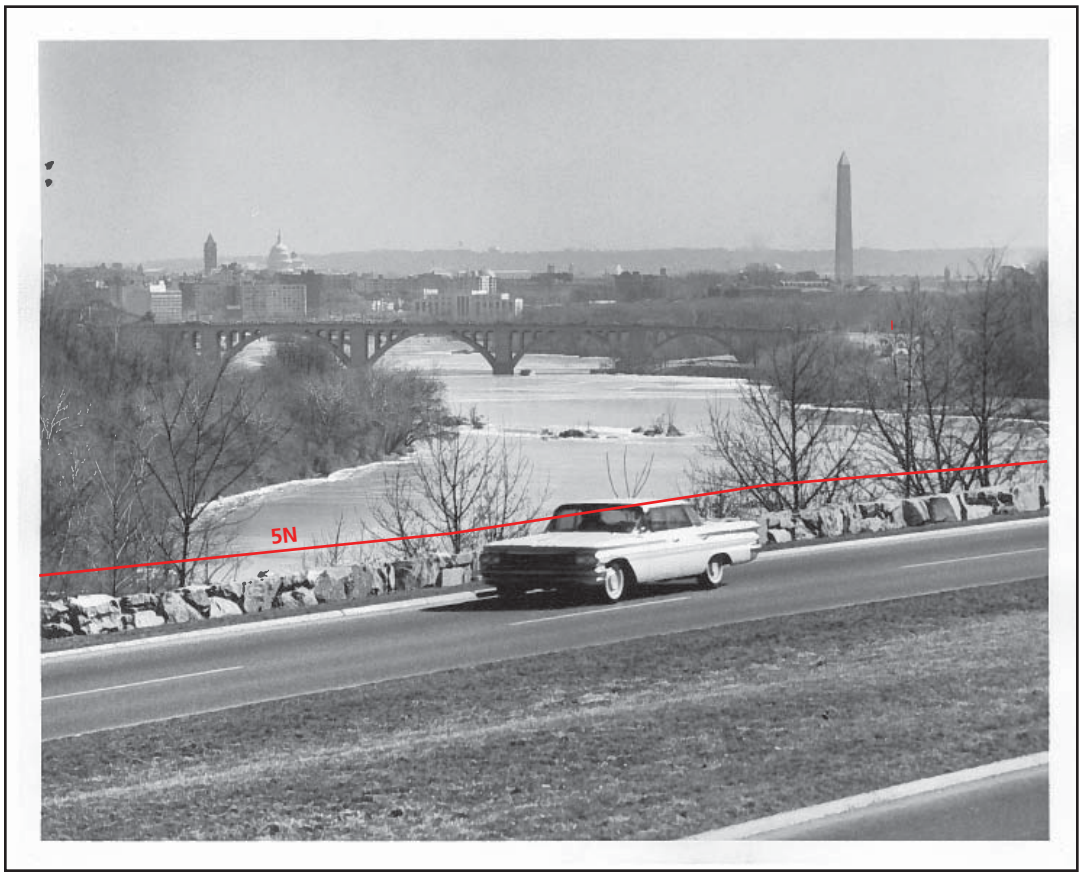
APPENDIX B: PERIOD PHOTOGRAPHS (PP)



PP-11. 1961 image depicting two areas of erosion and slumping, in the foreground and midground respectively. This image also clearly shows established vegetation along the southern portion of guardwall 2N that transitions into open slopes. This photo also suggests open conditions adjacent to guardwall 3N, which is barely visible in the distance. (Image courtesy of the NPS Museum Resource Center, Box 12a, PH12 PF12, GWMP) 1961.

PP-12. Slumping seen along guardwall 2N, as well as the established vegetation at the southern terminus of the guardwall before tranisitioning to an open vista. (Image courtesy of the GWMP CRM Program Archives, GWMP Construction/Repairs 1960-1969 Folder) 1961.

APPENDIX B: PERIOD PHOTOGRAPHS (PP)



PP-13. Vista over the southern portion of guardwall 5N. The treetops seen along the lower portion of this vista have now grown in, and this striking vista of the Three Sisters, Key Bridge, and the monumental skyline is now only visible through a shroud of trees during the winter months. (Image courtesy of the NPS Museum Resource Center, Box 12b, PH12 PF15, GWMP Folder 3; Photo by Abbie Rowe, National Park Service) 1959.

PP-14. This is the same vista over guardwall 5N that is visible as PP-13, over guardwall 5N, but shot with a wider perspective. Obstructing vegetation is visible along the northern portion of the guardwall creating a fairly discrete brief vista in this location. Also, the guardrail of Windy Run Bridge can be seen in the background in the far southern visible extent of the Parkway, helping locate this vista. (Image courtesy of the GWMP CRM Program Archives, GWMP General Views 1960-1969 Folder) 1959.

APPENDIX B: PERIOD PHOTOGRAPHS (PP)

PP-15. Another vista taken from the oft-photographed vantage looking over the southern extent of guardwall 5N, again showing a relatively brief vista window between established vegetation. (Image courtesy of the NPS Museum Resource Center, Box 12b, PH12 PF15, GWMP Folder 3; Photo by Abbie Rowe, National Park Service) 1959.

PP-16. Photograph taken from the northern end of guardwall 5N during Parkway construction. This image shows an open vista along the northern extent of guardwall 5N, with mature vegetation towards the center of the guardwall (Image courtesy of the NPS Museum Resource Center, Box 12b, PH12 PF14, GWMP Folder 2; Photo by Abbie Rowe, National Park Service) 1958.

APPENDIX B: PERIOD PHOTOGRAPHS (PP)

PP-17. Zoom-in of the same vista seen in PP-16, looking over the northern extent of guardwall 5N. This vista remains open and visible today. (Image courtesy of the NPS Museum Resource Center, Box 12a, PH12 PF13, GWMP) 1958.

PP-18. Photograph taken during Parkway construction depicting sweeping vistas associated with guardwalls 7N (midground) and 6N (background). The vistas over these guardwalls remain largely unobstructed. (Image courtesy of the NPS Museum Resource Center, Box 12a, PH12 PF13, GWMP; Photo by Abbie Rowe, National Park Service) 1958.

APPENDIX B: PERIOD PHOTOGRAPHS (PP)

PP-19. Oblique aerial image from 1962 that captures four separate guardwalls. While the angle of the photograph and distance of the guardwalls make verification difficult, the image appears to depict vistas over the northern portion of guardwall 8N, and over guardwall 11N looking over the Donaldson Run Bridge. Potential vistas over guardwalls 9N and 10N are inconclusive based on the photograph, although there is other evidence that supports their presence. (Image courtesy of the NPS Museum Resource Center, Box 12b, PH12 PF16, GWMP Folder 4; Photo by Abbie Rowe, National Park Service) 1962.

PP-20. 1965 photo approaching the Donaldson Run Bridge, clearly depicting vistas over guardwall 11N approaching the bridge, at the bridge itself, and at Overlook #2 (12N). The southern extent of guardwall 13N appears to be obstructed by vegetation. (Image courtesy of the NPS Museum Resource Center, GWMP; Photo by Abbie Rowe, National Park Service) 1965.

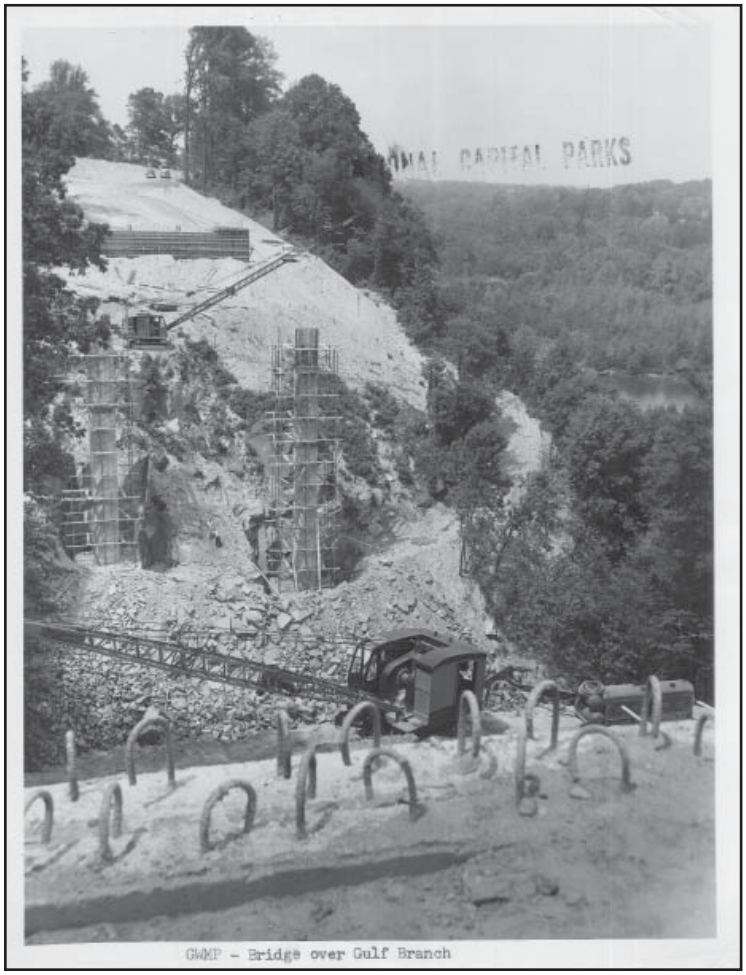
APPENDIX B: PERIOD PHOTOGRAPHS (PP)

PP-21. 1968 photo depicting the new sign announcing parking at the overlook in 1000', as well as vistas over the Donaldson Run Bridge and Overlook 2. (Image courtesy of the NPS Museum Resource Center, GWMP; Photo by Cecil W. Stoughton, National Park Service) 1968.

PP-22. 1994 aerial showing Donaldson Run Bridge. While it is difficult to appreciate the directional vista over guardwall 11N towards Donaldson Run Bridge, it is easy to appreciate the vista over the bridge itself and the canopy vista at the Overlook 2. (Image courtesy of HAER, VA-69-91, mislabeled as Windy Run Bridge) 1994.

APPENDIX B: PERIOD PHOTOGRAPHS (PP)

PP-23. This 1994 image clearly depicts the canopy vista associated with Overlook 2 and guardwall 12N. Today, Overlook 2 has been largely filled in by encroaching vegetation. (Image courtesy of HAER,VA-69-202) 1994



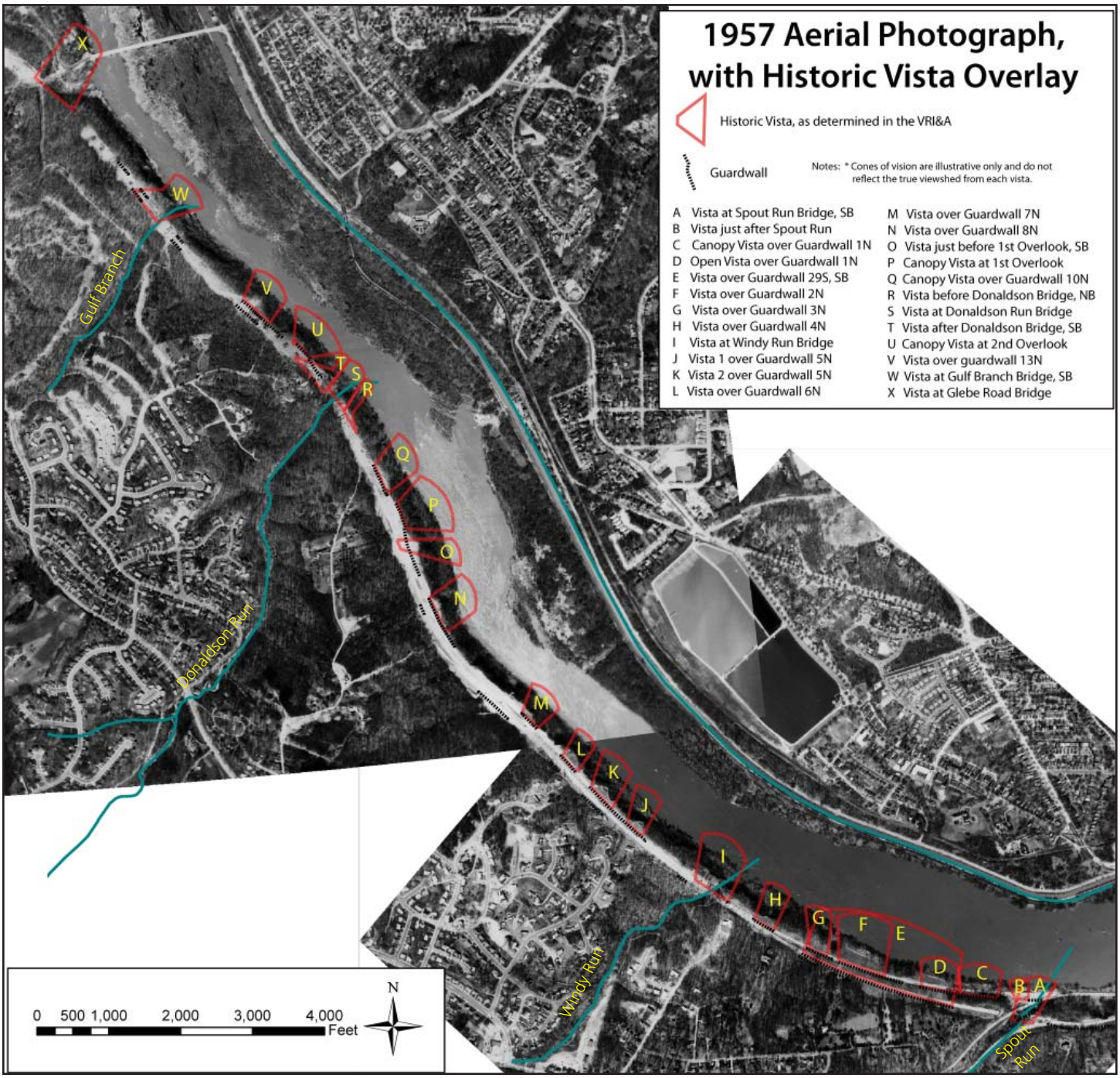
PP-24. Construction of the Gulf Branch Bridge in 1957. The thin vegetation and elevation differential will create an open vista over this future bridge crossing. Notice how the vegetation on the far shoulder has been cleared to enhance the southbound vista. Today, much of this has grown-in and the present vista opening is much more constricted. (Image courtesy of the NPS Museum Resource Center, Box 12a, PH12 PF13, GWMP; Photo by Abbie Rowe, National Park Service) 1957.

APPENDIX B: PERIOD PHOTOGRAPHS (PP)

PP-25. Image depicting the vista over the Glebe Road Bridge towards the Potomac River crossing at Chain Bridge. This vista remains visible today. (Image courtesy of the NPS Museum Resource Center, Box 12a, PH12 PF13, GWMP; Photo by Abbie Rowe, National Park Service) 1960.

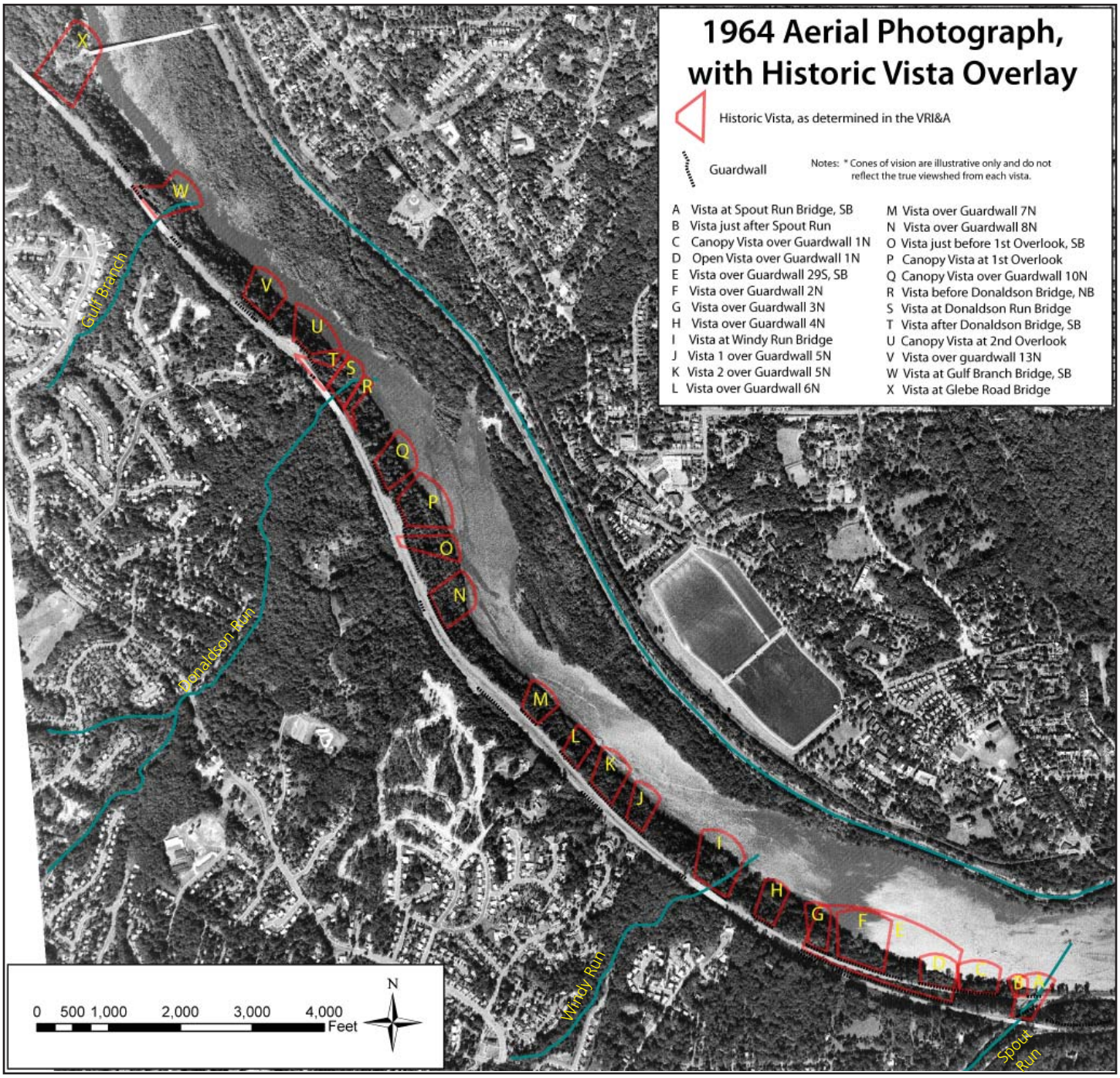
APPENDIX B: AERIAL PHOTOGRAPHS (AP)

AP-1. Aerial photograph depicting conditions along the northern GWMP during its construction in 1957. Historic vista cones were included (red outlines) so that the vegetation adjacent to the historic vista could be identified. Because the road construction regrading was so recent (and the regraded slopes were still devoid of vegetation) it is very easy to see gaps in the tree canopy, which typically correspond with the vista cones. (Aerial photograph courtesy of Arlington County, VA and is available on-line at http://gis.arlingtonva.us/Maps/DocView.htm) 1957.



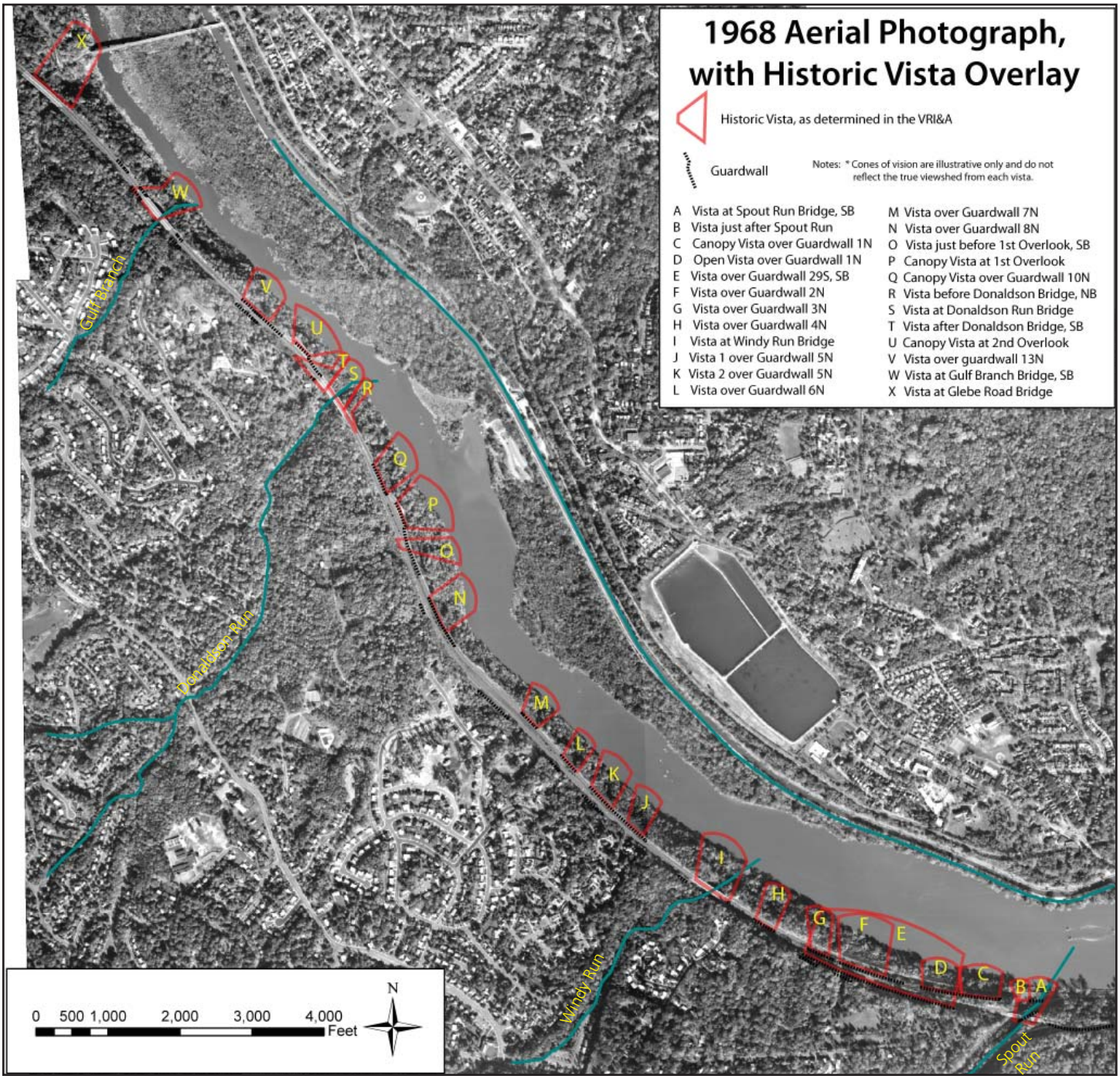
APPENDIX B: AERIAL PHOTOGRAPHS (AP)

AP-2. Aerial photograph depicting conditions along the northern GWMP shortly after the road was dedicated. Historic vista cones were included (red outlines) so that the vegetation adjacent to the historic vista could be identified. Unfortunately, the roadside vegetation is difficult to interpret in many instances, as the resolution is coarse and it is difficult to discern low shrub cover from mature tree cover. (Aerial photograph courtesy of USGS Aerial Photography Single Frame Records Collection, Photo ID: 1VBBM00010119, available online at http://earthexplorer.usgs.gov) 1964.



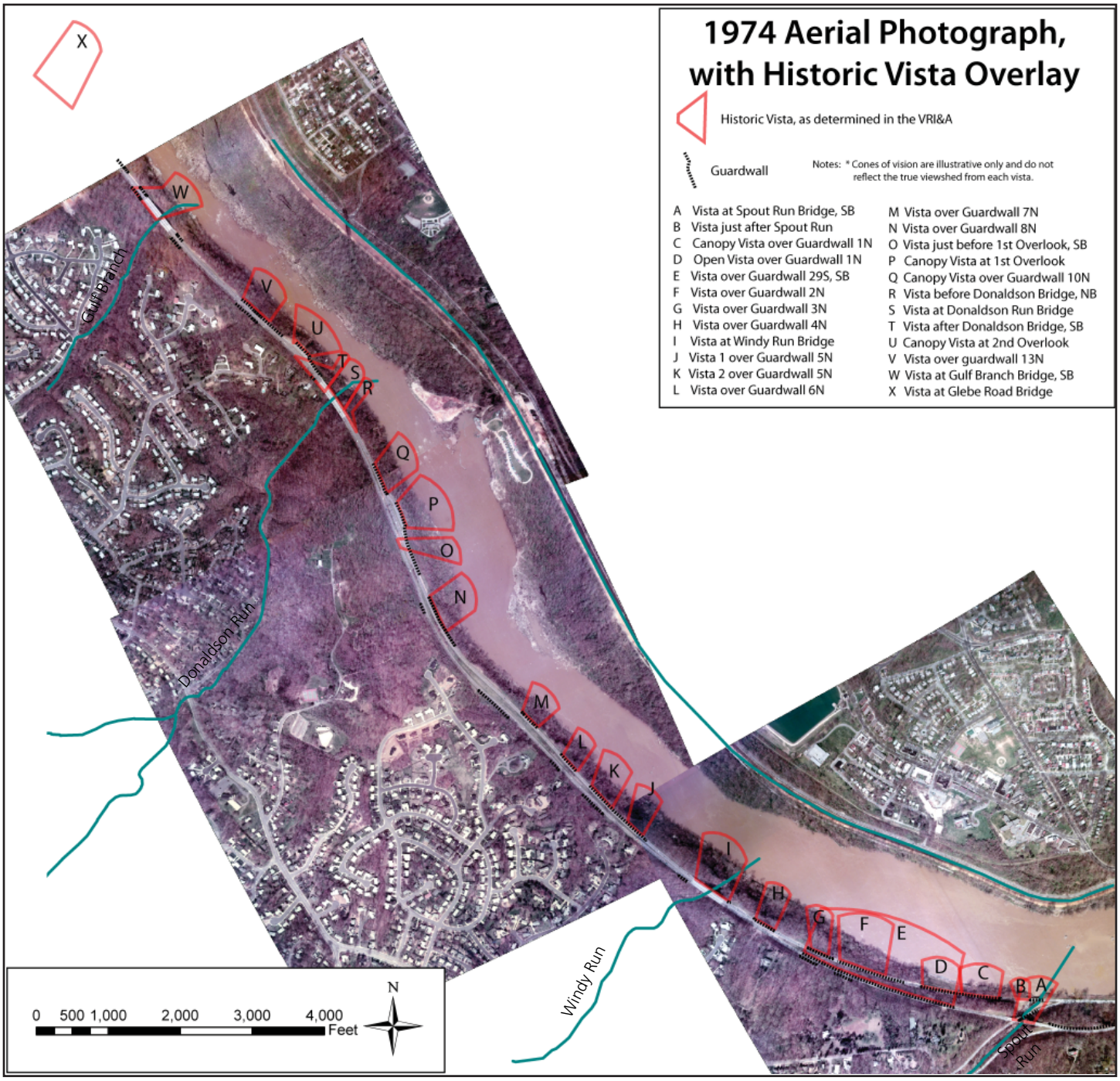
APPENDIX B: AERIAL PHOTOGRAPHS (AP)

AP-3. Aerial photograph depicting conditions along the northern GWMP in 1968. Historic vista cones were included (red outlines) so that the vegetation adjacent to the historic vista could be identified. Although the resolution of this photograph is quite good, it is still difficult in many instances to differentiate low-growing shrubs or intermittent tree cover with a raised canopy from wooded conditions that obscure all vistas. (Aerial photograph courtesy of USGS Aerial Photography Single Frame Records Collection, Photo ID: 1VCCO00010037, available online at http://earthexplorer.usgs.gov) 1968.



APPENDIX B: AERIAL PHOTOGRAPHS (AP)

AP-4. Aerial photograph depicting conditions along the northern GWMP in 1974. Historic vista cones were included (red outlines) so that the vegetation adjacent to the historic vista could be identified. Although the color photograph makes identifying vegetation a bit easier, like the other images this aerial is difficult to differentiate shrub cover from tree cover and it is most appropriately regarded as a piece of evidence that should be examined and weighted along with other data (Aerial photograph courtesy of Arlington County, VA and is available on-line at http://gis.arlingtonva.us/Maps/DocView.htm) 1974.



Appendix C

Duration of Vista Modifier Data Analysis

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Duration of Vista Modifier Data

Direction	Open or Filtered	Mile Points	Name	Length of Vista (Feet)	*Duration of Vista (Seconds)	** Point Value
NB	Open	17.769-17.805	Spout Run NB	91	1.24	0
NB	Filtered	17.808-17.882	Filtered Spout Run NB	658	8.97	3
NB	Open	17.878-18.019	Three Sisters NB	706	9.62	3
NB	Filtered	17.923-18.018, 18.037-18.196	Filtered Three Sisters NB	1088	14.83	3
NB	Filtered	18.322-18.366	Filtered South of Windy Run NB	229	3.12	1
NB	Open	18.451-18.476	Windy Run NB	186	2.53	1
NB	Filtered	18.630-18.726	Filtered Georgetown Reservoir NB	495	6.75	3
NB	Open	18.730-18.771	Georgetown Reservoir Castle Gatehouse NB	250	3.40	1
NB	Open	18.830-18.860	GW Mt. Vernon Campus #1 NB	177	2.41	1
NB	Open	18.944-18.970	GW Mt. Vernon Campus #2 NB	195	2.65	1
NB	Filtered	19.872-19.982, 20.007-20.037	Filtered South of Scenic Overlook #1 (Interspersed by Vegetation) NB	618	8.42	3
NB	Open	19.424-19.473	Scenic Overlook #1 NB	290	Indefinite	3
NB	Open	19.503-19.563	Fletcher's Cove NB	288	3.92	1
NB	Filtered	19.543-19.593	Filtered Fletcher's Cove NB	222	3.03	1
NB	Open	19.668-16.769	Donaldson Run NB	492	6.70	3
NB	Filtered	19.808-19.852	Filtered Scenic Overlook #2 NB	248	Indefinite	3
NB	Filtered	19.808-19.852	Filtered North of Scenic Overlook #2 (Interspersed by Vegetation) NB	370	5.04	2
NB	Open	20.176-20.212	Gulf Branch NB	175	2.38	1
NB	Open	20.490-20.586	Glebe Road NB	248	3.38	1

Appendix C: Duration of Vista Modifier Data Analysis

Direction	Open or Filtered	Mile Points	Name	Length of Vista (Feet)	*Duration of Vista (Seconds)	** Point Value
SB	Open	20.599-20.487	Glebe Road SB	428	5.83	2
SB	Open	20.259-20.166	Gulf Branch SB	319	4.35	2
SB	Open	19.815-19.674	Donaldson Run SB	1626	22.17	3
SB	Filtered	19.859-19.815	Filtered Scenic Overlook #2 SB	320	4.36	2
SB	Open	19.579-19.548	Fletcher's Boat Rental SB	220	3.00	1
SB	Open	19.497-19.423	Scenic Overlook #1 SB	356	4.85	2
SB	Filtered	19.277-19.184	Filtered Rosslyn and River SB	290	3.95	2
SB	Open	19.073-18.953	Washington Monument SB	503	6.85	3
SB	Open	18.900-18.851	GW Mt. Vernon Campus SB	384	5.23	2
SB	Open	18.821-18.645	Capitol Dome, Old Post Office, Castle Gatehouse SB	536	7.30	3
SB	Filtered	18.699-18.606	Filtered Georgetown Reservoir Castle Gatehouse SB	191	2.60	1
SB	Open	18.525-18.459	Windy Run SB	227	3.09	1
SB	Filtered	18.239-18.130	Filtered National Cathedral SB	685	9.34	3
SB	Open	18.126-18.110	National Cathedral SB	50	.68	0
SB	Filtered	18.108-18.053	Filtered Georgetown SB	555	7.57	3
SB	Open	18.014-17.998, 17.955-17.946	Three Sisters (Interspersed by Veg.) SB	235	3.20	1
SB	Filtered	17.981-17.959	Filtered Three Sisters SB	376	5.13	2
SB	Open	17.826-17.778	Spout Run SB	179	2.44	1
NB	Filtered	22.784-22.854	Filtered Riverview near CIA HQ NB	502	6.85	3

* Duration of Vista was calculated by dividing the length of the vista by 73.33 (the distance in feet that one travels per second when driving 50 miles per hour).

** Point Value was assigned as follows: 0 pts for vistas with durations less than 2 seconds, 1 pts for durations between 2-4 seconds, 2pts for durations between 4-6 seconds, 3 pts for durations greater than 6 seconds.

Appendix D

Call to Action; Enjoy the View: Air Quality Assessment

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Enjoy the View – Air Quality Assessment

George Washington Memorial Parkway

Natural Resource Report NPS/NRSS/ARD/NRR—2015/939

ON THE COVER
View from the Netherlands Carillon, Washington D.C.
NPS Webcam image

Enjoy the View – Air Quality Assessment

George Washington Memorial Parkway

Natural Resource Report NPS/NRSS/ARD/NRR—2015/939

Air Resources Division

National Park Service
PO BOX 25287
Denver, CO 80225-0287

March 2015

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Denver, Colorado

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Report Series is used to disseminate comprehensive information and analysis about natural resources and related topics concerning lands managed by the National Park Service. The series supports the advancement of science, informed decision-making, and the achievement of the National Park Service mission. The series also provides a forum for presenting more lengthy results that may not be accepted by publications with page limitations.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available in digital format from the NPS Air Resources Division Website (http://www.nature.nps.gov/air/) and the Natural Resource Publications Management website (http://www.nature.nps.gov/publications/nrpm/). To receive this report in a format optimized for screen readers, please email irma@nps.gov.

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NPS 850/128330, March 2015

Contents

Figures

Page

Abstract

George Washington Memorial Parkway is one of the first National Park Service areas to take up the Call to Action item #38: Enjoy the View. Clean, clear air is critical to the appreciation of scenic views, to human health, and the health of ecosystems. This air quality assessment report presents air pollution effects, sources, monitoring data, and trends relevant to George Washington Memorial Parkway (GWMP) as well as reviews some of the applicable laws, responsibilities, and progress toward clean air goals in the region. Air pollution can harm human health; visibility of scenic views; and ecological resources, including water quality, soils, plants, and animals. Air pollutants of specific concern include ground-level ozone, fine particles, sulfate, nitrate, ammonia, heavy metals (for example, mercury), and toxic organic compounds. While greenhouse gas emissions cause climate change, climate change impacts in GWMP are beyond the scope of this report. Most of the air pollution that impacts NPS areas comes from outside park boundaries. Vehicles using the GWMP are the most immediate sources of air pollution to the area, but GWMP is also downwind from large urban and industrial areas. Despite the progress that has been made in air pollution control, the Washington area has poor air quality at times, and is still not meeting the ozone standard.

Acknowledgments

Staff from the National Park Service Air Resources Division including: Ksienya Pugacheva, Ellen Porter, Pat Brewer, Colleen Flanagan Pritz, Susan Johnson, and Melanie Peters contributed to the compilation of this report.

Introduction

George Washington Memorial Parkway (GWMP) is one of the first National Park Service (NPS) areas to take up the Call to Action item #38: Enjoy the View. As part of A Call to Action, Enjoy the View advances the vision of the NPS into the next century by engaging parks in collaborative efforts to identify and protect both air quality and scenic views. The goal of the action is to protect clean, clear air and spectacular scenery in National Park areas now and for future generations.

Clean, clear air is critical to the appreciation of scenic views, to human health, and the health of ecosystems. Since the Clean Air Act of 1970, great progress has been made toward improving air quality nationwide. However, most parks—including George Washington Memorial Parkway—still experience air quality impairment that mars scenic views. The ecosystem impacts of air pollution are not fully understood, and important work remains before we can reach clean air goals.

With our second century approaching, the realm of potential impacts to scenic views and clean air is evolving and we need to be responsive. Air quality assessment reports, like this one, and Visual Resource Inventories are critical components of Enjoy the View. These efforts will establish a baseline of air quality and scenic conditions crucial for park planning and internal and external decisions that may impact scenic, cultural, and natural resources. Collaboration with a variety of stakeholders will build understanding about the value of clean air and scenic views, and encourage actions to protect them.

This air quality assessment report presents air pollution effects, sources, monitoring data, and trends relevant to George Washington Memorial Parkway before reviewing some of the applicable laws, responsibilities, and progress toward clean air goals in the region.

Air Pollution Effects in GWMP

Most visitors expect clean air and clear views in parks. However, air pollution often affects George Washington Memorial Parkway (GWMP). Air pollution can harm human health; visibility of scenic views; and ecological resources, including water quality, soils, plants, and animals. Air pollutants of specific concern include ground-level ozone, fine particles, sulfate, nitrate, ammonia, heavy metals (e.g., mercury), and toxic organic compounds.

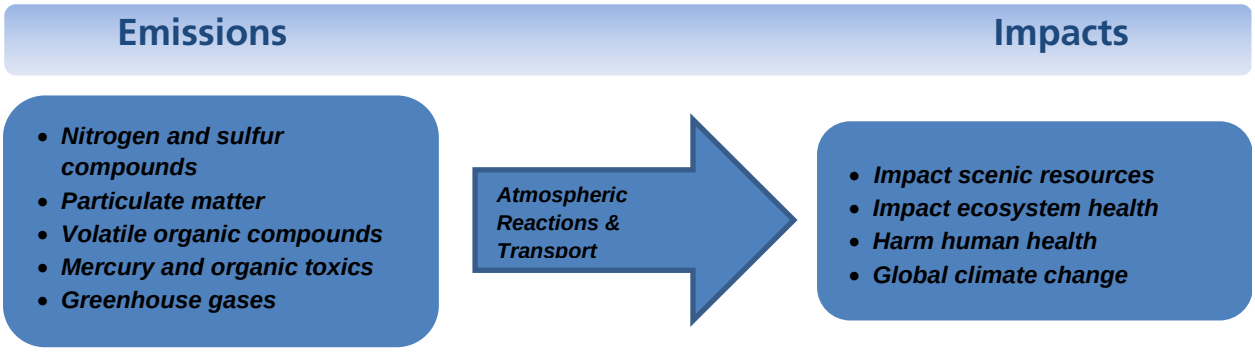

Figure 1. Air pollution causes a variety of resource impacts. Most pollution affecting NPS areas comes from outside the parks. Pollution from human-generated and natural sources is emitted in one place, transported through the air—and sometimes changed by chemical reactions—before impacting national park units.

Visitor and Staff Health

Clean air allows people to fully enjoy national parks. Air pollution can impact human health, limiting activities for visitors and staff, and jeopardizing the park experience when it reaches unhealthy levels.

Ground-level ozone forms in the atmosphere when nitrogen oxides, from burning fossil fuels or fires, react in the presence of sunlight with volatile organic compounds, which are emitted from motor vehicles or industrial processes and natural sources like vegetation. Ground-level ozone can cause inflammation and irritation of the respiratory system in humans. The counties that GWMP is located in do not currently meet the national health standard for ozone.

Particulate matter, including fine particles (2.5 micrometers in diameter and smaller) and coarse particles (such as dust or smoke emitted from human-caused and natural sources) can also cause inflammation and irritation of the respiratory system in humans. People can be more susceptible to health effects from air pollution when they are engaged in strenuous recreation, which may be a primary reason visitors come to "the playground system of the National Capital." The counties that GWMP is located in do not currently meet the national health standard for fine particulate matter.

Visibility of Scenic Views

Clean, clear air is essential to enjoying spectacular park views. Many visitors come to parks specifically to experience the magnificent scenery we are charged with protecting, including views

that extend beyond park boundaries. Our ability to clearly see color and detail in distant views (visibility) can be impacted by air pollution.

Particulate matter (i.e., fine, and coarse particles) decreases visibility to some degree in every national park including GWMP. Sulfate, nitrates, ammonium, organic compounds, and soil contribute to fine particle mass. Fine and coarse particles can create a white or brown haze—by absorbing or scattering light—this affects not only how far we can see but also how well we are able to see the colors, forms, and textures of a scenic vista. Some haze may have natural causes such as fog or wildfire smoke, but haze affecting GWMP is predominantly human-generated. GWMP's scenery—including some of the most recognizable vistas in the world—is a draw for millions of visitors, yet is regularly marred by air pollution. Haze takes away from the visitor experience.

Ecological Resources

Good air quality supports healthy park wildlife, vegetation, lakes, streams, and soils. The ecosystem and its individual components including water, soils, plants and animals, constitute an interdependent system where all living things are dependent upon the other living and non-living things for survival. An impact to one resource can have cascading effects throughout the system.

Ground level ozone can cause plant injury and reduced growth in some sensitive plant species. Ozone enters plants through leaf openings called stomata and oxidizes plant tissue. Many other factors can magnify the extent of ozone injury such as soil moisture, presence of other air pollutants, insects or diseases, and other environmental stresses. A risk assessment concluded that plants at GWMP are at high risk for ozone damage (Kohut 2007; Kohut 2004). Ozone-sensitive plants in the park include *Prunus serotina* (black cherry) and *Rudbeckia laciniata* (cut-leaf coneflower). A full list of ozone-sensitive plant species is available from NPSpecies.

Also***, sulfur and nitrogen compounds*** in air pollution can deposit into ecosystems and cause acidification, excess fertilization (eutrophication), and changes in soil and water chemistry that can alter aquatic life. Acidification of soils, lakes, and streams can result in changes in community structure, biodiversity, reproduction, and decomposition. Ecosystems in GWMP have been rated as moderately sensitive to acidification effects (Sullivan et al. 2011a; Sullivan et al. 2011b). Plants sensitive to the effects of acidification in the park include *Acer saccharum* (sugar maple) trees.

Although nitrogen is an essential plant nutrient, surplus levels of atmospheric nitrogen deposition can stress ecosystems. Excess nitrogen acts as fertilizer, favoring some types of plants and leaving others at a competitive disadvantage. The long-term effects of these changes may include shifts in plant and animal species composition, increase in insect and disease outbreaks, and disruption of ecosystem processes such as nutrient cycling and wildfire frequency (Blett & Eckert 2013; Bobbink et al. 2010). Although GWMP receives high levels of nitrogen deposition, in general, ecosystems in the park are not typical of nitrogen-sensitive systems and were rated as having low sensitivity to nutrient enrichment effects (Sullivan et al. 2011c; Sullivan et al. 2011d). However, some vegetation communities in the park—wetland, grassland, and meadow plant communities—may be more sensitive to excess nitrogen deposition.

A critical load, defined as the level of deposition below which harmful effects to the ecosystem are not expected, is a useful tool in determining the extent of deposition impacts to park resources. It can also serve in communicating these impacts to managers, regulators, and the public. A critical load of 3–8 kilograms nitrogen per hectare per year (kg N/ha/yr) has been suggested to protect lichen and forest vegetation in the Eastern Temperate Forests Ecoregion, which includes GWMP (Pardo et al. 2011). The estimated maximum 2010–2012 average for total nitrogen deposition in the Eastern Temperate Forests ecoregion of GWMP was 13.3 kg/ha/yr (NADP 2014). Therefore, total deposition levels in the park are above ecosystem critical loads for some park vegetation communities, suggesting that lichen and forest vegetation are at risk for harmful effects.

Mercury and other toxic pollutants (e.g., pesticides, dioxins, polychlorinated biphenyls [PCBs]) can affect the reproductive health of both wildlife and humans when consumed. These toxics can build up in the food chain causing negative effects in fish, birds, and wildlife and cause reduced reproductive success, impaired growth and development, and decreased survival rates. Other toxic air contaminants of concern include pesticides (e.g., DDT), industrial by-products like PCBs, and emerging chemicals such as flame retardants for fabrics (PBDEs). PCBs, are a class of man-made compounds once manufactured for a variety of industrial applications, including coolants and lubricants in electrical equipment. New production of PCBs was banned in 1979 due to possible harmful human health effects and persistence in the environment. Mercury and other contaminants are known or suspected to cause cancer or other serious health effects in humans and wildlife.

While there are direct mercury inputs to surface waters from industrial processes, another contributor of mercury to inland water bodies is atmospheric deposition. Wet and dry deposition can lead to mercury loadings in water bodies, where mercury may be converted to a bioavailable toxic form of mercury, methylmercury, and bioaccumulate through the food chain. A mercury sensitivity analysis based on water chemistry and physical parameters rated the potential for methylmercury production at GWMP from moderate to severe, as compared to other NPS units (USGS 2015).There are no data on mercury in biota specifically in the parkway, but there are elevated levels of mercury (and other contaminants such as PCBs) in fish from adjacent reaches of the Potomac River through Maryland, Washington D.C., and Virginia. Fish consumption advisories have been issued by Maryland and Virginia for many riverine fish of varying sizes, because of elevated levels of PCBs (MDE 2013; VDH 2013). Sites previously contaminated with PCBs may emit and re-deposit the compound, and PCBs may be re-suspended with sediments in the water column. Tidal portions of the Potomac River are listed as impaired due to elevated levels of PCBs in fish tissue.

These threats to ecosystem resources have implications for the overall biodiversity, species preservation, and natural systems that GWMP contains in an otherwise urban environment.

Sources of Air Pollution

Most of the air pollution that impacts NPS areas comes from outside park boundaries. Vehicles using the GWMP are the most immediate sources of air pollution to the area, but GWMP is also downwind from large urban and industrial areas. Pollutants emitted from power plants, industries, and mobile sources can travel hundreds of miles in the atmosphere. Agricultural emissions also contribute to air pollution at the GWMP.

Mobile sources, such as cars, buses, planes, trucks, and trains, account for more than half of all the air pollution in the United States according to the Environmental Protection Agency (EPA) (http://www.epa.gov/air/caa/peg/carstrucks.html). Exhaust and dust from motor vehicles on and near GWMP contain nitrogen oxide, volatile organic compounds, and particulate matter emissions. For Virginia, Washington D.C., and Maryland, 69% of nitrogen oxide and 15% of particulate matter emissions come from mobile sources (NEI 2014).

Large point sources of air pollution like power plants, industrial paper mills, iron and steel mills, and petroleum refineries are major emitters of sulfur dioxide and nitrogen oxides. These pollutants react in the atmosphere to form sulfate and nitrate particles and acidic deposition. For Virginia, Washington D.C., and Maryland, electric generation and industrial processes account for 22% of nitrogen oxide and 87% of sulfur dioxide emissions (NEI 2014). Industry is also a significant source of airborne mercury and other toxics. A total of 77% of airborne mercury in Virginia, Maryland, and Washington D.C. stems from industry (NEI 2014).

Area sources of air pollution, such as agriculture, construction, and residential wood burning are sources of ammonia and particulate matter emissions. For Virginia, Washington D.C. and Maryland, 82% of ammonia emissions originate from agricultural fertilizer application and livestock waste. Construction and residential wood burning are responsible for 18% of particulate matter emissions (NEI 2014).

States and EPA have evaluated geographic source regions that contribute to regional haze, ozone, and fine particles. For the District of Columbia, coal- and oil-fired electric power plants in Ohio, Pennsylvania, Virginia, West Virginia, and Maryland are major contributions to regional haze, ozone, and fine particles.

Almost all the sources of pollutants such as sulfur dioxide, nitrogen dioxide, volatile organic compounds, and ozone, particulate matter also emit greenhouse gases (GHGs). GHGs contribute to global climate change. GWMP became a Climate Friendly Park in 2011, and completed a GHG emissions inventory and action plan (http://www.nps.gov/climatefriendlyparks/downloads/Action%20Plans%20and%20Inventories/GWMPCFPActionPlan_Final.pdf). The total GHG emissions for the park, including park operations, concessioners, and visitors to the parkway, was 18,621 metric tons carbon dioxide (CO_2) equivalent ($MTCO_2E$). Visitors to the parkway emitted 15,944 $MTCO_2E$ (86%). Visitor emissions are counted once they cross the boundary into the park until they leave the park. All of park operations emissions, including park employee commuting was 1,716 $MTCO_2E$ (9%).

Air Quality Monitoring

The NPS Air Resources Division (ARD) coordinates an extensive air monitoring program that measures air pollution levels in national parks. This program collects data that allows NPS to:

- understand current air quality conditions,
- assess the effects of air pollutants on park resources,
- observe long-term trends of air pollutants,
- evaluate the causes and sources of air pollution,
- gauge the effectiveness of national and regional air pollution control policies, and
- provide a scientific basis for air resource management decisions.

When on-site monitors are not available, near-by representative monitors can sometimes be used to evaluate air quality trends. However, identification of a "representative site" depends on the pollutant, network, distance from the park, and local site characteristics.

Visibility Monitoring

The Interagency Monitoring of Protected Visual Environments (IMPROVE) is a national visibility monitoring program established in 1985. The goals of this program are to monitor current visibility conditions, track changes in visibility, and determine the causes of visibility impairment.

GWMP has one representative IMPROVE station (WASH 1) located in Washington, D.C. Data from the site can be used to assess visibility trends at GWMP (http://vista.cira.colostate.edu/improve/Data/IMPROVE/improve_data.htm).

Gaseous Pollutant Monitoring

The NPS ARD operates a network of air quality monitoring stations in rural areas that measure ground-level ozone and a variety of meteorological parameters. States and local air pollution agencies operate many additional stations in urban areas, including areas around GWMP.

There are four ozone monitors within 10 kilometers of park boundaries with enough data for trends and conditions analyses (http://www.epa.gov/airdata/ad_maps.html). The NPS Air Resources Divisions chose the Aurora Hills Visitor Center in Arlington, Virginia (Site ID 510130020) site for this analysis, as the site is closest to GWMP boundaries and is centrally located (Figure 1). The site is operated by the Virginia Department of Environmental Quality (DEQ).

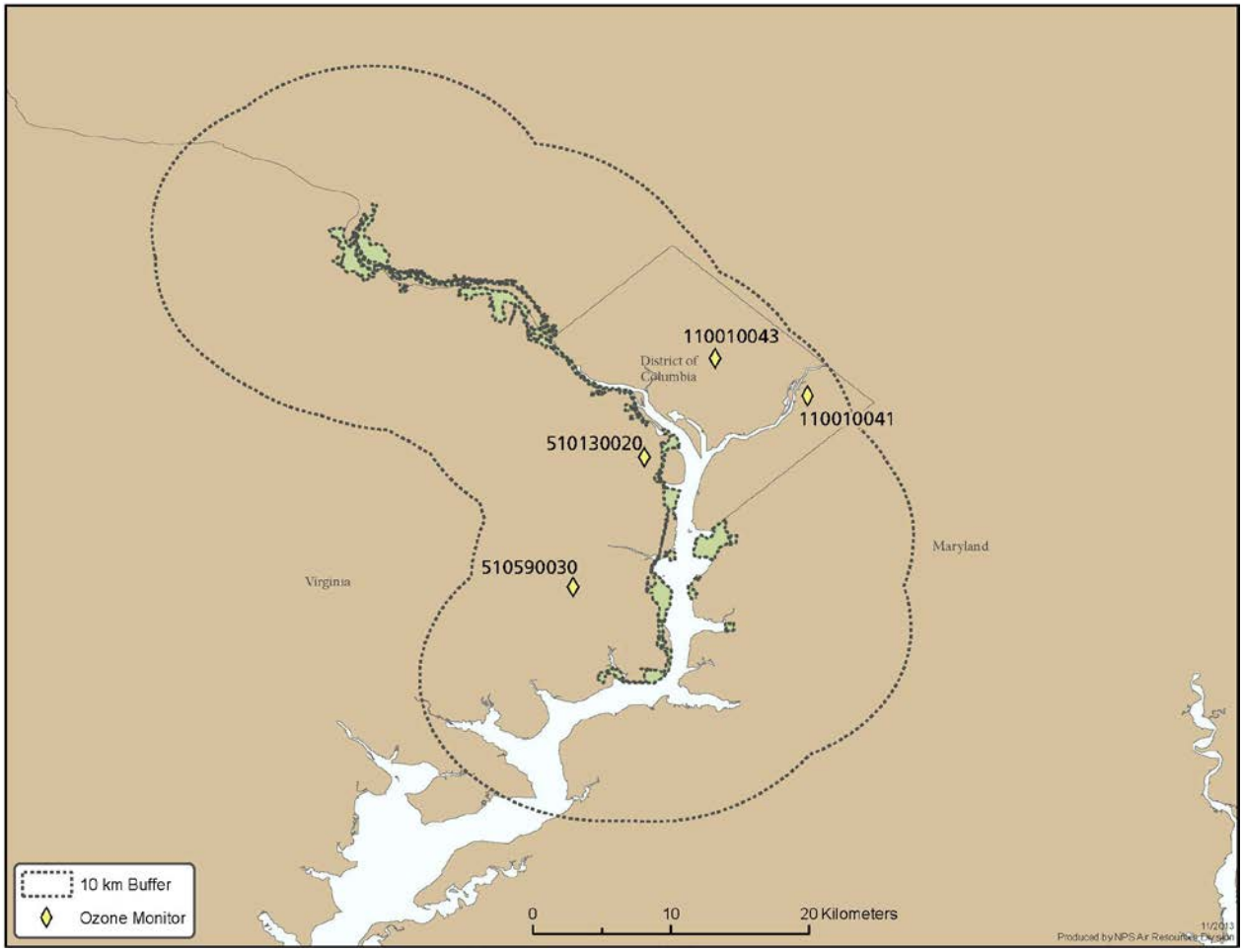

Figure 2. Ozone monitors within 10 kilometers of George Washington Memorial PKWY boundaries. Aurora Hills Visitor Center (510130020) monitor is closest to the parkway and is centrally located.

Atmospheric Deposition

The NPS and other federal, state, and local agencies monitor wet deposition of nitrate, ammonia, sulfate, mercury, and other compounds through the National Atmospheric Deposition Program (NADP) and the Mercury Deposition Network (MDN). There are no representative deposition samplers near GWMP. However, interpolated estimates are available and used to assess condition at GWMP.

Air Quality Conditions and Trends

Air quality status assessments are based on current conditions compared to NPS ARD benchmarks for specific measures of visibility, ozone, and atmospheric deposition. NPS ARD uses six specific measures to summarize current air quality conditions at GWMP:

Indicator of Air Quality	Specific Measure
Visibility	Visibility on mid-range days minus natural visibility condition on mid-range days
Ozone	Human health: 4th-highest daily maximum 8-hour concentration
	Vegetation health: 3-month maximum 12-hour W126
Atmospheric deposition	Sulfur wet deposition
	Nitrogen wet deposition

For each of the specific measures of air quality identified above, data from national air quality monitoring networks were reviewed and 5-year averages (2008–2012) were calculated for monitoring sites with at least 3 years of complete annual data. The Inverse Distance Weighted (IDW) interpolation method was then used to estimate 5-year average values for all locations in the contiguous U.S. The condition for GWMP is the value derived from this national analysis at the geographic center of the park. Interpolated data are useful for assessing current conditions because many parks do not have on-site air quality monitors. The estimated 5-year averages (conditions) for GWMP were compared to established benchmarks to assigned one of three status categories:

- Warrants Significant Concern,
- Warrants Moderate Concern, or
- Resource is in Good Condition.

At GWMP trends were computed from data collected over a 10-year period from the WASH 1 IMPROVE monitor located in Washington, D.C., for visibility; and the Virginia DEQ Aurora Hills Visitor Center in Arlington, Virginia (Site ID 510130020) for ozone. These locations have at least 6 years of annual data and an annual value for the final year of the 10 year period, i.e. 2012.

Visibility

The Clean Air Act established national goals to preserve, protect, and enhance air quality in national parks and other special areas, and specifically return visibility to “natural conditions” in Class I areas. The NPS Air Resources Division (ARD) recommends a visibility benchmark condition for all NPS units, regardless of Class designation, consistent with the general Clean Air Act goal. Natural visibility conditions are those estimated to exist in a given area in the absence of human-caused

visibility impairment. Currently, average visibility is often impaired by haze and warrants a condition of "Significant Concern" at GWMP, a condition seen throughout most of the eastern U.S. This condition is based on NPS Air Resource Division benchmarks and the 2008–2012 estimated visibility on mid-range days of 11.3 deciviews (dv) above estimated natural conditions (7.8 dv). (*The deciview (dv) is a visibility metric used track visibility conditions. One deciview represents the minimal perceptible change in visibility to the human eye.*) At the Washington D.C. monitor, pollution has reduced average visual range from natural conditions of 100 miles to 20 miles. On the haziest days, visual range has been reduced from 75 miles to 10 miles. Severe haze episodes occasionally have reduced visibility to as little as 6 miles (IMPROVE 2013). Currently visibility on the average and haziest days in 2008–2012 are 40 and 20 miles, respectively, at the Washington D.C. monitor.

Visibility trends are evaluated for the 20% best visiblity days, when concentrations of haze-causing pollutants are the lowest, and the 20% worst visibility days, when concentrations of haze-causing pollutants are the highest. The Clean Air Act visibility goal seeks to improve visiblity on the 20% worst days, and maintain visibility on the 20% best days. Data show that from 2003–2012 visibility improved on both the 20% clearest days and 20% haziest days at the Washington D.C. monitor (Figure 3), primarily due to emissions reductions required under state and federal requirements to reduce ozone and fine particle pollution in the East.

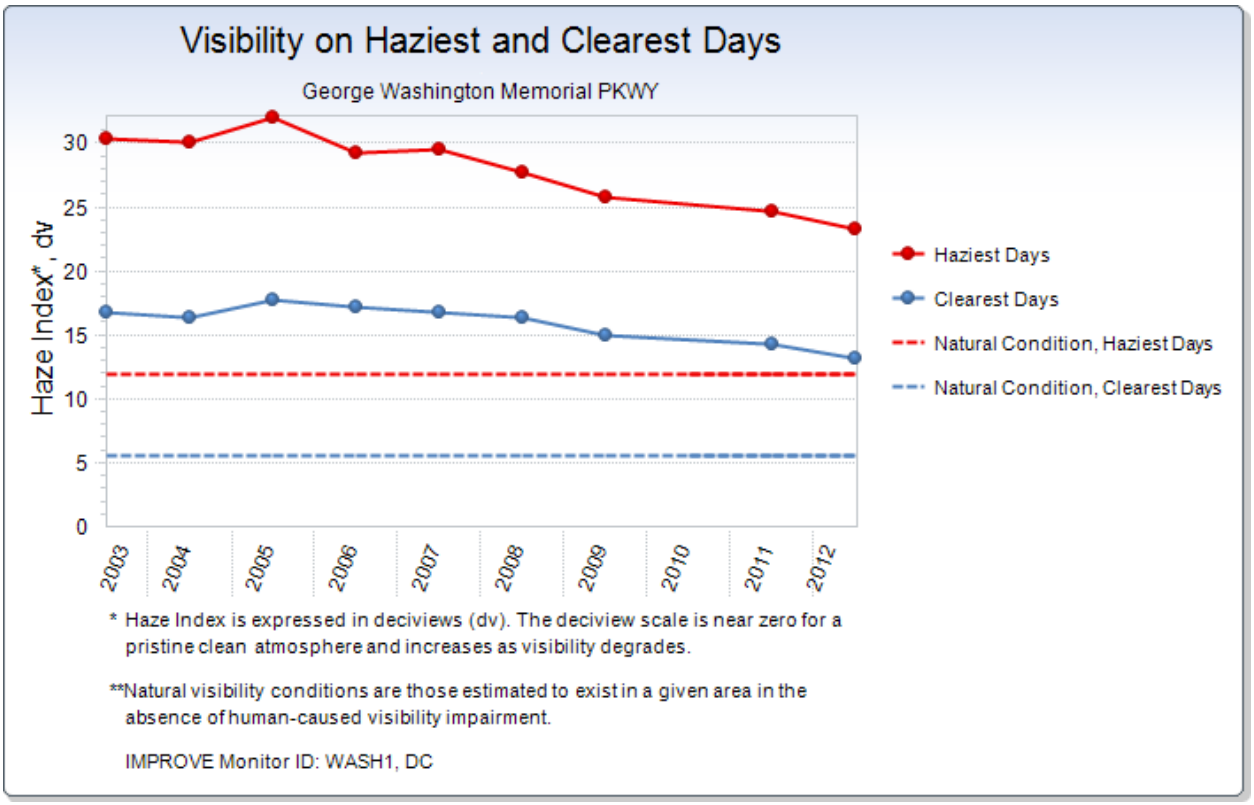

Figure 3. Visibility on haziest and clearest days, 2003–2012.

To improve visibility at GWMP, it is important to understand which pollutants have the greatest contributions to haze. Light extinction is used to calculate the contributions of individual pollutants

to haze. At the Washington D.C. monitor (Figure 4) and most monitors in the eastern U.S., sulfate, primarily from fossil fuel burning, is the largest contributor to haze on the 20% percent worst visibility days. Nitrate is a larger component of haze at the Washington D.C. monitor than at nearby rural monitors due to the contribution from mobile vehicle traffic in the urban area. Organic carbon, from a combination of natural vegetation emissions, biomass burning, and human caused emissions (for example, diesel and gasoline fuel combustion from mobile and industrial sources), is also an important contributor. Figure 4 illustrates that reductions in sulfate have been responsible for improved visibility at the Washington D.C. monitor over the past decade. Nitrate and organic carbon contributions to haze have not greatly changed over the decade.

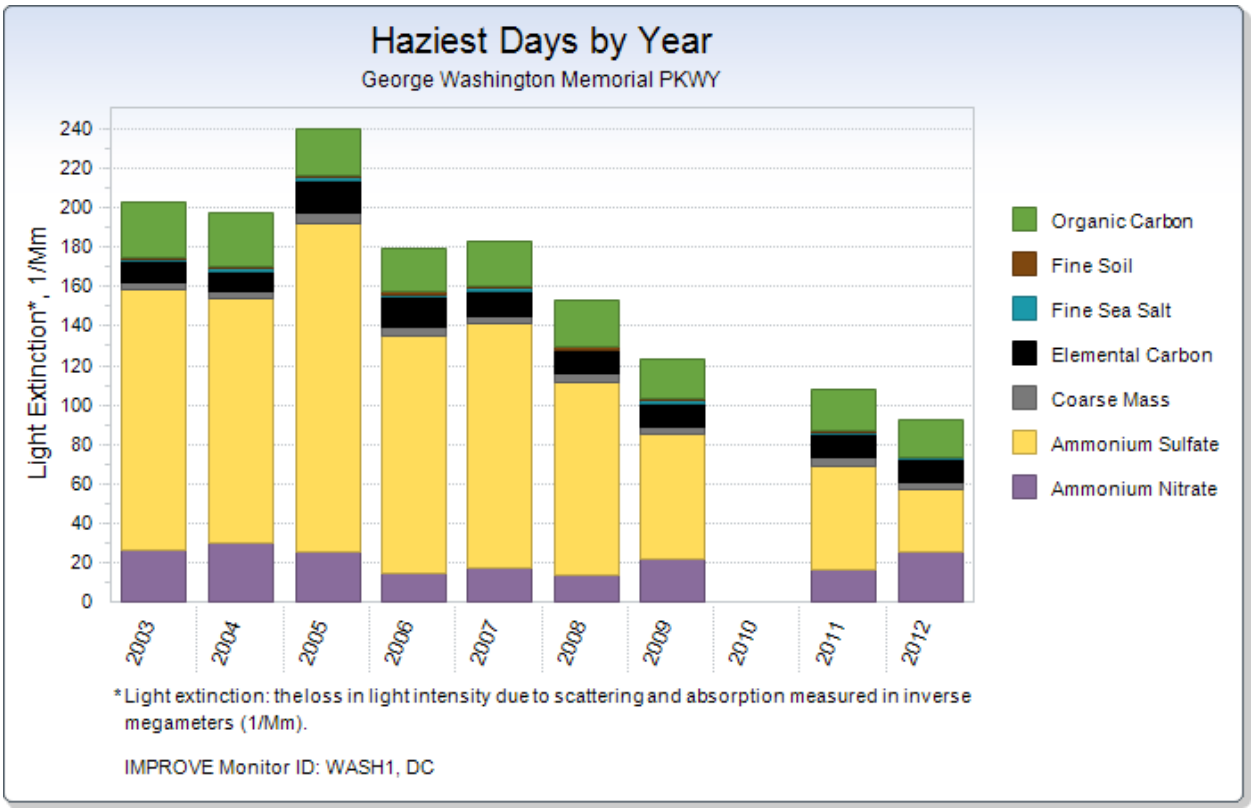

Figure 4. Contributions to haze on the haziest days, 2003–2012.

Long-term visibility monitoring also shows strong seasonal differences in visibility at the Washington D.C. monitor. As illustrated for 2012 (Figure 5), sulfate contributions are greatest in the summer months and lowest in the winter months. This is a function of both highest coal-fired power generation in summer months when air conditioning demand is highest and higher photochemical formation of sulfate in the atmosphere at warmer temperatures. In contrast, nitrate formation is greater at colder temperatures and nitrate concentrations are highest during the winter months and lowest during the summer months. Higher organic carbon in November and December might reflect contributions from prescribed fire and/or residential wood burning.

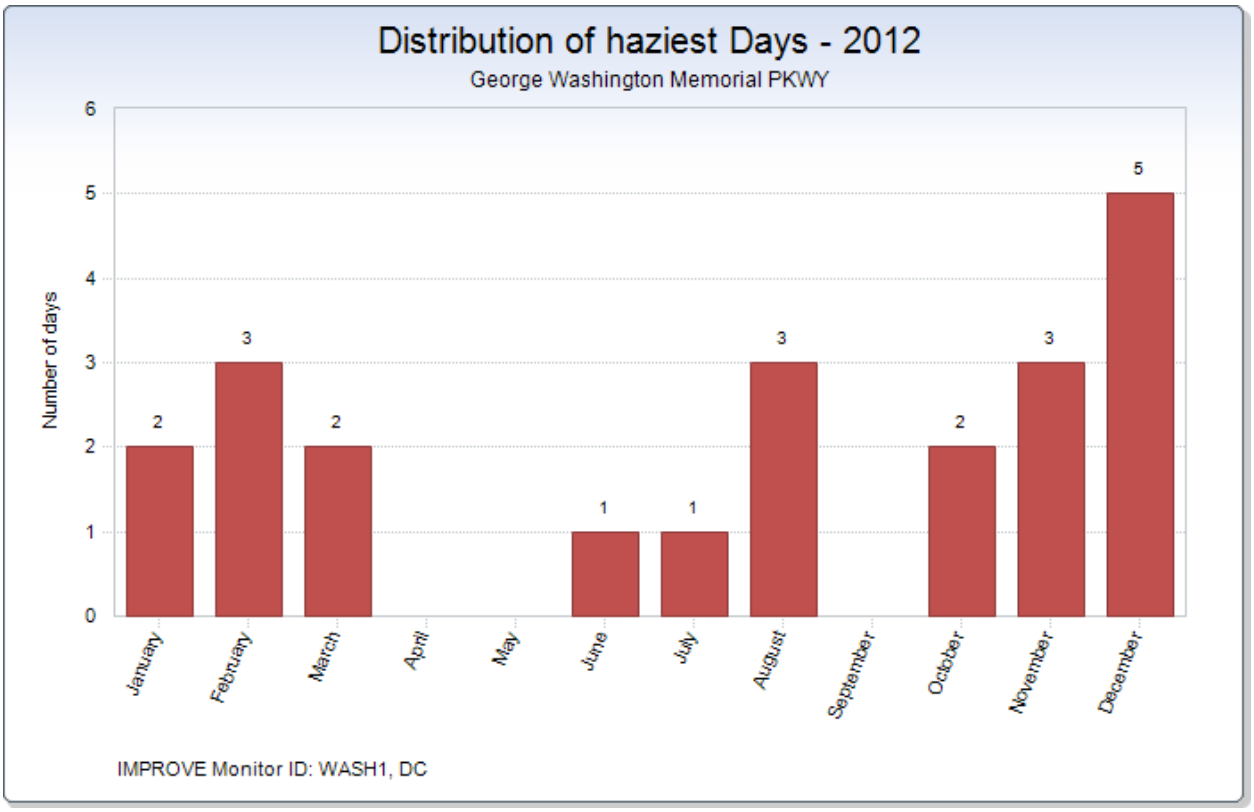

Figure 5. Seasonal variations in haze contributions on the haziest days, 2012.

Ozone

The EPA's ozone standards are the basis for benchmarks for rating ground-level ozone condition. These standards were revised in 2008 in order to be more protective of human health and welfare. The primary standard to protect human health and secondary standard to protect ecosystem health are identical. To attain the standard, the 3-year average of the annual 4th-highest daily maximum 8-hour average ozone concentrations measured at each monitor must not exceed 75 parts per billion (ppb). The NPS ARD recommends a benchmark for good ozone condition of 60 ppb or less, which is 80% of the human health-based NAAQS.

Currently, ozone conditions at GWMP are not meeting the NPS ARD desired conditions and warrant significant concern. Estimated 4th-highest daily maximum 8-hour average ozone concentration for the parkway from 2008–2012 was 77.4 parts per billion (ppb). In addition, GWMP falls within a county designated by the EPA as "nonattainment," for, it doesn't attain the ozone standard of an 8-hour average concentration of 75 ppb. There were no statistically significant trends in ozone concentration at the park from 2003−2012 (Figure 6). The drop in ozone levels in 2009 reflects reduced emissions from electricity generation and industry, a potential result of the economic recession

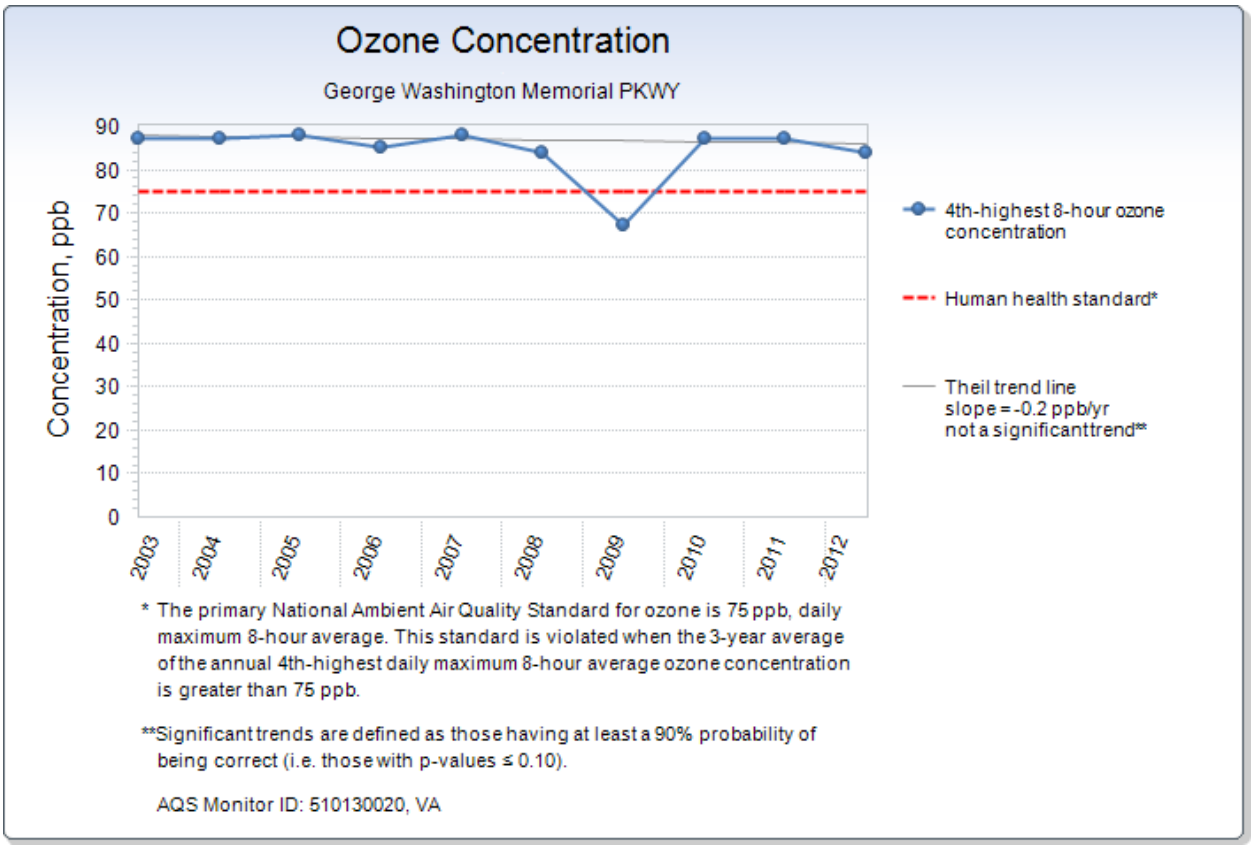

Figure 6. Trends in annual 4th-highest daily maximum 8-hour average ozone concentration (ppb/yr), 2003–2012. Monitor ID: Aurora Hills Visitor Center (510130020).

The NPS ARD also rates ozone condition using the W126 metric, which focuses on the biological response of vegetation to ozone. The W126 metric is a biologically relevant measure that focuses on plant response to ozone exposure and is a better predictor of vegetation response than the metric used for the human health standard. The W126 metric measures cumulative ozone exposure over the growing season in parts per million-hours (ppm-hrs). The NPS ARD recommends a W126 of less than 7 ppm-hrs as the desired condition to protect sensitive vegetation. The estimated W126 metric at the Aurora Hills monitor for 2008–2012 was 18.0 parts per million-hours (ppm-hrs), and is rated as a significant concern for vegetation risk. For 2003–2012, there was not a statistically significant trend in the W126 metric at the Aurora Hills monitor (Figure 7).

Sulfur and Nitrogen Wet Deposition

Although both wet and dry forms of deposition affect ecosystems, wet deposition alone is frequently used to characterize deposition, because dry deposition measurements are very limited. Deposition is measured in kilograms per hectare per year (kg/ha/yr) of wet nitrogen or sulfur deposition. Deposition monitoring data are not available near GWMP, so estimates generated by interpolating data from more distant sampling sites are used to evaluate condition.

NPS ARD recommends a nitrogen or sulfur wet deposition of less than 1 kg/ha/yr as the desired condition to protect sensitive ecosystems. Evidence is not currently available to indicate that wet

deposition amounts less than 1 kg/ha/yr cause ecosystem harm. Nitrogen and sulfur deposition are rated as a significant concern at the park because levels are estimated well above natural background levels (for 2008–2013: estimated wet nitrogen deposition was 4.1 kg/ha/yr and estimated wet sulfur deposition was 3.5 kg/ha/yr).

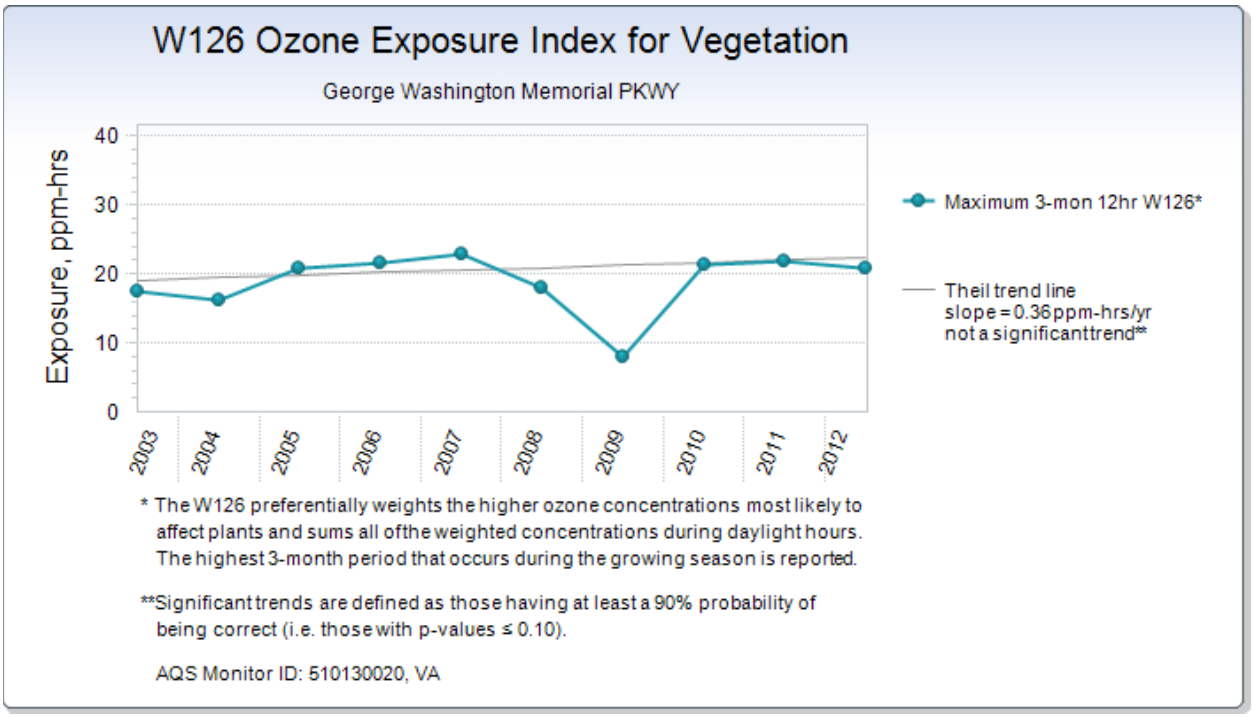

Figure 7. Trends in maximum 3-month 12-hour W126 2003–2012. Monitor ID: Aurora Hills Visitor Center (510130020).

GWMP does not have a representative wet deposition monitor to assess 10-year trends. Although interpolated estimates are sufficient for evaluating condition, ARD recommends they not be used in trends analyses.

Mercury Wet Deposition

The NPS ARD does not currently assess the condition for mercury deposition, as condition thresholds for mercury deposition have not been established. Environmental conditions play a significant role in the potential for mercury to be a contaminant of concern across the landscape. Therefore, the ARD recommended desired condition, once developed, will take into account the landscape type and various water chemistry parameters.

Air Quality Laws, Responsibilities and Progress

Clean Air in National Parks – Law, Policy and Guidance

In the Clean Air Act (CAA), Congress set a national goal "to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic or historic value" (42 U.S.C. §7470(2)). This goal applies to all units of the National Park system. Air quality is important for all parks, such as GWMP, that contain air quality-sensitive natural resources, where clarity of scenic views is an important value or where maintenance of air quality standards is important for protecting visitor and employee health.

Additional authority to consider and protect air quality related values (AQRVs) such as visibility and ecosystem health in parks is provided by Title 54 commonly known as the NPS Organic Act (54 USC 100101(a) *et seq.*), which requires that parks remain "unimpaired for the enjoyment of future generations" providing a mandate for environmental protection. This gives the NPS a responsibility to ensure that internal management actions do not conflict with the purposes for which parks were established by impairing natural resources.

The NPS Management Policies of 2006 clearly reiterate our responsibilities to protect air resources. The Service will actively promote and pursue measures to protect natural and cultural resources and visitor enjoyment, human health and scenic vistas from air pollution. We are directed to integrate air resource management into NPS operations and planning, work externally to prevent air pollution, keep our own operations clean, and promote public understanding of air resources through educational and interpretive programs.

The NPS ARD has developed guidance and recommendations to assist parks, other agencies, and partners with air quality analyses needed for park natural resource condition assessments, planning, and NEPA analyses:

- Internal Air Quality Planning Guidance (http://www.nature.nps.gov/air/planning/index.cfm)
- External (NEPA) Air Quality Planning Guidance (http://www.nature.nps.gov/air/planning/index.cfm)
- Federal Land Managers' Air Quality Related Values Work Group (FLAG) Guidance, Nitrogen & Sulfur Deposition Analysis Guidance (http://www.nature.nps.gov/air/permits/flag/index.cfm)

GWMP Responsibilities and Opportunities

Parks are required to obtain permits for certain air pollution sources such as electrical generators that burn fossil fuels like diesel, propane, or coal. Whether or not a permit is required depends upon the amount of emissions from the generator and the particular state or local requirements. “Conformity” refers to the requirement that park operations be consistent with state regulatory plans to attain or maintain air quality standards. This means GWMP must ensure that their park actions do not cause a violation of air quality standards or prevent improvement in an area that already violates one or more

standards. GWMP is in an area that violates both the ozone and the $PM_{2.5}$ standards. GWMP staff can check with the NPS ARD for further assistance.

The NPS successfully influences the reduction of air pollution from sources that threaten park resources. The NPS ARD, and in some cases parks, engage in extensive cooperative conservation with air regulatory agencies, stakeholders, and other federal land managers to address air resource issues. For example, the Clean Air Act requires companies to obtain an air emissions permit prior to constructing new sources of air pollution or making modifications to an existing facility. When a new or modified source would affect park resources, NPS ARD works with the air quality regulators to analyze the potential impacts to park resources and identify appropriate control technologies. Park support is often important in the process and effectively engaging with stakeholders.

Park planning efforts such as foundation documents, general management plans, and resource stewardship strategies provide an opportunity to highlight the importance of clean air to maintaining park resources and values. NPS management policies state that "the Service will seek to perpetuate the best possible air quality in parks." Addressing air resources in park planning provides a framework for managing air resources and communicates the importance of air resources to the public, industry, air regulatory agencies, and future NPS managers and staff.

The NPS has successfully influenced initiatives aimed at reducing air pollution from sources that threaten park resources. Success requires active NPS participation and cooperative conservation partnerships with air regulatory agencies, stakeholders, and other federal land managers to address air resource issues. Including protection of air and scenic resources in park planning documents supports these efforts.

Air resources can be addressed in GWMP planning in many ways. The conditions of air resources and known threats can be identified along with further data and research needs. Management goals for air resources, as well as strategies for meeting those goals and overall protection of the resources, should be included in plans.

Regional Air Pollution Control Requirements and Progress

To reduce acid deposition, the 1990 Clean Air Act Amendments required reductions in sulfur dioxide and nitrogen oxide emissions from electric power plants beginning in 1995. In 1998, EPA required further controls of nitrogen oxides from power plants and large industrial sources in the eastern states to reduce ozone. Beginning in 2004 EPA has required highway vehicles, trucks, diesel engines, heavy duty equipment, and marine vessels to burn cleaner fuels and operate cleaner engines to reduce ozone and fine particles.

EPA sets National Ambient Air Quality Standards (NAAQS) for carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide. EPA is required to review the national standards every five years and to revise the standards as necessary to protect human health and welfare. EPA revised the national standard for ozone in 1997 and again in 2008. EPA proposed but did not finalize a further revision to the ozone standard in 2011. EPA is currently reviewing the latest scientific evidence and proposed (not yet finalized) a revised ozone standard in late 2014. EPA

revised the national standards for fine particles in 1997, 2006, and again in 2012. EPA reviewed and revised the carbon monoxide, lead, nitrogen dioxide, and sulfur dioxide standards between 2008 and 2011.

When any area of the country violates EPA's NAAQS, they are designated as 'nonattainment' areas. Each state or district, then has to develop a plan to implement the actions needed to reduce the pollution enough so that the NAAQS are attained (i.e., complied with, not violated).
GWMP is located in the metropolitan Washington D.C. nonattainment area for 8-hour ozone (2008 standard) and fine particulate matter (1997 standard). However, monitoring data show that the GWMP counties are currently meeting the national standard for fine particles. Washington D.C. submitted a re-designation request for meeting the 2006 fine particulate matter standard; but the EPA has not yet approved the district's request. To see the State Implementation Plan (SIP) for the Washington DC metropolitan area, click here: http://www.mwcog.org/environment/air/SIP/default.asp.

In 2004, EPA implemented the Clean Air Interstate Rule (CAIR) to require additional emission reductions from power plants in the eastern U.S. to reduce interstate transport of pollutants. In 2008, the Court for the District of Columbia partially overturned CAIR and instructed EPA to revise its definition of interstate contributions to ozone and fine particles in downwind states. In July 2011, EPA finalized the Cross State Air Pollution Rule (CSAPR) to replace CAIR. In August 2012, the Court overturned CSAPR and allowed EPA to continue to implement CAIR until legal review is completed and EPA could implement a revised rule for interstate transport. In 2013, the Supreme Court heard arguments from EPA and challengers concerning CSAPR and interstate transport, and upheld CSAPR in 2014.

Despite the legal uncertainty, significant reductions in sulfur dioxide and nitrogen oxide emissions from power plants have been accomplished, as illustrated for sulfur dioxide in Figure 8. In response to these reductions, acid deposition, ozone, fine particles and regional haze have decreased in the District of Columbia and surrounding counties.

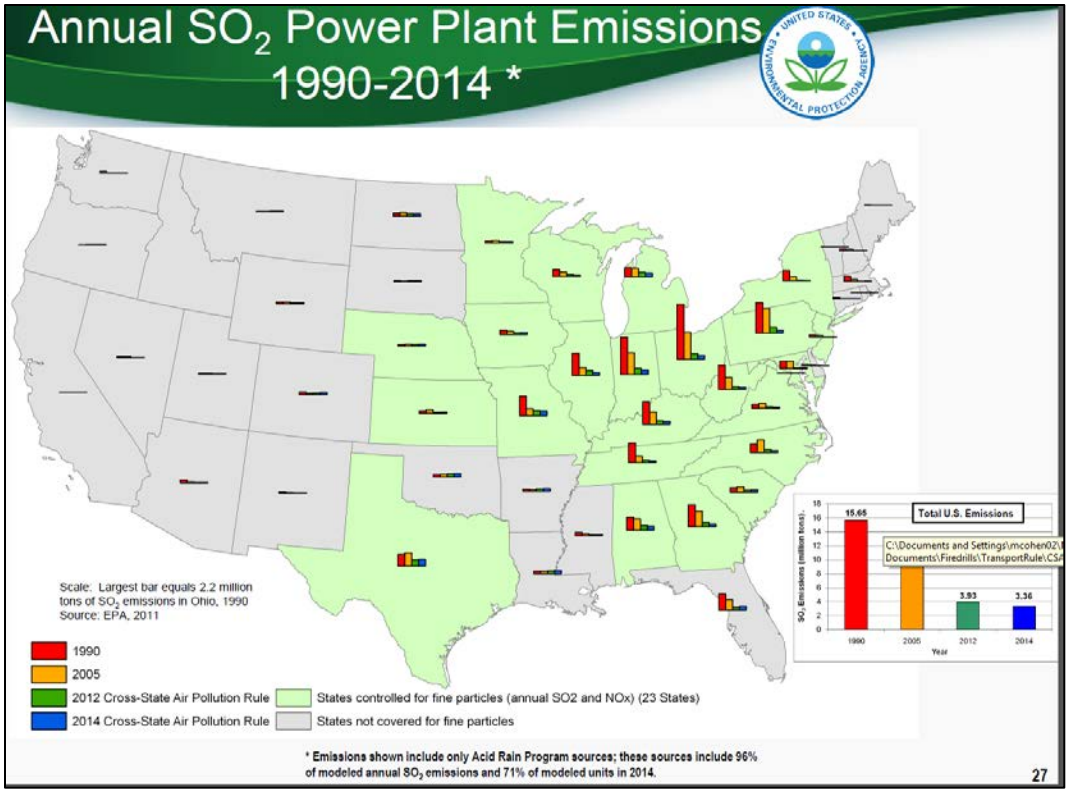

Figure 8. Annual sulfur dioxide emissions from electric power plants, by state, in 1990, 2005, and required by 2012 and 2014 under the Clean Air Interstate Rule. States covered by the Rule are highlighted in green.

The Regional Haze Rule (1999) requires states to protect visibility in Class I national parks and wilderness areas. The District of Columbia's regional haze plan, submitted to EPA in 2011, took credit for emissions reductions in eastern states for ozone and fine particles and did not define any controls specific for regional haze. Virginia and Maryland required controls for a few paper mills as part of their regional haze plans. States and the District of Columbia are required to submit revised regional haze plans in 2018.

Despite the progress that has been made in air pollution control, the Washington area has poor air quality at times, and is still not meeting the ozone standard. The Metropolitan Washington Council of Governments (COG) (http://www.mwcog.org/environment/air/) provides daily reports and forecasts of regional air quality for the Washington region, notifying the public (http://www.cleanairpartners.net/airalert.cfm) when unhealthy air quality is expected. Through COG, the Metropolitan Washington Air Quality Committee (http://www.mwcog.org/environment/committee/committee/default.asp?COMMITTEE_ID=14) coordinates planning to reduce pollutant emissions, including developing strategies to improve air quality and ensure compliance with national air quality standards.

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The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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