1. NAME OF PROPERTY

Historic Name: Washington Aqueduct

Other Name/Site Number: N/A 029-5198

2. LOCATION

Street & Number: N/A

Not for publication: N/A

City/Town: Great Falls (MD) to D.C.

Vicinity: Washington D.C.

Counties: Montgomery Co., MD; District of Columbia; Fairfax Co., VA

Codes: 031, 001, 059

State: MD, DC, VA

Zip Code: N/A

3. CLASSIFICATION

Ownership of Property		Category of Property	
Private:	_	Building(s):	_
Public-Local:	X	District:	X
Public-State:	_	Site:	_
Public-Federal:	X	Structure:	_
		Object:	_

Number of Resources within Property

Contributing	Noncontributing	
3	14	buildings
0	0	sites
39	22	structures
0	0	objects
42	36	Total

Number of Contributing Resources Previously Listed in the National Register: 10

Name of Related Multiple Property Listing: N/A

4. STATE/FEDERAL AGENCY CERTIFICATION

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this ____ nomination ____ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ____ meets ____ does not meet the National Register Criteria.

Signature of Certifying Official — Date

State or Federal Agency and Bureau

In my opinion, the property ____ meets ____ does not meet the National Register criteria.

Signature of Commenting or Other Official — Date

State or Federal Agency and Bureau

5. NATIONAL PARK SERVICE CERTIFICATION

I hereby certify that this property is:

___ Entered in the National Register
___ Determined eligible for the National Register
___ Determined not eligible for the National Register
___ Removed from the National Register
___ Other (explain):

Signature of Keeper — Date of Action

6. FUNCTION OR USE

Historic:	Government	Sub:	Public Works
	Industry		Waterworks
Current:	Government	Sub:	Public Works
	Industry		Waterworks

7. DESCRIPTION

Architectural Classification:	Mid-Nineteenth Century	Sub:	Classical Revival
	Late Victorian		Italianate
			Second Empire

Materials:

Foundation: Stone (Conduit)
Walls: Brick (Caretaker Dwelling), Stone (Culvert headwalls, Bridges, Gatehouses)
Roof:
Other:

Describe Present and Historic Physical Appearance.

Introduction

The original National Historic Landmark (NHL) nomination for the Washington Aqueduct was prepared by Ben Levy and Paul Ghioto of the National Park Service (NPS) in June 1973. The NPS nomination identified the nineteenth-century portion of the Washington Aqueduct system as possessing national significance under NHL Criterion 1, for epitomizing the involvement of the Army Corps of Engineers in the field of public works. The Aqueduct system also is nationally significant under NHL Criterion 4, for representing an exceptionally important example of a municipal water supply system. The work was designed by the noted architect-engineer Montgomery Cunningham Meigs. With regard to historic districts, the Landmarks Criteria require an entity that is both distinctive and exceptional (U.S. Department of the Interior 1991:51).

The original NHL nomination was amended to provide clearly delineated district boundaries, define a period of significance for the property, and include a resource count of contributing and non-contributing resources within the proposed district. The current nomination also correctly replaces the original nomination's misuse of the "transportation" theme with "technology" themes. The category of the property also was revised; the original nomination classified the resource as a "structure," while the revised nomination categorizes the property as a "district." The National Register defines an historic district as containing a significant concentration, linkage, or continuity of sites, buildings, structures, or objects that are related historically or aesthetically by plan or physical development.

The period of significance for the Washington Aqueduct spans the period from 1853 to 1880, which encompasses the initial approval and construction to its completion. The U.S. Army Corps of Engineers selected Montgomery C. Meigs as the engineer responsible for the design and supervision of the initial construction. Although Meigs' direct involvement in the project lasted only until 1862, when he was appointed Quartermaster General of the U.S. Army, his plans were carried out by his successors with only minor modifications. As a result, the NHL period of significance includes those resources included as part of Meigs' plan but built after his departure. The last components of Meigs plan - including the Distributing Reservoir, three caretaker houses and four brick air vents - did not reach completion until the 1870s.

The Washington Aqueduct NHL boundaries as revised in this documentation are based on the 1973 NHL boundaries and encompass the underground path of the conduit stretching from Great Falls to the Georgetown Reservoir and beyond. These areas are linked by a linear system of underground conduits, tunnels, and water mains. The original NHL boundaries have been expanded in two geographic locations (Great Falls and Dalecarlia Reservoir) to incorporate extant resources associated with the Aqueduct's initial period of construction, which spanned the period 1853 to 1880.

Construction of the Washington Aqueduct

Construction of the Washington Aqueduct, a water supply system for Washington, D.C., began in 1853 by the U.S. Army Corps of Engineers. Designed by Captain Montgomery C. Meigs, the system consisted of a 12-mile, underground conduit extending from the Great Falls of the Potomac River in Maryland to the District of Columbia. The Aqueduct system is 60 feet in width throughout most of its length, but widens at three locations: Great Falls, Dalecarlia Reservoir, and the Georgetown Reservoir. These three areas contain the majority of the above-ground resources constructed as part of the original Aqueduct system. The

Aqueduct was designed as a gravity-fed system. The conduit's gravity flow was augmented by a pump at Rock Creek Bridge. A descent of nine inches every 5,000 feet allowed water to flow through the conduit by gravity. To achieve the appropriate slope, Meigs designed six bridges to carry the conduit across valleys and 11 brick-lined tunnels to carry the conduit through rock. In addition, 26 culverts were constructed to divert streams underneath the conduit. Other resources built as part of Meigs' plan included brick air vents along the conduit, waste weirs, gatehouses, a receiving reservoir, and a distributing reservoir. These support structures were integral elements of Meigs' overall design, and typically were characterized by their Classical Revival detailing, such as the influent gatehouse at the Georgetown Reservoir and the sluice tower at the Dalecarlia Reservoir. Other architectural styles also were employed. The brick air vents along MacArthur Boulevard were designed in the Italianate style, while the caretaker dwellings at Great Falls and Dalecarlia were designed in the Second Empire style.

The original system was designed to divert Potomac River water into the system at Great Falls. A dam was built at Great Falls to direct water into intake works located on the north shore of the river. From there, the water flowed 10 miles through a nine-foot diameter masonry conduit (now referred to as the "old conduit") to a Receiving Reservoir at Dalecarlia Farms. This 50-acre Receiving Reservoir consisted of an earthen dam across Little Falls Creek and provided both a place for the turbid river water to settle, and a water storage site for times when the conduit was closed due to excessively muddy Potomac waters or for repairs. From the Receiving Reservoir, water was channeled through a two-mile extension of the conduit to a 36-acre Distributing Reservoir located on the western edge of Georgetown. This reservoir allowed for further sedimentation and served as a distribution point. From the Distributing Reservoir, water was delivered through cast-iron pipes to various parts of the city (Meigs 1853; Ways 1993:15-16; U.S. Army Corps of Engineers 1953:5-8).

A high service reservoir constructed in Georgetown at High and Road Streets (now Wisconsin and R Streets) also was built as part of the Meigs plan. This High Service Reservoir was designed to supply water to the areas of Georgetown that were too high in elevation to receive water via the gravity-fed system. Water was pumped up 145 feet to this site by an hydraulic ram housed in the west abutment of a bridge constructed at Pennsylvania Avenue (Bridge 6) to carry water mains over Rock Creek Valley (Historic American Engineering Record 1992:1; Ways 1993:16). This high service reservoir no longer exists; the site now is occupied by the Georgetown Branch of the D.C. Public Library.

Potomac River water was first delivered to the city of D.C. via the Washington Aqueduct in 1864. As in the case of many cities, Washington's original water supply system was unable to meet the demand of its expanding service area. Subsequent additions to the Washington Aqueduct have included a second distributing reservoir (McMillan Reservoir); two water filtration plants to provide safer and cleaner water; a second conduit (the "new conduit") to increase the water-carrying capacity of the system; new high reservoirs to facilitate the delivery of water to areas of Washington at a higher elevation; and a supplemental intake facility at Little Falls. Unlike other municipal water systems, however, the original system has been expanded not replaced. The original Washington Aqueduct system remains largely intact and operational. The U.S. Army Corps of Engineers continues to own and operate the system.

Today, much of the Washington Aqueduct is located below MacArthur Boulevard, a roadway established during the 1860s as Conduit Road, an access road for the conduit. Some of the Aqueduct's above-ground resources, such as brick air vents, bridges, and culverts are located along MacArthur Boulevard. The area spanned by the Aqueduct gradually becomes more urban as the conduit proceeds eastward towards the city. Some of the system's original features have been concealed by subsequent development

This nomination presents the Washington Aqueduct as a linear historic district consisting of a series of above-ground elements that are physically linked by a below-ground conduit or, as in the case of Bridges 5 and 6, by underground water mains. Portions of the Aqueduct property excluded from the NHL boundaries include the Little Falls pumping facility and the Dalecarlia property west of MacArthur Boulevard. The Little Falls complex, which consists of five structures, was constructed in 1959 to supplement the Great Falls intake facility. The construction date falls outside of the period of significance (1853 - 1880); therefore, the property is not included within the district boundaries. The western portion of the Dalecarlia property contains a water filtration plant added to the Aqueduct system during the 1920s. Due to its later construction date, the property was not included in the NHL district boundaries.

A total of 78 built resources were identified within the NHL boundaries. Of this total, 42 are considered as contributing elements, while the remaining 36 elements are non-contributing resources. One of the contributing resources within the NHL boundaries, the Cabin John Bridge (WA31), also is listed in the National Register as an individual resource. Another one of the buildings, the Castle Gatehouse (GR3), was included as a contributing resource in the 1973 NHL nomination, but was revised in the current nomination to be a non-contributing resource. This was based on more recent archival research that revealed that the gatehouse was built in 1901; a data sheet prepared by C.P. Heins of the U.S. Engineer Office, Washington, D.C., depicts a section, plan, and elevation of the structure. Since the Castle Gatehouse was not associated with the Meigs-era construction, it was not included as a contributing element of the NHL property. This building, however, was listed individually in the National Register in 1973.

In general, most of the resources classified as non-contributing were constructed during later periods of development and are not associated with the original construction of the Aqueduct. The following resources associated with the Meigs design were considered non-contributing due to lack of integrity: Brick Vent 2 (WA23), Culvert 23 (WA40), Culvert 24 (WA41), waste weir (WA43), and Culvert 26 (WA44). Evidence of the original design of these structures is concealed by subsequent modifications. Other alterations are discussed in more detail in the resource-specific descriptions below.

Of the six original bridges constructed as part of the Meigs plan, four bridges are contributing resources, while two bridges (Bridges 5 and 6) are non-contributing resources. Bridge 5 has been covered by earth fill and is no longer visible. Although the bridge is extant, it was not possible to survey the structure to assess its appearance and resource integrity. As a result, Bridge 5 was counted as a non-contributing resource within the NHL property. Bridge 6 has been substantially altered since its construction and no longer retains its integrity.

The following discussion highlights some of the Washington Aqueduct's most important contributing resources. A list of resources included within the NHL boundaries is presented at the end of Section 7; this list identifies contributing and non-contributing resources. Included in each resource description are construction date, original and current use, architectural and engineering features, building materials, and resource integrity. Resource descriptions are organized according to location: Great Falls, Dalecarlia, Georgetown, and along the conduit path. Much of the resource-specific archival information was compiled from annual reports submitted to Congress by the Chief Engineer of the Corps of Engineers.

Great Falls

The primary intake facility for the Washington Aqueduct is located along the Potomac River in Great Falls, Maryland, approximately 16 miles northwest of the Washington city center. Construction at Great Falls began in 1853. The first structures completed at Great Falls were a rip-rap dam (WA1) designed to direct water into the Aqueduct system; an intake facility along the north shore of the river; and, a gatehouse (GF2) to control the flow of water into the conduit. Both the gatehouse and the Great Falls Dam survive; the original intake facility is no longer extant. During the 1870s, a dwelling (GF4) was constructed to house the Great Falls gatekeeper.

Great Falls was modified during subsequent building campaigns to expand the dam and make repairs from flood damage. In 1922, a new conduit was constructed parallel to the original 1853 conduit, and a new intake facility was built along the river at this point. Additional facilities were incorporated into the area during the 1950s, including two dwellings to house Corps of Engineers personnel. A new intake facility was constructed between 1967 and 1970 to replace the 1853 and 1922 conduit entries.

<u>Gatehouse (GF2)</u>. The gatehouse at Great Falls was designed by Montgomery Meigs and was in operation by 1862 (Photograph 1). Gates within the gatehouse regulated the flow of water to the conduit. During periods when the water was especially turbid, the gates were closed. If increased pressure was necessary in the aqueduct system, the gates were opened to allow a greater volume of water into the conduit. The gatehouse was taken out of service in 1970 when the new intake facility became operational.

Description. The gatehouse is a one-story, three-by-one bay structure occupying a rectangular plan. The building is constructed of coursed Seneca sandstone with smooth-cut quoins defining the corners of the structure. A mansard roof sheathed in hexagonal slate shingles shelters the building. A metal door centered in a projecting section of the west elevation provides the only access to the building. There are no windows in the building. A dormer containing a circular louvered copper vent punctuates the roof slope on each elevation. The mansard roof and round dormers effectively convey an association with the Second Empire style. *Alterations*. The building originally was sheltered by a wooden gable roof with projecting cross gable. Annual reports filed by the Chiefs of the Aqueduct reveal that this roof was left exposed and rotted, as did the wooden gate structures within the building. In 1877, a metal cornice and mansard roof were constructed, and iron components were added inside the building to replace the deteriorated wooden structures.

<u>Gatekeeper Dwelling (GF4)</u>. In 1875, a substantial dwelling was completed at Great Falls to house the conduit gatekeeper. Prior to completion of this dwelling, the caretaker resided in a wood-frame structure. This was one of three caretaker residences included as part of Meigs plan and constructed between 1874 and 1875. Other residences were built at the Receiving Reservoir (Dalecarlia Reservoir) and the Distributing Reservoir (Georgetown Reservoir). These three dwellings were built according to the same plan but using different materials, exemplifying the Army's early usage of standardized plans. As Quartermaster General of the Army, Montgomery Meigs encouraged the use of standardized plans at Army installations. Meigs hoped to control costs and to establish consistent construction standards at the expanding number of Army posts (Ways 1993:107;Cannan 1994:440). The gatekeeper dwelling at the Georgetown Reservoir has been demolished; the dwelling at Dalecarlia (DS37) survives but is abandoned. The dwelling at Great Falls was transferred to the National Park Service ca.1970. The building now houses offices for Park Service officials.

Description. The gatekeeper dwelling is a two-story, "L" plan, two-by-two bay, stone structure constructed on a stone foundation. A mansard roof sheathed with wooden shingles shelters the building. Two brick interior chimneys rise above the roof plane. A one-story, flat-roofed porch occupies the crook of the "L" plan. Two building entries open onto the porch. Windows throughout the structure are two-over-two light, double hung, wooden sash units.

Alterations. A one-story, shed-roofed, frame addition supported by a concrete foundation was appended to the south elevation. The walls of the addition are clad with German siding.

Great Falls Dam (WA1). Montgomery Meigs designed the Great Falls dam to divert water from the Potomac River into the Aqueduct conduit. The original dam was constructed between 1857 and 1863, and consisted of a rip-rap structure. Soon after its completion, the original rip-rap structure was damaged from sudden water level changes during the spring and was replaced with a solid masonry dam between 1864 and 1867.

Description. The current dam consists of a cut stone head wall and a slope of stone rubble. The dam extends from the north shore across the Potomac to the south shore. On the Virginia side, the dam is cemented to a natural outcropping of rocks and extends approximately ten feet onto land. The dam is angled upstream to minimize the impact of the river current on the dam's structural integrity.

Alterations. As originally built, the masonry dam extended roughly halfway across the river; the dam was extended to the Virginia shore between 1882 and 1886. During 1895 and 1896, the dam's lip was raised two feet to 150 feet above sea level. In 1928, "flash boards" were added to the lip of the dam to raise the contained water level to 151.5 feet above sea level, increasing flow throughout the Aqueduct system. Despite these modifications, the portion of the dam constructed between 1864 and 1867 survives intact and continues to serve its intended purpose.

Conduit Path (MacArthur Blvd.) and Other Miscellaneous Distribution Locations

Construction of the original Aqueduct conduit was initiated in 1853, along with the construction of six bridges, 26 culverts, three waste weirs, and two by-conduits. During the 1860s, an access road was established above the conduit. Originally called Conduit Road, the access road was renamed MacArthur Boulevard during World War II. Due to a number of delays, the original Meigs plan did not reach completion until 1878 with the construction of the final four above-grade air vents along the conduit.

The majority of the Aqueduct's Meigs-era above-ground resources are located in discrete functional clusters at Great Falls, Dalecarlia, and Georgetown; however, many of the system's resources are dispersed outside these three areas along the conduit path. Most of these original resources are intact.

Old Conduit (WA3). The original conduit designed by Meigs carried Potomac River water 10 miles from Great Falls to the Receiving Reservoir (Dalecarlia Reservoir), and then two miles further to the Distributing Reservoir (Georgetown Reservoir). Branch by-conduits were established at each reservoir; these by-conduits allowed water to bypass the reservoirs and connect directly with the city distribution system, if necessary. The conduit, which served as the essential part of the Meigs plan, was constructed between 1853 and 1864. Water flows by gravity through the conduit. The conduit continues to function as originally designed.

Description. The conduit consists of a circular brick channel and the materials that support the brick channel. The conduit maintains a constant descent rate of nine inches per 5,000 feet, and extends a total of 12 miles. The Potomac valley topography varies throughout the 12-mile length of the conduit. In order to maintain the constant grade of nine-inch-per-5,000 foot, three methods of construction were used: tunneling; cut-and-fill; and building on elevated fill. A fourth method, the use of bridges, also was used to maintain gravity flow over irregular grades.

Eleven tunnels were bored through rock. Originally unlined, the tunnels were relined with concrete. In both cut-and-fill and elevated sections, the brick conduit was constructed to conform to the same general characteristics. The brick conduit was constructed within a bed of rammed earth, which in turn rested upon a watertight layer. When impermeable rock was unavailable as a foundation, a layer of puddled clay was laid. The term "puddling" refers to the act of forming a compact mass that becomes impervious to water when dry (Merriam-Webster 1988). A column of rammed earth was constructed upon the puddled or rock foundation, which was defined by steeply sloped sides. The brick conduit was constructed within the upper portion of the rammed earth column. Next, earthen fill was deposited to cover the foundation and rammed earth column.

The cut-and-fill and elevated sections differed in that cut-and-fill sections of the conduit simply required the excavation of a channel for the conduit, which was backfilled once the conduit was in place. Elevated sections, on the other hand, required the construction of a large earthen embankment. The fill protected the conduit from exterior damage and frost.

Meigs' design for the conduit called for a channel that was circular in section, nine feet in diameter, and constructed with three courses of brick. This circular channel configuration differed from both New York's Croton Aqueduct and Boston's Cochituate Aqueduct. The Croton Aqueduct utilized a horseshoe shaped channel, while the Cochituate Aqueduct utilized an ovular configuration. As built, the channel's diameter varied from nine to eleven feet. The U.S. Army Corps of Engineers 1896 Annual Report stated: "In sections where the soil in which it was built was considered particularly good the inner ring of brick was omitted, and the diameter is 9 feet 9 inches. Where the conduit passes as an unlined tunnel through rock the excavation was sufficient to contain an inscribed circle 11 feet in diameter" (U.S. Army Corps of Engineers, *Annual Report* 1896:3906).

By-conduits around the system's reservoirs varied from the main conduit design. The by-conduit around the Receiving Reservoir was constructed with a nine-foot diameter through most of its course, but 625 feet of this by-conduit was only eight feet in diameter. The by-conduit around the Distributing Reservoir was constructed with a seven-foot diameter.

A two-lane road, now known as MacArthur Boulevard, was constructed parallel to the conduit during the 1860s to serve as an access road for the conduit and to facilitate repairs and inspections. The road extends along the top of the conduit's earth berm, defining the conduit path. It first enters beneath the roadway near Anglers Inn in Montgomery County. The conduit, however, does not follow the exact route of the roadbed into the District; in some cases, it was more advantageous to blast tunnels through hillsides as opposed to deep-rock cuts. Bridge 3 provides one example. The bridge is not connected to any roadbed but, instead, lies at the foot of a hill through which a tunnel has been sent (Levy and Ghioto 1973:287-288).

Alterations. Few alterations were made to the conduit during its early years of operation. Between 1869 and 1871, the by-conduit around the receiving reservoir was lined with brick, because the rock through which the unlined by-conduit passed was soft and spalling rapidly. In 1881, the head of the conduit between Dalecarlia and Georgetown was enlarged to create more pressure at the conduit entrance and cause the water to flow faster through the conduit.

In 1895, the Dalecarlia by-conduit wall collapsed while in use. The by-conduit was repaired the following year and strengthened through the addition of reinforced concrete retaining walls abutting the repair.

The next alteration to the conduit was the lining of the system tunnels. Spalling rock falling into the conduit was noted as early as the 1870s. Between 1911 and 1913 a comprehensive effort was undertaken to line the tunnels with concrete. Presently, the application of gunnite to the entire conduit interior is a routine maintenance procedure.

The access road over the conduit (MacArthur Boulevard) also has been improved during the Aqueduct's operation. As early as 1868, the Chief Engineer of the Aqueduct noted that the conduit had become a heavily traveled artery between southern Montgomery County and Washington. To alleviate wear upon the conduit's earthen embankment by the heavy traffic, work began on macadamizing the road in 1871. Work progressed slowly; by 1885, the road between the Georgetown Reservoir and the Angler's Inn was paved. In 1892, the road was realigned to match exactly the path of the conduit channel at this location. The adjustment was intended to prevent wagons straying from the macadam road from damaging the conduit embankment during the wet spring season. In 1974, recognizing the importance of the conduit access road as a county transportation artery, maintenance and policing of the road was turned over to Montgomery County (U.S. Army Corps of Engineers, *Dalecarlia Master Plan* 1983:7).

Between 1922 and 1925, a second conduit (referred to as the "new conduit") was constructed within the conduit corridor. The new conduit, which is situated on the Potomac side, follows the same alignment as the old conduit, except for a small segment between Great Falls and the exit of Tunnel No. 1. Although the new conduit falls within the boundaries of the NHL district, it is not associated with the period of significance (1853 – 1880) and, therefore, is considered a non-contributing resource.

Culverts (WA5, 9, 11-19, 21, 22, 26-29, 32, 34-36, 38, 40-42, and 44). Structures constructed on an earthen foundation possess greater stability, and are less costly to maintain, than structures maintained above grade. Therefore, when crossing small stream valleys engineers often prefer to import fill and create an artificial earthen foundation, rather than erect a bridge. Culverts are just such structures. They serve two functions in the Aqueduct: to support the conduit as it crosses small stream valleys, and to allow existing streams to follow their natural course without eroding the conduit. A total of 26 masonry culverts were built between 1854 and 1856 as part of the Meigs plan. Similar masonry culverts were designed by Engineer John B. Jervis for the Croton Aqueduct in New York (Lange 1991:5).

Description. Culverts of Meigs' design were constructed of brick, with coursed ashlar headwalls. Like Meigs' bridges, Seneca sandstone typically was used in the construction of the culvert headwalls. Culvert dimensions varied; width and height were determined by the potential volume of water and debris that channeled body of water might carry during an average flood. Some of the culverts were designed with stepped sides and act as embankment walls. Others were capped with flat slabs of stone and covered in earth. Culvert 12, which spans Rock Run, is the largest culvert designed for the system and survives fully intact (Photograph 2).

Alterations. The majority of changes to the culverts occurred during the 1920s with the construction of a second conduit (the "new conduit"), which ran parallel to the original conduit's corridor. Some of the 1850s culverts possessed sufficient width to carry the new conduit, however, many of the culverts were extended to accommodate the combined width of the conduits. This was achieved by constructing poured concrete culvert headwalls that matched the original in height and width. These new culverts lacked ornamentation (Photograph 3). The original culvert elements no longer are visible on the river side; the stone faces are still visible on the north side of the culverts. Despite the change in configuration, the 1850s culverts still retain their original fabric and continue to perform their intended purpose. The culverts, therefore, still retain sufficient integrity to convey their engineering significance and qualify as contributing elements.

Waste Weirs. Three waste weirs were constructed between 1855 and 1858 as part of the original conduit system. Waste weirs served three functions: to provide gates through which sections of the conduit could be de-watered quickly; to provide blowoff points in the system should water pressure within the conduit channel build to dangerous levels; and, to allow access for repair. A section of the conduit could be drained by putting wooden stop planks across the conduit at the upstream waste weir, and opening the gates in the downstream weir. Waste weirs allowed a portion of the conduit to be drained without interrupting the entire system.

Description. Waste weirs consisted of a two-door, wood-frame gate set in the conduit channel wall, a gate chamber abutting the conduit channel exterior, and a tunnel leading from the gate chamber to a nearby creek, into which conduit water was discharged. Conduit gatekeepers accessed the waste weir gates via wooden catwalks constructed in the discharge tunnels.

Waste Weir One, which is located at the exit of Tunnel No. 1, discharges into the C&O Canal. Waste Weir Two is located at the intersection of MacArthur Boulevard and Sangamore Road, and discharges into the Little Falls Branch valley. Waste Weir Three (WA43), located north of the Georgetown Reservoir between Culvert 25 (WA42) and Culvert 26 (WA44), is not visible from grade.

Alterations. Waste Weirs One and Two, which became damaged and unworkable, were repaired in 1892. Rotting wooden structural members were removed and replaced with iron framing. In 1894, a metal door was installed over the entry to Weir Three to deter unauthorized entry. In 1895, a grate was installed over the opening of Weir One upon completion of its discharge tunnel; this was done to prevent large objects from damaging the weir gates when the Potomac River flooded. In ca. 1910, iron sluice gates replaced the original gates of Weir Two. Valve mechanisms in the weirs were motorized during the 1940s; however, these motors have since been abandoned.

<u>Bridges (WA6, 7, 24, 30, 82, 83)</u>. Bridges were incorporated into the Washington Aqueduct system for the purpose of transporting the Aqueduct over valleys. As described above, a system of masonry culverts also was constructed as part of Meigs' design to cross small stream valleys; bridges, however, were required to cross the larger valleys.

Six bridges, identified as Bridges 1-6, were designed by Meigs. Construction of these bridges began in the mid-1850s; however, due to sporadic Congressional funding, the bridges did not reach completion until the 1870s. Bridges 1-4 were built between Great Falls and the Distributing Reservoir; these bridges were designed as single span masonry bridges. Bridges 5 and 6 were located east of the Distributing Reservoir and were designed to convey iron water mains across Foundry Branch and Rock Creek. As originally designed, Bridges 5 and 6 were single span cast-iron structures; both bridges have been altered and are classified as non-contributing structures.

Description. Bridges 1-4 are single span masonry bridges constructed of Seneca sandstone. The spring arches of the bridges range in dimension from 14 feet (Bridge 1) to 220 feet (Bridge 4). The beltcourse, voussoirs, and keystone of each bridge are constructed of a more finely dressed sandstone. A steel door set into the bridge face provides access to the bridges' interior.

Bridge 3, the Griffith Park Bridge, was designed by Montgomery Meigs and Charles Talcott to carry the old conduit across Mountain Spring Branch (Photograph 4). The bridge span measures 75 feet. The load created by the masonry deck above the conduit channel is supported by a system of interior arches, similar in design to the Croton Aqueduct's Sing-Sing Kill Bridge (Lange 1991:7).

Bridge 4 (Cabin John Bridge), originally known as the Union Arch, carries the old conduit across Cabin John Creek (Photograph 5). Meigs designed the bridge with Alfred Rives, which consisted of a semi-circular arch measuring 220-feet wide and 57-feet high (Miller 1972:2). A system of interior arches supports the load created by the masonry deck above the conduit channel; this is similar in configuration to Bridge 3. Upon its completion in 1864, the Cabin John Bridge was the longest single span masonry arch in the world. The bridge was listed in the National Register of Historic Places in 1973.

Bridges 5 (no longer visible) and 6 (Rock Creek Bridge) were designed by Meigs to carry the Aqueduct's two original 48-inch iron distribution mains across Rock Creek into the Federal City. The single-span design of the iron bridges utilized two large cast-iron pipes that served two purposes, to transport water across the valley and to serve as arches supporting the bridge structure (Photograph 6).

Alterations. Alterations to the masonry bridges have been minimal. Roadways and stone parapets were added to both Bridge 3 and the Cabin John Bridge (Bridge 4) during the 1870s to accommodate traffic on the bridge deck. During the 1980s, the deteriorated stone parapet on the Cabin John Bridge was replaced with cast concrete colored to resemble the Seneca sandstone.

Bridge 5 has been buried beneath earth fill and is no longer visible. Since a current description and assessment of integrity were not possible during this investigation, the bridge was counted as a non-contributing element within the NHL.

Bridge 6 was modified in 1916 under the McMillan plan to accommodate increasing traffic loads. The iron portions of the bridge were dismantled and a concrete-arched structure was constructed. The bridge presently exists as a 200-foot single arch concrete structure clad in smooth granite block facing (Photograph 7). The bridge deck contains a roadway, sidewalks, and balustrade. The roadway is 50 feet wide and paved with asphalt. The 10-foot wide sidewalks, which flank the roadway, are constructed of poured concrete. A balustrade extends the length of each sidewalk. Although the bridge structure has been altered, the original pipes are visible on the underside of the bridge and continue to carry water (Photograph 8). Bridge 6 was counted as a non-contributing element within the NHL.

Brick Vents (WA10, WA23, WA37). Air vents were incorporated into the conduit to maintain water "freshness," and encourage sedimentation during the passage from Great Falls to Dalecarlia. Of the four vents constructed in 1873 along the conduit path, only three remain extant. Two vents (WA10 and WA37) retain their original design. One vent (WA23) was replaced with a newer structure and was not included as a contributing resource. New York's Croton Aqueduct also incorporated air vents, one every mile (Lange 1991:5). The Croton Aqueduct vents also were intended to maintain an even pressure throughout the conduit.

Description. WA10 and WA37 are one-story, brick structures with an octagonal plan (Photograph 9). Pavilion roofs shelter the structures. Metal vent grates occupy the peaks, and approximately one-half, of the roof surfaces. The vents incorporate wooden Italianate style cornices. Brick walls are painted red. One of the vents, WA23, no longer retains its original design and has been replaced with a four-foot tall concrete structure.

Alterations. Vents WA10 and WA37 appear unaltered. Vent WA23 appears to have been replaced with the current concrete structure during the construction of the Capital Beltway.

Dalecarlia Reservoir

The Dalecarlia Reservoir straddles the D.C./Maryland border. Only the property on the east side of MacArthur Boulevard is included in the NHL boundaries. Property on the west side of MacArthur Boulevard was excluded from the district boundaries; this portion of the Dalecarlia property contains a water filtration plant dating from the 1920s, which falls outside of the district's period of significance.

The reservoir basin (Receiving Reservoir), created by damming Powder Mill Creek between 1854 and 1858, was the first feature established at Dalecarlia. As originally designed, the reservoir had a total holding capacity of approximately 150,000,000 gallons. It was hoped that holding murky river water in this reservoir and the Georgetown Reservoir two miles away would allow any material carried in suspension to settle before distribution to the city. In some cases, however, the water had a muddy yellowish color. To resolve this problem a filtration plant was added in 1928 (Levy and Ghioto 1973:288). By 1859, a sluice tower (WA51) and effluent gatehouse (no longer extant) were completed and the system between Dalecarlia and the city of Washington became operable, fed by Powder Mill Creek and Little Falls Branch.

Between 1864 and 1867, a by-conduit was constructed to allow Potomac water to bypass the Receiving Reservoir and flow directly to Washington if waters in the reservoir were more turbid than the water arriving directly from the river. In 1875, a substantial gatekeeper's dwelling (DS37) was constructed on a hill overlooking the reservoir and Conduit Road.

Concern over the reservoir's water quality led to the temporary abandonment of the reservoir in 1888. Instead, water was channeled through the by-pass conduit directly to the system's Distributing Reservoir. To alleviate pollution concerns, a system of open channels was established between 1894 and 1895 to divert the tributaries of Powder Mill Creek around the reservoir. When the diversion channels were completed, the reservoir was reintegrated into the Aqueduct system.

During the 1920s, Dalecarlia became the site of Washington's second filtration plant. The first water filtration plant was the MacMillan Filtration Plant opened in 1902. Most of the construction associated with the development of the filtration plant at Dalecarlia occurred on the west side of MacArthur Boulevard, removed from the reservoir itself. Once the filtration plant was in operation, the Dalecarlia Reservoir fed both the Distributing Reservoir and the Dalecarlia filtration plant. The Dalecarlia Treatment Plant is not included in the Washington Aqueduct NHL district boundaries due to its later construction date.

Abandoned Dwelling (DS37). In 1875, a permanent dwelling was completed at the Dalecarlia Reservoir to house the reservoir gatekeeper. This is one of three caretaker residences constructed by the Aqueduct between 1874 and 1875. Other residences were built at Great Falls and the Distributing Reservoir (Ways 1993:107). As stated earlier, these three dwellings were built using standardized plans but using different materials. When he became Quartermaster General, Meigs encouraged the use of standardized plans at Army installations. Meigs hoped to control costs and to establish consistent construction standards at the expanding number of Army posts (Cannan 1994:440). The caretaker dwelling at Dalecarlia currently is abandoned.

Description. The dwelling is a two-story, "L" plan, two-by-two bay, brick structure constructed on a concrete foundation. The building was designed in the Second Empire style (Photograph 10). Building walls are brick coursed in 6:1 American bond. Scrolled brackets support a dentilled cornice. A mansard roof sheathed with slate shingles shelters the building. Two brick interior chimneys rise above the roof plane. A one-story, shed-roofed porch occupies the crook of the "L" plan.

Alterations. A two-story, wood-frame addition was built on the east (rear) elevation. The addition is sheathed in German siding. A hip-roofed porch wraps around the east and south elevations of the addition.

Receiving Reservoir (WA47). WA47 was created by damming Powder Mill Creek between 1854 and 1858. Montgomery Meigs designed the Receiving Reservoir as a settling area for the Potomac River water, where excess sediments in the water could settle before the water continued on into the distribution system. Potomac River water entered the west end of the reservoir and exited at the east end. Little Falls Branch, Powder Mill Creek, and East Creek also fed the reservoir. The Receiving Reservoir was first officially referred to as the "Dalecarlia Reservoir" in 1893.

Description. The Dalecarlia Reservoir is located on the east side of MacArthur Boulevard. The reservoir is divided into two parts: the forebay (three acres), where water enters the reservoir; and the remainder of the reservoir (44 acres). The shore is paved with rip-rap.

Alterations. During 1871 and 1872, the bare earthen walls of the Receiving Reservoir were lined with rip-rap to prevent erosion from damaging the reservoir walls and soiling the reservoir water. By 1888, the tributaries that naturally fed the Receiving Reservoir and its associated creeks were recognized as sources of reservoir pollutants and the reservoir was taken out of service. The by-pass conduit was utilized to divert water around the reservoir. During 1894 and 1895, a series of channels and dams were constructed to divert the tributaries from the Receiving Reservoir, and the reservoir was again reintegrated into the Aqueduct system.

During the 1930s, an earthen dam (WA50) was constructed in the western portion of the basin. This modification, however, did not impact significantly the overall design and function of the reservoir. In addition, a few structures related to the inflow and outflow of water in the reservoir are located along the reservoir shore. These structures include the Booster Control Station (D5) built in 1935; the Booster Pump Station (D6) constructed in 1935; and, Intake Gatehouse (D7) constructed in 1959 (Ways 1993:165). These structures are considered non-contributing elements since they were constructed after the period of significance (1853 - 1880).

Sluice Tower (WA51). The Sluice Tower was completed by 1858. This tower is situated in the southern end of the reservoir and is surrounded by water (Photograph 11). The structure is situated above a tunnel that leads to the Little Falls Branch drainage. Gates within the tower wall were opened by valves located within the tower. The sluice tower enabled the Dalecarlia gatekeeper to accelerate emptying of the reservoir for maintenance purposes, and provided an additional emergency release during periods of high water. Though the Receiving Reservoir dam had a spillway to prevent overfilling the reservoir, the addition of the sluice tower ensured that water would not cross the dam lip. Earthen dams are most susceptible to erosion when water is allowed to cross the lip.

Description. The Sluice Tower extends one-story above the Dalecarlia Reservoir's water level. The building has an octagonal plan and is constructed of stone. An entablature of stone defines the roof line. The building terminates in a pavilion roof sheathed in fishscale slate shingles. An urn crowns the roof peak. No windows punctuate the building walls. A single entry is located on the tower's northeast elevation. An iron ladder extends from the entry into the water. An inscription on the west elevation reads:

> Washington Aqueduct. Built by order of the Congress of the United States for bringing water into Washington. Begun A.D. 1853 on the 8th day of November. Water delivered in Washington from this reservoir A.D. 1859, on the 3rd day of January. From the Potomac River A.D. 1863 on the 5th day of December. 151 feet above 0 of the Washington Aqueduct, or 150 feet above ordinary high water at Washington. A.D. 1858.
> Captain M. C. Meigs, Chief Engineer.

Alterations. No alterations were recorded.

Georgetown Reservoir

The Georgetown Reservoir occupies approximately 65 acres in northwest Washington. The facility consists of only seven built resources. The first construction at the Georgetown facility was the reservoir basin (WA61), which was excavated between 1862 and 1864. The reservoir was surrounded by an earth dike, which was paved with rip rap to further sedimentation and preserve the walls. Originally, this reservoir was designed as the Distributing Reservoir, where water was stored before distribution to the city. Influent and Effluent Gatehouses were built to control the flow of water in and out of the reservoir; only the Influent Gatehouse (GR1) survives. In 1875, a dwelling was built at the Distributing Reservoir for the gatekeeper; this building no longer survives.

One building, the Castle Gatehouse (GR3), often is mistaken for one of the original resources designed by Meigs. This castellated structure was constructed in 1901 in association with the new Washington City Reservoir and Tunnel, the first major expansion to the Aqueduct. The Castle Gatehouse regulates the flow of water from the Georgetown Reservoir into the City Tunnel. The building was listed in the National Register in 1974.

Influent Gatehouse (GR1). GR1 was constructed between 1864 and 1872 to regulate the flow of water into the Distributing Reservoir from the Receiving Reservoir. The gates in the building could also be adjusted so Dalecarlia water flowed into the Distributing Reservoir by-pass conduit rather than the reservoir.

Description. GR1 is a one-story, concrete, octagonal plan structure constructed on a granite sill foundation (Photograph 12). Stucco on the building walls is scored to resemble cut stone. A plain cornice defines the roofline. A concrete dome shelters the interior. A wooden double door is located in the west elevation. No windows punctuate the building walls.

Pipe Vault (GR7). GR7 is the stairwell that leads to the pipe vault where the old city water mains are located. The pipe vault is a brick-lined barrel vault constructed between 1862 and 1864. A 12-inch, a 30-inch, and two 48-inch iron mains lead through the pipe vault from the Effluent Gatehouse to the city distribution system.

Description. GR7 is a one-story, brick, hexagonal plan structure constructed on a Seneca sandstone foundation. Brick walls coursed in 6:1 American bond rise from the foundation to terminate at a dome roof. The wall exterior is stuccoed and scored to resemble cut stone. A metal entablature defines the roofline. No windows punctuate the building elevations. A single door is located in the northeast elevation. A transom infilled with stucco is situated above the door. A metal spiral staircase descends into the pipe vault. Each riser bears the inscription "M.C. Meigs" (Photograph 13). The pipe vault itself is a brick barrel vault, and extends the width of the dam embankment.

Alterations. The pipe vault was a small ovular chamber prior to 1890. By 1890, the existing pipes were leaking into the dam embankment. To prevent erosion, the vault was extended the width of the embankment. During the twentieth century, electric lighting was installed within the pipe vault.

Reservoir Basin (WA61). The Georgetown Reservoir Basin was begun in 1862, usable by 1864, and completed in 1873 when the interior walls were finally lined with stone paving to prevent erosion. The Georgetown

Reservoir was originally designated the Washington Aqueduct's Distributing Reservoir. Water was transported to this reservoir from the Receiving Reservoir at Dalecarlia. Like the Receiving Reservoir, the Distribution Reservoir provided an opportunity for sediment to settle out of the water. From the Distributing Reservoir, water was sent through pipes directly into the city's distribution system. The mains to the city were turned off in August 1905. After that date, all water held within the reservoir proceeded directly to the McMillan Reservoir and Filtration Plant where it was filtered, and then sent on for public use. The Georgetown Reservoir continues to serve as a settling reservoir for the McMillan facility.

Description. The Georgetown reservoir is an artificial basin created through the construction of earthen walls on a rectangular plan. An earthen embankment divides the reservoir into northern and southern basins. The northern half is also divided.

Alterations. In 1864, the basin dividing wall was raised to the height of the outer walls; water flowed from the north basin to the south basin through a gate in the wall. During the 1940s, a cement floor was installed in the basin to allow deposited sediments to be collected with plows. Also, a series of baffle walls were constructed to improve sedimentation. These proved to be ineffective and were later removed (Ways 1993:176). A concrete wall later was added to divide the north basin.

Resource Integrity

The Washington Aqueduct system, as a whole, retains a high level of integrity to convey its period of significance. Most early American water systems of this type, such as New York's Croton Aqueduct and Boston's Cochituate Aqueduct, are no longer in service. Washington's system remains in use and, despite expansions and equipment upgrades, operates according to Meigs' original design.

Although the system has been expanded, most of the Meigs-designed buildings and structures survive in good condition with minimal alterations, and still retain their integrity. The buildings designed by Meigs, such as the gatehouse at Great Falls, the sluice tower at Dalecarlia, and the influent gatehouse at Georgetown retain their original design and materials. Some of the resources, such as the culverts and bridges, have undergone modifications. These changes, however, have not detracted from their engineering significance and the resources were not determined to lack integrity. The culverts, for example, were modified during the 1920s during the construction of a new conduit. The new conduit, which ran parallel to the original conduit, resulted in the extension of the existing culverts to accommodate the combined width of the conduits. The culvert extensions obscure the 1850s elements along the river side; however, the original stone faces are still visible on the north side. These culverts were assessed as contributing elements since the original fabric is still intact and they continue to serve their intended purpose.

The iron pipes that carry water into the city also were included in the NHL property. However, Bridges 5 and 6 designed to carry the Aqueduct's water across creek valleys were classified as non-contributing elements. Bridge 5 currently sits in earth fill and is no longer visible. Bridge 6, originally constructed of cast iron, currently is a concrete bridge faced in granite. Bridge 6 no longer retains sufficient integrity to contribute to the NHL.

The following table presents all built resources located within the defined boundaries of the Washington Aqueduct NHL property. The table is organized according to geographic location (Great Falls, Conduit Path, Dalecarlia Reservoir, and Georgetown Reservoir). Resources assessed as contributing are indicated by a "Y" in the Status column; those evaluated as noncontributing are indicated by an "N".

RESOURCE NO.	DATE	BUILDING NAME	ORIGINAL USE	STATUS
Great Falls – Maryland				
WA1**	1854-1928	Great Falls Dam		Y
GF2**	1862	Gatehouse	Gatehouse	Y
GF4*	1875	Caretaker House	Gatehouse dwelling	Y
GF5*	1956	Park Ranger Dwelling	CoE personnel qtrs.	N
GF6*	1956	Ranger Station	CoE personnel qtrs.	N
GF7	1970	Intake Structure	Intake house	N
WA2	ca. 1960	Shed	Shed	N
GF-S-3*	1941	Garage	Vehicle storage	N

Conduit Path (under MacArthur Blvd.) and other Miscellaneous Distribution Locations-Maryland/Washington, D.C.

WA3**	1853-1856	Old Conduit	Conduit	Y
WA4	1922-1928	New Conduit	Conduit	N
WA5	1856	Culvert 1	Culvert	Y
WA6	1857	Bridge 1	Bridge 1	Y
WA7	1857	Bridge 2	Bridge 2	Y
WA8	1920s	Cross Connection 1	Cross connection	N
WA9	1856	Culvert 2	Culvert	Y
WA10**	1873	Brick Vent 1	Air vent	Y
WA11	1855	Culvert 3	Culvert	Y
WA12	1855	Culvert 4	Culvert	Y
WA13	1855	Culvert 5	Culvert	Y
WA14	1855	Culvert 6	Culvert	Y
WA15	1855	Culvert 7	Culvert	Y
WA16	1855	Culvert 8	Culvert	Y
WA17	1856	Culvert 9	Culvert	Y
WA18	1856	Culvert 10	Culvert	Y
WA19	1856	Culvert 11	Culvert	Y
WA20	1922-1928	Cross Connection	Cross Connection	N
WA21	1856	Culvert 12	Culvert	Y
WA22	1856	Culvert 13	Culvert	Y

WA23**	1960s	Brick Vent 2	Air vent	N
WA24**	1858	Griffith Park Bridge	Bridge 3	Y
WA25	1920s	Griffith Park Culvert	Culvert	N
WA26	1856	Culvert 14	Culvert	Y
WA27	1856	Culvert 15	Culvert	Y
WA28	1856	Culvert 16	Culvert	Y
WA29	1856	Culvert 17	Culvert	Y
WA30**	1864	Cabin John Bridge	Bridge 4	Y
WA31	1922-1928	Cabin John Syphon	Syphon	N
WA32	1856	Culvert 18	Culvert	Y
WA33	1922-1928	Cross Connection 3	Cross connection	N
WA34	1855	Culvert 19	Culvert	Y
WA35	1855	Culvert 20	Culvert	Y
WA36	1855	Culvert 21	Culvert	Y
WA37**	1873	Brick Vent 3	Air vent	Y
WA38	1855	Culvert 22	Culvert	Y
WA39	1910/1940	Gatehouse	Blowoff tunnel gatehouse	N
WA40	1856	Culvert 23	Culvert	N
WA41	1856	Culvert 24	Culvert	N
WA42	1856	Culvert 25	Culvert	Y
WA43	1856	Waste Weir No. 3	Waste Weir	N
WA44	1858	Culvert 26	Culvert	N
WA83*	1862/1916	Rock Creek Bridge	Bridge 6	N
-------	1855-1858	Waste Weir 1	Waste Weir	Y
-------	1855-1858	Waste Weir 2	Waste Weir	Y
WA82*	1858;post 1950	Bridge 5	Bridge 5	N
-------	1859	Iron Mains	Iron Pipes	Y

Dalecarlia Reservoir- Maryland/Washington D.C.

WA47**	1854-1858	Dalecarlia Reservoir	Receiving Reservoir	Y
WA48	1893-1895,1973	Diversion Channels	Diversion Channels	N

*= Properties constructed as part of the Aqueduct, but no longer owned by the Washington Aqueduct.

**=Identified in the original 1973 NHL documentation as contributing to the NHL.

WA49	1959	Little Falls Outfall	Little Falls Outfall	N

WA50	1933	Cross-reservoir dam	Dam	N
D4	1939	Storage	Storage	N
D5	1935	Booster Control Stn.	Booster control stn.	N
WA51	1858	Sluice Tower	Sluice tower	Y
D6	1935	Booster Pump Station	Booster pump station	N
D7	1959	Intake Gatehouse	Intake gatehouse	N
D8	1939	South Screen Building	Screen building	N
DS32	1950	Storehouse	Storehouse	N
DS36	ca.1900	Garage	Unknown	N
DS37	1875	Abandoned Dwelling	Caretaker house	Y
DS42	ca. 1950	Transformer house	Transformer house	N
DS45	1954	Storage	Storage	N

Georgetown Reservoir – Washington D.C.

WA61*	1862-1873	Georgetown Reservoir	Distributing Reservoir	Y
GR1	1864-1872	Gatehouse	Influent gatehouse	Y
GR3	1901	Castle Gatehouse	Gatehouse	N
WA62	1872	Platform	Effluent gatehouse	N
GR7	1862-1864	Pipe Vault	Pipe vault access	Y
GR8	1890	Pipe Vault Well	Lighting well	N
GR9	1901	West Shaft House	West shaft house	N
4598 MacArthur Boulevard	ca. 1965	NPS Maintenance Building/ Center for Urban Ecology		N

* = Properties constructed as part of the Aqueduct, but no longer owned by the Washington Aqueduct.

** = Identified in the original 1973 documentation as contributing to the NHL.

8. STATEMENT OF SIGNIFICANCE

Certifying official has considered the significance of this property in relation to other properties:
Nationally: X Statewide:_ Locally:_

Applicable National Register Criteria:	A X B_ C X D_
Criteria Considerations (Exceptions):	A_ B_ C_ D_ E_ F_ G_
NHL Criteria:	1; 4
NHL Theme(s):	VII. Transforming the Environment 1. Manipulating the Environment and its Resources
Areas of Significance:	Community Planning and Development Engineering Health/ Medicine
Period(s) of Significance:	1853-1880
Significant Dates:	1853, 1864
Significant Person(s):	N/A
Cultural Affiliation:	N/A
Architect/Builder:	Captain Montgomery Cunningham Meigs
Historic Contexts:	V.K. Political and Military Affairs, 1783-1860: The Army and Navy XVIII.H. Technology: Construction XVIII.K. Technology: Water & Sewerage XVIII.L. Fire, Safety, Sanitation, and Pollution Controls

State Significance of Property, and Justify Criteria, Criteria Considerations, and Areas and Periods of Significance Noted Above.

Introduction

The original Washington Aqueduct system is nationally significant under NHL Criteria 1 and 4. Under Criterion 1, the system is representative of the national pattern in nineteenth-century public works construction in which public water systems were introduced as part of municipal services. The Aqueduct was designed and built by the U.S. Army Corps of Engineers and represented the District of Columbia's first water system. From 1824, with the passage of the Rivers and Harbors Act, until the Civil War, the Army Corps developed a special relationship with Congress due to its direct involvement in civil works along the nation's Navigable Water Ways and specifically the development of Washington, D.C.

The Washington Aqueduct also derives its significance under NHL Criterion 4 as an exceptionally important example of a municipal water supply. Between 1853 and 1861, noted nineteenth-century architect-engineer Montgomery C. Meigs designed and supervised the construction of the Washington Aqueduct, a twelve-mile underground masonry conduit that stretched from Great Falls, Maryland, to the District of Columbia. The period of significance for the Washington Aqueduct NHL encompasses the period from 1853 with the approval and initial construction under Meigs to 1880 through the completion of Meigs' plan for the water system. Although Meigs' direct involvement in the project lasted only until 1861 when he was appointed Quartermaster General of the U.S. Army, his plans were carried out by his successors with only minor modifications. The NHL period of significance includes those resources designed as part of Meigs' plan, but built after his departure.

Establishment of the Washington Aqueduct System 1853-1880

Initial Survey Efforts

During the eighteenth and nineteenth centuries, District of Columbia residents procured water from springs, wells, or cisterns scattered throughout the region. Plans for a District of Columbia water system were developed during the first half of the nineteenth century, and included designs by the architect Robert Mills. Unfortunately, these plans were never implemented. By the 1850s, due to rapid population growth in the city, the need for a municipal water system became apparent. The wells and springs utilized up to this point as a water source proved insufficient, especially for fire protection (Hellman 1983:5-9; Ways 1993:4).

Congress addressed the problem in 1850 with an appropriation of $500 to conduct a survey of potential municipal water sources (Hellman 1983:11;Ways 1993:4). The modest appropriation financed only a study of Rock Creek as a potential source. This initial survey was conducted by Colonel George W. Hughes of the Corps of Engineers. Hughes' report estimated that, if Rock Creek were dammed for use as Washington's primary source of water, the creek could provide an estimated eight million gallons per day, a volume considered far below that necessary to supply the rapidly growing city. Congress responded by financing a more comprehensive study of potential water sources. In 1852, Congress provided an additional $5,000 for a second survey (Ways 1993:5).

On the recommendation of General Joseph G. Totten, Chief of the U.S. Army Corps of Engineers, this second survey was conducted by Lieutenant Montgomery Cunningham Meigs (Photograph 14). Within three months, Meigs had completed his survey and submitted a 55-page report to General Totten. Unlike the first study, Meigs' report addressed the *future* water needs of the city's population and provided comparisons of the water supplies of other cities. His report also calculated the equipment and operating costs required for the aqueduct's operation (Levy and Ghioto 1973:284). He investigated three water sources -- Great Falls, Little Falls, and Rock Creek -- and described the advantages and disadvantages of each source. Meigs' report concluded that Great Falls would be the most logical choice due to its ample water supply, as well as its geographic relationship to the city. Due to its depth and scope, Meigs' report to Congress was received favorably and approved in March 1853 (Ways 1993:7-13). During that same year, Congress appropriated the funds necessary for survey right of way acquisitions and initial construction. Plans and specifications for the water system got underway immediately. As early as November 1853, ground was broken at Great Falls, Maryland for construction of the conduit (Levy and Ghioto 1973:285).

Meigs' Plan for the Washington Aqueduct

In developing his plan for the Washington Aqueduct, Meigs investigated the leading American water systems, particularly New York's Croton Aqueduct, Philadelphia's Water Works, and Boston's Cochituate Aqueduct. In November 1854, Meigs traveled to New York to inspect the Croton Aqueduct before it was put into service (Meigs 1853:36; Ways 1993:64). Meigs developed a concept similar to these systems, incorporating an underground conduit to carry the water, and a receiving reservoir and distributing reservoir to allow sediment to settle out of the water before distribution.

The design conceived and built by Meigs was a gravity-fed system beginning at Great Falls, Maryland, and extending approximately 16 miles into the city center. A 10-mile brick conduit was planned to carry the water from a dam at Great Falls to the receiving reservoir at Dalecarlia Farms. Accomplishing this feat required construction of a masonry dam halfway across the river and a control gate at Great Falls. Construction of the Receiving Reservoir (now known as Dalecarlia) was formed by an earthen dam across the Little Falls Creek, and was the first feature established at Dalecarlia (Levy and Ghioto 1973:285-286). A two-mile extension of the conduit also was constructed as part of Meigs' plan to convey water from the Receiving Reservoir to a Distributing Reservoir. The Distributing Reservoir required excavation to 12 feet and construction of a large earthen rectangular dike for storage. Cast-iron mains were incorporated to deliver the water from the Distributing Reservoir to the city (Meigs 1853: Ways 1993:15-16;U.S. Army Corps of Engineers 1953:5-8).

The 12-mile conduit, which represented the largest item to be constructed, was envisioned by Meigs to supply the city's water needs for the next 200 years. However, population increases and changes in consumption, resulted in capacity being reached in less than a third of the predicted time (Levy and Ghioto 1973:285).

Meigs' plan also incorporated a high service reservoir at High and Road Streets (now Wisconsin and R Streets) in Georgetown. This high service reservoir supplied water to the areas of Georgetown that were too high in elevation to receive water via the gravity-fed system. Water was pumped up 145 feet to this site using a hydraulic ram contained within the west abutment of the Rock Creek Bridge (Historic American Engineering Record 1992:1; Ways 1993:16).

In addition to the primary features such as the Great Falls Dam and intake works, the conduit, and the two reservoirs, numerous other structures were incorporated as part of Meigs' plan. Many of these structures were designed to ensure that the conduit maintained the proper slope throughout its 12-mile route. This included six bridges to carry the conduit across valleys; 11 brick-lined tunnels to carry the conduit through rock; and, 26 culverts to divert streams underneath the conduit.

Besides the construction of the conduit to deliver water to the city, the most notable achievement of Meigs and his engineers was the construction of six bridges to aid in the flow of the stream. Two in particular, Cabin John Bridge and Rock Creek Bridge, enjoyed the most critical acclaim at the time. Cabin John Bridge (Bridge 4) was begun in 1858, operational in 1864, and completed in 1872 as a collaborative effort between Meigs and Alfred Rives. The timber, granite, and sandstone single span structure measured 220 feet, and was the longest single span masonry arch at the time of its completion. Rock Creek Bridge (Bridge 6), constructed between 1858 and 1862, employed two 48-inch cast-iron pipes not only to transport water but also to serve as supporting arch ribs for the structure. Seneca sandstone was used in the construction of the bridge abutments. Rock Creek Bridge provided an important crossing not only for the water mains, but also for traffic between Georgetown and Washington. The bridge's 200-foot arch was an engineering marvel, and still stands as one of the longest unsupported metal pipe arches in the world (Levy and Ghioto 1973:285-286; Historic American Engineering Record 1992:1; Ways 1993:80-84). The metal pipe arches on the bridge survive although the original bridge has been encased within a replacement concrete bridge.

Other structures incorporated into Meigs' original plan included brick air vents along the conduit's path, a control gatehouse at Great Falls, a sluice tower, Taintor Gatehouse (now demolished) at the receiving reservoir, and an influent gatehouse at the inlet of the distributing reservoir (Meigs 1853). The sluice tower was operable by 1859. Most of these structures were completed after Meigs departure; however, their construction was undertaken following his original plans.

Limited development existed in the Potomac Valley at the time of the Aqueduct construction. The most significant improvement in the area was the Chesapeake and Ohio (C&O) Canal. By 1831, the canal had been completed between Georgetown and Seneca, providing an important link between the District of Columbia and western markets. Although the canal never became the intended all-water route to the Ohio River and the west, it did bring commerce to the Potomac River Valley, and provided a major economic boost to local farmers (Hiebert and MacMaster 1976:101). Canal boats transported wheat and corn meal to Georgetown, and returned with fertilizer and other supplies to county farms (Sween 1984:50). The canal not only benefited area farmers, but it also spurred the development of small commercial and industrial enterprises along the Potomac River. The quarry industry was particularly important in the area, exploiting local deposits of blue stone, limestone, red Seneca sandstone, slate, marble, and granite (Unrau 1976b:1-2; Wesler et al. 1981:169). Work on the canal ended in 1850.

The C&O Canal not only provided Meigs with initial access to Great Falls, but it also played an important role in the construction of the Aqueduct. Materials required for the various structures constructed during the Aqueduct's initial period of development included brick, sand, cement, cast iron pipe, and a myriad of valves and fittings. Typically, these items were delivered by schooner to the Washington Aqueduct Wharf at 27th Street in Georgetown, which was built specifically to receive supplies during construction of the Aqueduct. From there, the materials were transported to the project site by boats using the C&O Canal, which ran parallel to the conduit site. The canal also facilitated the delivery of building materials originating north of the site. Seneca sandstone quarried at Seneca, Maryland, nine miles north of Great Falls, was used to construct the culverts, gatehouses, and bridges (Ways 1993:32-33; Levy and Ghioto 1973:285).

Under Meigs' supervision, construction of the Aqueduct began in November 1853. Lack of funding, difficulties in obtaining land, political disputes, and the Civil War delayed the progress of construction (Ways 1993:10). Montgomery Meigs met with disfavor during Buchanan's presidency and, in September 1860, was transferred by the Secretary of War to Dry Tortugas Island to supervise the construction of Fort Jefferson. In February 1861, Meigs returned as chief engineer of the Aqueduct (Levy and Ghioto 1973:286).

Meigs' direct supervision of the Aqueduct project ended in June 1861 when President Abraham Lincoln appointed him Quartermaster General of the U.S. Army. Although this appointment marked the end of his formal involvement with the Aqueduct, Meigs remained actively interested in and committed to the project until his death in 1892. By the time of Meigs' appointment to the Quartermaster General, the only portions of the Aqueduct system that were actually in place and operational were the Receiving Reservoir, the Rock Creek Bridge, and the Georgetown High Service Reservoir. The Cabin John Bridge was under construction; work at Great Falls had just begun, and the Distributing Reservoir had yet to be built (Ways 1993:96-7). Despite Meigs' departure, work on the Aqueduct proceeded according to his plans.

Completion of Meigs' Plan for the Aqueduct

Work on the Aqueduct continued under the supervision of Chief Engineer William R. Hutton for one year following Meigs' departure. Hutton was succeeded by Chief Engineer Silas Seymour, who supervised construction from July 1863 to 1865. Under Seymour's supervision, water from the Potomac River first reached the city via the new Aqueduct in July 1864. However, many of the original components designed by Meigs did not reach completion until the 1860s and 1870s.

Construction of the conduit, which was initiated in 1853, was not completed until 1864. Work at Great Falls was initiated that same year and included construction of a dam, intake works on the Maryland shore of the Potomac River, and a gatehouse. The gatehouse was in operation by 1862; the dam was completed the following year. During the first year of the dam's operation, it suffered extensive damage from sudden water level changes during the spring and was replaced between 1864 and 1867 with a solid masonry structure.

The Distributing Reservoir constructed at Drover's Rest, on the western edge of Georgetown, was begun in 1862 and reached completion in 1873. This 36-acre reservoir served as a distribution point, and allowed for further sedimentation. Water was transported to this reservoir from the Receiving Reservoir at Dalecarlia. Water then proceeded to the city's distribution system.

Between 1864 and 1867, a by-conduit was under construction at Dalecarlia Reservoir. This by-conduit allowed Potomac River water to bypass the Receiving Reservoir during periods of turbidity. During the 1860s, a road was constructed along the conduit to provide access for maintenance crews. Originally known as Conduit Road, it was renamed MacArthur Boulevard in 1942.

Four brick air vents were constructed in 1873 along the conduit path; only two of the original vents are extant. Three caretaker houses also were constructed during this period, following Meigs' original designs. These dwellings were built between 1874 and 1875 for the gatekeepers at Great Falls, the Receiving Reservoir, and the Distributing Reservoir (Ways 1993:107). Only two of these structures survive, including the stone residence at Great Falls and the brick structure at Dalecarlia. Both represent early examples of standardized plans developed by the Army.

Subsequent Growth of the Washington Aqueduct

Improvements to the Aqueduct and Development of the McMillan Filtration Plant, 1881 – 1919

Throughout the years, the Washington Aqueduct has undergone a series of upgrades and expansions to meet the demands of Washington's increasing population. These changes ensured that the Washington Aqueduct continued to provide an adequate and high-quality water supply to its service area. The first expansion occurred during the 1880s when Congress authorized the creation of a second distributing reservoir to improve water service to the eastern areas of the city. The site chosen for this new "Washington City Reservoir," was in the northwest section of the District of Columbia, in the vicinity of Howard University. Excavation began on the new reservoir in 1885 and was completed in 1888. A four-mile tunnel, known as the Washington City Tunnel, was constructed to link the new reservoir to the existing Washington Aqueduct system via the Georgetown Reservoir. The new reservoir, later named McMillan Reservoir, went into operation when the tunnel finally was completed in 1902 (Martin 1990:24).

Another improvement undertaken during the 1880s included modification of the Great Falls Dam. In 1882, the dam was extended to the Virginia shore to increase the volume of water diverted into the Aqueduct. Three years later, funds were allocated to raise the lip of the dam by two and one-half feet; this was another improvement aimed at increasing the flow of water to the city (Ways 1993:108,119).

The next upgrade to the Washington Aqueduct was the addition of a filtration system. During the 1880s and 1890s the threat of disease, such as dysentery, cholera, and typhoid fever, mandated the need for an effective water filtration system. A study of filtration systems was initiated in 1898 by Lieutenant Colonel Alexander M. Miller, and was presented to Congress in 1900. Miller's study resulted in the decision to establish a slow sand filter plant on land adjacent to the new (McMillan) reservoir. Unlike rapid sand systems, slow sand filtration systems did not require chemical treatment. At that time, Washington's medical community did not advocate the use of chemical additives in the water system. Construction of the filtration system was initiated in 1903 according to plans prepared by engineers Allen Hazen and Edward Hardy. Following three years of construction, the filtration plant became operational in 1905 (Kanarek 151; Ways 1993:146-147,149; Miller 1900).

Expansion of the Aqueduct and Construction of the Dalecarlia Plant, 1920 - 1939

The most ambitious expansion of the Washington Aqueduct occurred in the 1920s. This was in response to the rapidly growing demand for water to keep pace with the increased population during World War I. By 1919, the maximum consumption had risen to 78 million gallons per day. To meet the increased demand, plans were developed to add a second major conduit (now referred to as the "new conduit"), to construct a second water filtration facility, and to establish new high service reservoirs. These recommendations were presented to Congress in 1921 and approved; work on the expansion plan began in 1922. These expansions to the original Aqueduct system effectively doubled the city's reserve of potable water (Kanarek 151).

The new conduit, which was constructed of concrete, ran parallel to the original conduit on the river side. The original and new conduits were interconnected at three locations so that sections could be drained for inspection or repair without closing the entire system. The new conduit alleviated fears that the water supply could be disrupted due to breakdowns in the original conduit (U.S. Army Corps of Engineers, Annual Report 1919:2027).

The new water filtration facility established at Dalecarlia consisted of a rapid sand filtration plant, which was used to remove sediment and clarify the water. This plant was intended to supplement, not replace, the original slow sand filter plant. Another reason for designing the new plant was to supply filtered water to the high areas of D.C. where pumping was necessary for water delivery. Construction at Dalecarlia included two sedimentation basins and 20 rapid sand filters; a laboratory facility; a chemical building (known as the Head House); a 15-million gallon treated water storage reservoir; and, a pump station. The pump station transported treated water to the high service reservoirs. These expansions to the system effectively doubled the city's reserves of potable water (Ways 1993:161; Kanarek 151).

Six brick dwellings also were built at Dalecarlia during the 1920s. The houses formed a row between the new filtration plant and the Potomac River, and were used to house plant employees (Ways 1993:159-161). Like the caretaker residences designed by Meigs and built during the 1870s, these dwellings are examples of the Army's standardized plans. These buildings were designed as two-story Colonial Revival style residences (Cannan 1994:441-442).

A hydroelectric generating plant was another 1920s addition to the Aqueduct system. This structure was built below the Dalecarlia facility along the C&O Canal; it was designed to generate energy to operate the treatment and pumping facilities at Dalecarlia. The plant remained in service until the late 1960s (Ways 1993:162).

In 1926, the service area of the Washington Aqueduct was expanded when Congress approved the sale of water to Arlington County, Virginia. A 24-inch water main was built from the Dalecarlia Treatment Plant across the Chain Bridge to connect with the Arlington County system (Ways 1993:163).

Three important improvements were made to the Washington Aqueduct during the 1930s. First, a booster pump station was added to the Dalecarlia Reservoir. Built in 1935, this pump station was designed to increase the rate of flow from the reservoir to the plant by raising the water level in the basin (U.S. Army Corps of Engineers, Annual Report 1935). Second, improvements were made to the pumping station at the McMillan filtration plant. In 1937, the original steam pumps were replaced with three electric pumps, which increased significantly the plant's pumping capacity. Third, a second clear water reservoir was constructed at McMillan in 1939 (U.S. Army Corps of Engineers, Annual Report 1940:2323).

Planning for the Future, 1940 - 1964

By 1940, the population serviced by the Aqueduct rose to over 720,000; by the end of World War II, the population skyrocketed to over one million. To meet the demand for water, a number of changes were made to the water system. At Dalecarlia, the hydroelectric station was converted to a raw water pump station to draw water from the C&O Canal. At the Georgetown Reservoir, a makeshift booster was installed at the outlet of the basin to increase the volume of water directed through the City Tunnel to the McMillan Reservoir. At McMillan, improvements included the installation of self-propelled sand-washing machines, which allowed the filtration sand to be cleaned in situ (Norman 1990; Ways 1993:169). Other changes at McMillan included pump upgrades and the addition of a booster pump to the East Shaft Gatehouse.

Anticipating continued growth of the city, Congress commissioned a study of future water needs for Washington. The resulting report, commonly known as "The 480 Report," was submitted to Congress in 1946, and presented a plan to meet the projected water needs of the city through the year 2000 (Ways 1993:173-174). A variety of projects were implemented as a result of this report. At Dalecarlia, new flocculation-sedimentation basins, an additional clear water reservoir, and a new pumping station were constructed. At Little Falls, a new complex was established as a supplemental raw water source that could be utilized when the water from Great Falls was insufficient to meet demand, or if one of the main conduits failed. Unlike the gravity-fed intakes at Great Falls, the intakes at Little Falls were powered by electric pumps (Ways 1993:178-84).

A significant change to the water treatment process occurred in 1952 when flouride first was added to the city's water. The medical community supported this decision, asserting that flouride was effective in preventing tooth decay in children (Ways 1993:180).

The 1960s brought another wave of construction at Dalecarlia with the addition of a new chemical building and a second filter building. The chemical building served as a storage and dispensing facility for alum, chlorine, lime, flouride, and sulfur dioxide. The new filter building added 22 rapid sand filter beds to the system (Ways 1993:185).

Contemporary Improvements to the Aqueduct, 1965 to Present

Among the improvements to the Aqueduct during its most recent development was the addition of a new intake structure at Great Falls in 1967. The structure was built along the river side of the tow path and projects over a portion of the original Great Falls dam. This single facility was built to replace earlier intake structures, house the intakes, bar racks, screens, sluice gates, and control devices for both old and new conduits.

During the 1980s, a new chemical and filter building was constructed at the McMillan Reservoir. The new facility, built on the site of three original filter beds, contained 12 rapid sand filter beds, chemical treatment equipment, a chemical storage area, pumps, and control equipment (Ways 1993:190-191). When the new facility went into operation in 1986, all of the original slow sand filter beds were abandoned. In 1987, the Army Corps of Engineers transferred to the District of Columbia all of the land on the McMillan site that lies east of First Street, NW.

Thematic Context: Development of Public Water Supply Systems in the United States

The development of public water supply systems in America began as early as the seventeenth century. The first water system constructed in the 13 English colonies was established in Boston in 1652. The collected water was intended for fire fighting and the suppression of road dust, rather than public consumption (LaNier 1976:174).

The first system to deliver water to individual houses was established in 1752 in Bethlehem, Pennsylvania. A pump drew water from a nearby creek and delivered it to a water tower erected on the crest of a hill. From the tower, the water was fed to several distribution tanks. Wooden pipes extended from the distribution tanks to individual homes. The wooden pipes leaked profusely, and experiments were made with other materials. In 1813, Bethlehem, PA, was the first city in the United States to utilize cast iron distribution pipes. The system attracted interest throughout the colonies. Representatives from other colonies visited Bethlehem to inspect the system and its operation (Schodek 1987:196-197).

By 1800, 16 communities in the United States possessed water supply systems; most of the systems were intended for fire protection and the suppressing road dust. These systems generally were owned privately and served small communities (LaNier 1976:174).

The first major American cities to establish a public water distribution system were New York (1800) and Philadelphia (1801). New York's system was privately owned and operated. Philadelphia's system was municipally owned and operated. New York's waterworks became a source of municipal frustration, while the Philadelphia waterworks became a model system.

New York began construction of a waterworks system as early as 1771. Construction, however, was halted during the American Revolution, and military activity destroyed portions completed before the war. Interest in constructing the system was renewed following the war as the city's population grew and potable water supplies were taxed. Several companies competed for a contract to construct and operate the projected system. The Manhattan Company, headed by Aaron Burr, won the right to supply New York City with water. Burr, who was more interested in using the Manhattan Company as a vehicle for other investments, showed a general lack of interest in the project, which was reflected in the company's service (Schodeck 1987:203-204).

Several designs were considered by the Manhattan Company. The company chose a design that required minimal investment in infrastructure. Water was drawn from the city's Collect Pond, despite accurate predictions that the pond water would become polluted as the city's population increased. The Collect Pond water was pumped to a reservoir in the upper reaches of the city and gravity flow propelled the water through the system's wooden pipes (Schodeck 1987:204).

The inattentive attitude of the Manhattan Company was apparent from the outset. The New York legislature allowed the company to avoid repairing the streets excavated for water pipes. Trenches scarred the avenues with water service. The open trenches were an unintended benefit to the people of New York. Because revenues were lower than anticipated, the Manhattan Company delayed installing of the system's fire hydrants. The unpaved pipe trenches allowed the city's residents to access the distribution mains whenever they needed. Within 20 years of the system's establishment, the city was forced to investigate other alternatives.

In contrast to the New York system, Philadelphia waterworks were established not to supplement a flagging water supply, but to improve public health. During the 1790s, Philadelphia was plagued by a series of epidemics. Street cleanliness was thought to be the best prevention for disease. Philadelphians agreed that a water system was needed to flush the streets, and that the city should operate and maintain the system. Disputes arose over the appropriate water source. A significant portion of the population thought the city's cemeteries and privies were contaminating the local water supply, and that streets washed with contaminated water were little or no improvement. As a result, the city's new system drew water from the Schuylkill River, which had little development along its shores. In 1801, the Philadelphia Water Works began operations (Schodek 1987:198-201).

The system was hailed for the quantity and purity of its water. By 1814, the original system could not provide volumes sufficient for the city's increasing needs and a new waterworks was established on the banks of the Schuylkill below Fairmount Hill. Steam driven pumps delivered water to a reservoir on Fairmont Hill, from which the water flowed by gravity through brick conduits into the city (Schodek 1987:198-201).

In 1829, engineer Albert Stein introduced a concept that later became standard in American waterworks for the remainder of the century: the settling basin. Stein constructed a settling basin as part of the Lynchburg, Virginia, waterworks. The settling basin allowed sediment to settle from river water prior to distribution. Philadelphia's water system remained the nation's premier system until the 1840s, when New York constructed the Croton Aqueduct, which linked New York City with the Croton River, 41 miles to the north. Major David Douglass was the first engineer hired to construct the aqueduct. However, after making little progress over a three-year period, Douglass was replaced by engineer John B. Jervis in 1836. The gravity-fed system consisted of a dam built across the Croton River to impound water, and a 40-mile brick-lined conduit to carry water to New York City. The conduit measured eight-and-one-half feet tall and seven-and-one-half feet wide, and was supported by a concrete foundation. An earthen berm was placed over the conduit to protect it from freeze-thaw damage during spring and fall. Sixteen tunnels, 114 culverts, 33 ventilator shafts, six waste weirs, and two bridges were constructed as part of Croton's aqueduct system. The ventilator shafts were constructed to maintain steady air pressure within the conduit, as well as to allow the water to remain "fresh." The conduit emptied into a settling, or "receiving," reservoir. From the receiving reservoir, water flowed through iron pipes to the Murray Hill Distribution Reservoir, and then proceeded into the city. The Croton Aqueduct began service in 1842 (Lange 1991; Schodek 1987:206).

The Croton Aqueduct was hailed as an engineering marvel and served as a model for later large-scale aqueducts throughout the United States. By 1850, 85 U.S. communities possessed water systems (LaNier 1976:174). The largest cities with waterworks were Boston, Chicago, New York, Cincinnati, Philadelphia, Pittsburgh, Richmond, and St. Louis (Lange 1991:17). Between 1850 and 1860, 55 new systems were established (Turneaure and Russell 1924:9). Large municipalities that established waterworks during this period included Washington, D.C.; Brooklyn and Buffalo, New York; and, Cleveland, Ohio (Lange 1991:17). The Croton Aqueduct was designated a National Historic Landmark (NHL) in 1992.

Boston's Cochituate Aqueduct was another important mid-nineteenth-century municipal water system. This gravity-fed system was started in 1846 and modeled upon the Croton Aqueduct. Lake waters were channeled into an egg-shaped brick conduit and emptied into settling and distributing reservoirs. Noted engineer Loammi Baldwin designed the system. Water first coursed through the system in 1848. The aqueduct carries water eastward from Lake Cochituate in Wayland, Massachusetts, to Boston via a 14.5-mile long enclosed conduit. In Boston, the water first entered a receiving reservoir in Brookline. After 1870, water flowed from the receiving reservoir to a distributing reservoir at Chestnut Hill, in the Brighton section of Boston. The Cochituate Aqueduct was removed from service in 1940 and listed in the National Register in 1990 (Jenkins et al. 1989).

The Chicago waterworks system was established in 1852; however, significant components of the system were not completed until 1864. The Chicago system originally drew water from Lake Michigan near the mouth of the Chicago River. Between 1852 and 1864, pollution discharged into the Chicago River affected the water quality in the city system. E.S. Chesbrough, who helped construct the Cochituate Aqueduct, solved Chicago's problem by moving the system's intake facility two miles out into Lake Michigan. A brick conduit connected the intake area with the existing system, and was constructed beneath the lake bed. The new intake facility was opened in 1866. Subsequent expansions of the Chicago water system have followed Chesbrough's example. The system's Chicago Avenue Water Tower and Pumping Station were listed in the National Register in 1975 (Kehoe and Hern 1975).

The Civil War interrupted public works construction throughout the nation as civil engineers joined both armies, and the pool of skilled labor dwindled. By the end of the war, much of the south's infrastructure suffered extensive damage. While the south slowly recovered, infrastructure development in the north resumed at a frantic pace.

A sharp increase in the establishment of water distribution systems occurred after the Civil War. Between 1752 and 1865, 162 water systems had been established throughout the United States. During the 15 years following the Civil War, an additional 436 systems were established. Much of the increase can be attributed to technological improvements, advancements in engineering theory, and increased medical knowledge. Technical improvements during the mid-nineteenth century included the perfection of the cast-iron piping and Henry Worthington's improved pump designs. These improvements lowered the construction costs of water distribution systems (Turneaure and Russell 1924:9).

As access to water supplies became more convenient, communities experienced a rise in the volume of waste water. The increase in waste water led to engineering advances in the design of waste water disposal systems.

The most common disposal method adopted by large cities was open gutters along the sides or in the center of paved roads. These early drainage systems were overtaxed by the volume of waste water in cities that had waterworks. The nation's first comprehensive municipal drainage system was established in 1857 in Brooklyn, New York. By 1880, the first self-contained sewer systems were constructed in Memphis, Tennessee, and Pullman, Illinois (Schodek 1987:233; Armstrong 1976:402)

The importance of waterworks and waste water disposal systems was supported by improved medical knowledge during this period. In 1854, Englishman John Snow proved that cholera was transmitted through polluted water (Schodek 1987:233-234). In 1857, Louis Pasteur developed the germ theory of disease transmission. U.S. Army surgeons conducted experiments during the Civil War that validated Pasteur's theory (Wetterau 1990:372).

After 1880, water systems became an essential part of the community infrastructure. Between 1880 and 1896, 2,774 new water distribution systems were established. By the turn of the century, most communities with more than 2,000 residents possessed water collection and distribution systems (Turneaure and Russell 1924:9).

Towards the last quarter of the nineteenth century, water systems began to incorporate filtration. Between 1871 and 1875, the cities of Poughkeepsie and Hudson, New York, and Toledo, Ohio, established waterworks incorporating sand filtration systems (U.S. Army Corps of Engineers, Annual Report 1880). Sand filters originally were developed to remove turbidity from river water. That the filtration process also removed disease-causing bacteria was an incidental benefit. During the late 1870s and early 1880s, efforts were underway to refine a method of rapid sand filtration. Rapid filtration was used by paper mills to remove sediment from the water needed for processing. Rapid sand filtration used coarse sand filters to strain suspended solids from the water. The first modern, large-scale rapid filtration plant was constructed at Little Falls, New Jersey (Grandine and Cannan 1995:193; LaNier 1976:179).

During the late 1880s, the use of chlorine, ozone, and iodine water-disinfection systems was under investigation. The Philadelphia Water Works installed the first permanent chlorination machinery in 1913 (LaNier 1976:180). Since that time, chlorination has been the most common method of water treatment.

Montgomery C. Meigs

The Washington Aqueduct system also was designed by the noted architect-engineer Montgomery C. Meigs. The Washington Aqueduct was one of Meigs' earliest large-scale urban public works projects. Meigs was born in Georgia in 1816 and raised in Philadelphia. In 1832, he entered the U.S. Military Academy, the only engineering school in the country at the time. Meigs graduated from the Academy fifth in his class in 1836. During the following year, Meigs' began his involvement with the Corps of Engineers. Among his first projects were improvements to the Mississippi River navigation and the Port of St. Louis. In 1851, Meigs was appointed assistant to Chief of Engineers, General Totten. Totten recommended that Meigs undertake the water supply study authorized by Congress in 1852 (Ways 1993:6)

Meigs was a highly influential architect and engineer, particularly in the District of Columbia. In addition to the Washington Aqueduct, he was involved in the expansion of the U.S. Capitol between 1853 and 1859 (while supervising the Aqueduct), and the design and construction of the Pension building (now the National Building Museum) in 1881. Meigs died on 2 January 1892, and was buried in Arlington National Cemetary (Ways 1993:120).

The structures designed by Meigs for the Aqueduct illustrate the importance of architectural design in nineteenth-century engineering products. As Professor H.E. Babbitt explained in a 1962 textbook of waterworks, the physical appeal of waterworks historically has been an important factor in design. Babbitt noted that, in order to gain public confidence, the buildings relating to a water system should be:

> ... of pleasing design and should be surrounded by attractive grounds. The public not acquainted with the technicalities of water [supply and] treatment, is likely to judge the quality of the water as much from the appearance of the plant, both inside and out, as from the appearance and taste of the water (Babbitt 1962:469).

Meigs' buildings and bridges were meticulously designed and constructed. The above-ground resources constructed as part of the original system illustrate period architectural styles. The resources built between 1853 and 1880 typically were designed in the Classical Revival style, as illustrated by the Influent Gatehouse (GR1) at the Georgetown Reservoir and the Sluice Tower (WA51) at the Dalecarlia Reservoir. Structures built during the 1870s represent other period styles. The brick air vents along MacArthur Boulevard were designed in the Italianate style, while the caretaker dwellings at Great Falls and Dalecarlia were designed in the Second Empire style. The bridges and culverts also demonstrate the level of design attention given to the utilitarian span bridge with a span of 220-feet, was the longest single span masonry bridge in the world for nearly 40 years. The bridge was listed in the National Register of Historic Places in 1973. The longevity of the system, both in terms of its design as well as its operation, attests to Meigs' skill and careful attention to detail in the planning of the Washington Aqueduct.

Significance of the Washington Aqueduct

The Washington Aqueduct is nationally significant as a representation of a highly important period of development in American waterworks and of the U.S. Army Corps of Engineers' involvement in the field of public works (Criterion 1). The Washington Aqueduct also is an exceptionally important example of a municipal water supply (Criterion 4). It was designed by the noted nineteenth-century architect-engineer Montgomery C. Meigs.

The Washington Aqueduct's exceptional integrity and active operation provide a rare example of a nineteenth-century municipal water supply system. Although the Washington Aqueduct has been expanded to meet the demands of Washington's increasing population, the original system remains largely intact and operational. Other early-nineteenth century systems, such as New York's Croton Aqueduct and Boston's Cochituate Aqueduct, are not fully intact and are no longer in service. The Washington Aqueduct illustrates not only the technology of early gravity-fed water systems, but also the effect of waterworks on the physical development of cities. The financial commitment, as well as the meticulous planning and engineering necessary to provide an ample supply of water to the District of Columbia, represent an important development in nineteenth-century urban planning and development: substantial public works projects. By the turn-of-the-century, the provision of water had become an essential element of every American city.

In addition, the Washington Aqueduct also is nationally significant as a unique example of a major urban public works effort undertaken by the U.S. Army Corps of Engineers. During the early-nineteenth century, the U.S. Army Corps of Engineers was among the few Federal organizations with a staff of professional engineers. Between the passage of the Rivers and Harbors Act in 1824 and the Civil War, the Corps of Engineers was increasingly involved in civil works projects. The Washington Aqueduct exemplifies the military execution of a civil sector project in the antebellum period, and established a pattern that continued after the Civil War.

On a regional level, the Washington Aqueduct is significant for its contributions to the physical development of the District of Columbia. The patterns of residential development throughout the city were influenced by the Aqueduct. In addition to water, the Aqueduct provided access to previously inaccessible areas through the construction of bridges and roads. For instance, Conduit Road, the maintenance road for the conduit, quickly became a well-traveled route into the city. Towards the end of the nineteenth century, residential development gradually increased along Conduit Road. The area includes the D.C. neighborhood of Potomac Palisades, and the Maryland suburbs of Glen Echo, Idlewood, Brookmont, and Cabin John. Bridges, such as the Cabin John Bridge (Bridge 4), allowed traffic to cross otherwise impassable valleys. Similarly, the construction of Rock Creek Bridge (Bridge 6), originally developed to carry water mains over Rock Creek into the city, instituted an important traffic route between Georgetown and downtown Washington.

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__ Preliminary Determination of Individual Listing (36 CFR 67) has been requested.
X Previously Listed in the National Register.
__ Previously Determined Eligible by the National Register.
X Designated a National Historic Landmark.
__ Recorded by Historic American Buildings Survey: #
X Recorded by Historic American Engineering Record: # MD-47

Primary Location of Additional Data:

__ State Historic Preservation Office
__ Other State Agency
__ Federal Agency
__ Local Government
__ University
X Other (Specify Repository): Washington Aqueduct, Dalecarlia Reservoir

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10. GEOGRAPHICAL DATA

Acreage of Property: approximately 391 acres

UTM References: UTM References (Place additional UTM references on a Continuation sheet)

	Zone	Easting	Northing		Zone	Easting	Northing
1)	18	304760	4319760	19)	18	316580	4312600
2)	18	305340	4319240	20)	18	316860	4312850
3)	18	305480	4319120	21)	18	317680	4312680
4)	18	305440	4318940	22)	18	317380	4311600
5)	18	305220	4319080	23)	18	317300	4311720
6)	18	305720	4317740	24)	18	316920	4311760
7)	18	306200	4317300	25)	18	316940	4311540
8)	18	308220	4316500	26)	18	317320	4311000
9)	18	309620	4316440	27)	18	317340	4310880
10)	18	311070	4316160	28)	18	318060	4309900
11)	18	311300	4316100	29)	18	318060	4309560
12)	18	311640	4315960	30)	18	318200	4309460
13)	18	312340	4315960	31)	18	318420	4309260
14)	18	312480	4316040	32)	18	318820	4308720
15)	18	313260	4315820	33)	18	318740	4308520
16)	18	314060	4315740	34)	18	318200	4309100
17)	18	314680	4315220	35)	18	319670	4308170
18)	18	316140	4312680	36)	18	321500	4308040
				37)	18	321710	4307980

Verbal Boundary Description:

This verbal boundary description replaces the one presented in the 1973 NHL documentation.

The portion of the Washington Aqueduct being nominated for National Historic Landmark (NHL) designation is located in the jurisdictions of Fairfax County, VA; Montgomery Co., MD; and, Washington, D.C. The majority of the Aqueduct system consists of an underground resource. Most of the resource extends below MacArthur Boulevard; MacArthur Boulevard itself is not within the NHL boundary. This property begins in Fairfax County, VA, crosses into Maryland at Great Falls, then continues until it reaches the eastern edge of Bridge 6. The Aqueduct property included in the NHL boundaries is 60 feet in width throughout most of its length, but widens at three locations: Great Falls, Dalecarlia Reservoir, and the Georgetown Reservoir. These three areas contain the majority of the above-ground structures associated with the construction of the original Aqueduct system and included as part of the NHL. Portions of the Washington Aqueduct property excluded from the NHL boundaries include the Little Falls pumping facility and the Dalecarlia property west of MacArthur Boulevard; both properties were developed during the twentieth century and are not associated with the district's period of significance. The following paragraphs discuss in greater detail the areas where the system widens beyond 60 feet, which contain the majority of the above-ground resources included in the NHL designation.

Great Falls (Maryland)

Great Falls, which marks the beginning of the Aqueduct system, occupies five acres and consists of a masonry dam, intake structure, and gatehouse. The westernmost part of the dam is situated on the south shore of the Potomac River in Fairfax County, VA. The dam crosses to the north shore at the intake facility. At this point, the boundary turns north along the Potomac River, then east, then south following the Aqueduct property boundary. This boundary encompasses eight built resources associated with the Meigs-era construction of the Aqueduct. The boundary then proceeds south, following the path of the old conduit to encompass the underground resource. From Great Falls, the Aqueduct (occupying land approximately 60 feet wide) heads in a south-southeasterly direction through a wooded area for one and three-quarter miles until it reaches the intersection of MacArthur Boulevard. From this point, the Aqueduct runs in a southeasterly direction below MacArthur Boulevard for eight miles, until it reaches the Dalecarlia Reservoir. During this eight-mile stretch, the conduits cross two bridge structures, Bridges 3 (Griffith Park Bridge) and 4 (Cabin John Bridge).

Dalecarlia Reservoir (D.C.)

At the Dalecarlia facility, the Aqueduct discharges into the forebay, located in the northwestern neck of the Dalecarlia Reservoir. The boundary extends to the east, following the Washington Aqueduct property line to the western edge of the Dalecarlia Parkway. The NHL boundary then follows the western edge of the Dalecarlia Parkway southward to a point just north of the Parkway's intersection with Little Falls Road. From that point, the boundary follows the Aqueduct's property line northwest, and then west, along the north side of Little Falls Road. At the intersection of Little Falls Road and MacArthur Boulevard, the Aqueduct resumes its course heading in a southeasterly direction below MacArthur Boulevard.

Georgetown Reservoir (D.C.)

At the Georgetown Reservoir, the boundaries remain identical to the 1973 NHL boundary. The Aqueduct enters the reservoir in the northwestern corner of the basin. The boundary follows the north side of the reservoir, then turns south until it reaches Elliot Place. The boundary turns northeast until it reaches MacArthur Boulevard. The west edge of MacArthur Boulevard serves as the boundary on the east. The boundaries encompass all 65 acres of Washington Aqueduct property comprising the Georgetown Reservoir, as well as approximately 10 acres of property owned by the National Park Service. The NPS property at the Georgetown Reservoir was included in the original nomination by mistake. The building at 4598 MacArthur Boulevard is non-contributing to the NHL. The boundary then continues underground approximately two miles to the eastern edge of Bridge 6. This section of the NHL includes only the underground iron pipes and Bridges 5 and 6, and no other resources.

Boundary Justification:

The boundaries of the NHL property encompass all extant elements of the original Washington Aqueduct system designed by Montgomery Meigs. Although the system has evolved and expanded over time, most of the original elements survive intact and are operational. The NHL boundaries described in the previous section include both above-ground and underground resources that were built in association with the original system but that are no longer owned or operated by the Washington Aqueduct. Due to the original layout of the system, the property boundaries also encompass subsequent additions to the Aqueduct system, such as the new conduit and the new intake facility at Great Falls. These resources, however, were not included as contributing elements within the NHL district.

The NHL boundary remains the same as in the 1973 documentation except with additional property at Great Falls, Dalecarlia Reservoir, and the iron water mains that continue to the south side of Bridge 6. At Great Falls, the original 1973 NHL boundary has been expanded to incorporate built resources associated with the Aqueduct's period of significance. At Dalecarlia Reservoir, the NHL boundary has been expanded to follow historic Washington Aqueduct property lines associated with the Aqueduct's period of significance. The 1973 NHL boundaries at the Georgetown Reservoir have been retained without change. The boundary east of Georgetown Reservoir comprises only Bridges 5 and 6 and the underground water mains, but no other resources.

Although some areas within these expanded NHL boundaries contain no built resources, they were included within the original property boundary because they represented buffer areas once needed to maintain the security and integrity of the Aqueduct, and to prevent encroachment on the facility from development. One original buffer area originally part of the Aqueduct's property but not included in the earlier NHL designation is a nine-acre piece of land located along the south side of Little Falls Road. This parcel is excluded from the revised NHL boundary because it has never contained any above or below ground resources associated with the Aqueduct's period of significance, and because it has been extensively modified by modern development by its current owner, Sibley Hospital.

The Little Falls pumping facility and the Dalecarlia property west of MacArthur Boulevard were excluded from the 1973 and the current NHL boundaries. Little Falls pumping station was built in 1959 to supplement the Great Falls intake facility; its later construction date falls outside of the district's period of significance (1853 - 1880) and, therefore, was not included within the district boundaries. A water filtration plant occupies the western portion of the Dalecarlia property; the ca. 1920s plant was not associated with the Meigs-era construction and, therefore, was not included in the NHL district boundaries.

11. FORM PREPARED BY

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Address: 241 East Fourth Street, Suite 100
Frederick, Md. 21701

Date: August 2001

Telephone: (301) 694-0428

NATIONAL HISTORIC LANDMARKS SURVEY
December 5, 2001

480 000 FEET (VA)

Washington Aqueduct

18) 18 316140 4312600
19) 18 316590 4312600
[illegible] 4312350
21) 18 [illegible] 4311600
22) 18 317380 4311600
23) 18 317300 4311720
24) 18 316920 4311760
25) 18 316940 4311540
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28) 18 318060 4309900
29) 18 318060 4309500
30) 18 [illegible] [illegible]4460
31) 18 318420 4309260
32) 18 318820 4309720
[illegible] 18 [illegible]740 [illegible]520
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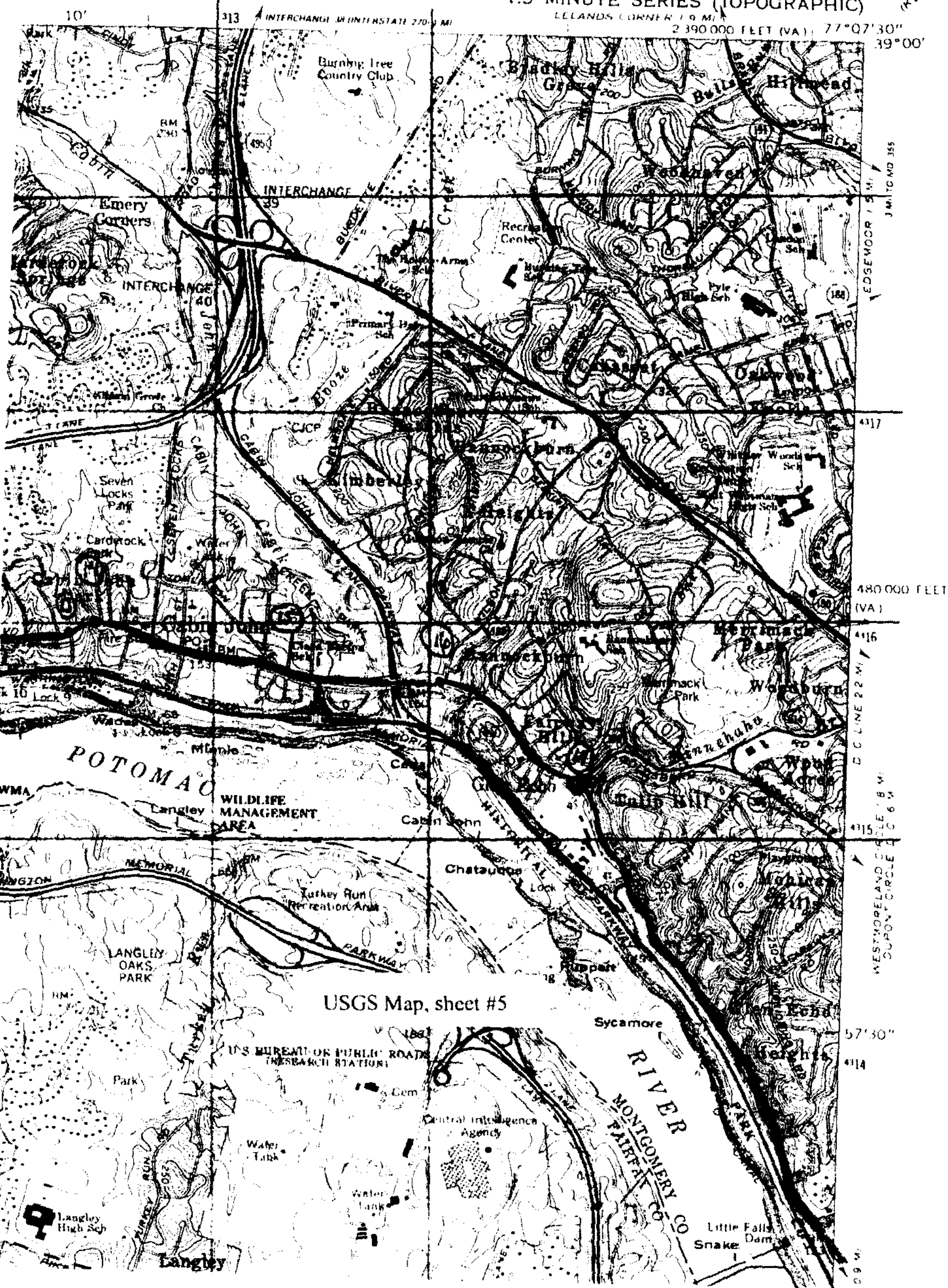
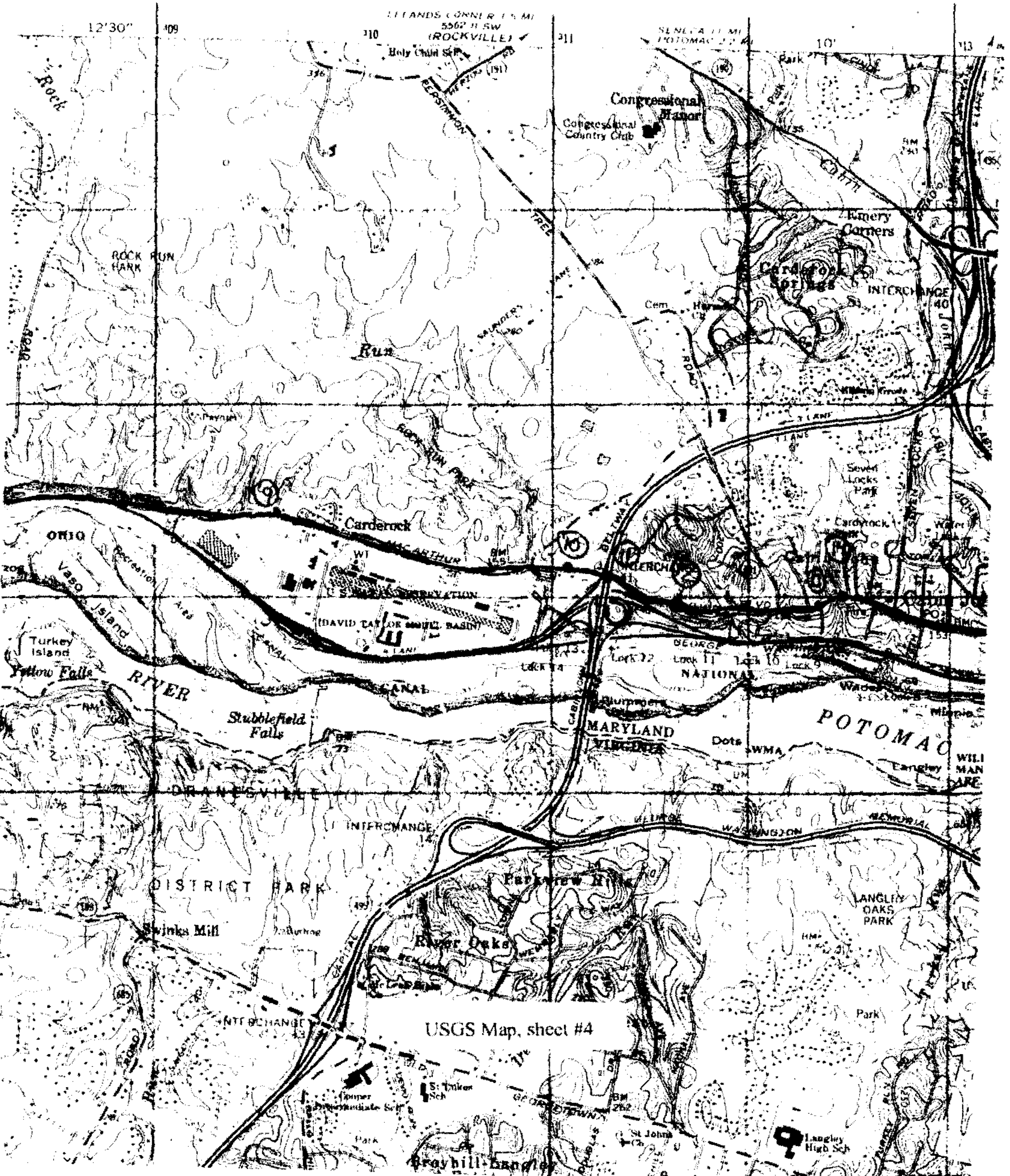
35) 18 319670 4308170
[illegible] 18 321500 4308440
[illegible]

USGS Map, sheet #7
The Palisades
Georgetown Reservoir
Glover-Archbold
Glover Park
U S NAVAL OBSERVATORY
Washington Cathedral
Woodley Park
Kalorama Circle
Mount Vernon Jr College and Seminary
Whitehaven Parkway
Dumbarton Oaks Park
Burleith
Foxhall Village
GEORGETOWN UNIVERSITY
Hospital
Georgetown
Oak Hill Cem
Sheridan Circle
POTOMAC
DISTRICT OF COLUMBIA
ARLINGTON CO VIRGINIA
Three Sisters
Riverwood
Spring Hill
Fort C F Smith
Woodmont
Highlands
Rosslyn
Theodore Roosevelt Memorial
Theodore Roosevelt Island
Little River
Kennedy Center
Washington Circle
Geo Washington Univ Hospital
GEORGE WASHINGTON UNIVERSITY
Colonial Village
Lyon Village
Fort Myer Heights
Courthouse
Clarendon
Lyon Park
WEST POTOMAC PARK
U S MILITARY RES
FORT MYER
Arlington House The Robert E Lee Memorial
ARLINGTON NATIONAL CEMETERY
Tomb of the Unknowns
Amphitheater
Columbia Island
RIVER
Columbia Gardens Cem
MEMORIAL BRIDGE
THEO ROOSEVELT BRIDGE
KEY BRIDGE
NATIONAL OCEAN SERVICE
HYDROGRAPHIC SURVEY INDEX
SCALE 1:24 000
(ALEXANDRIA)
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

FALLS CHURCH QUADRANGLE
VIRGINIA – MARYLAND
7.5 MINUTE SERIES (TOPOGRAPHIC)



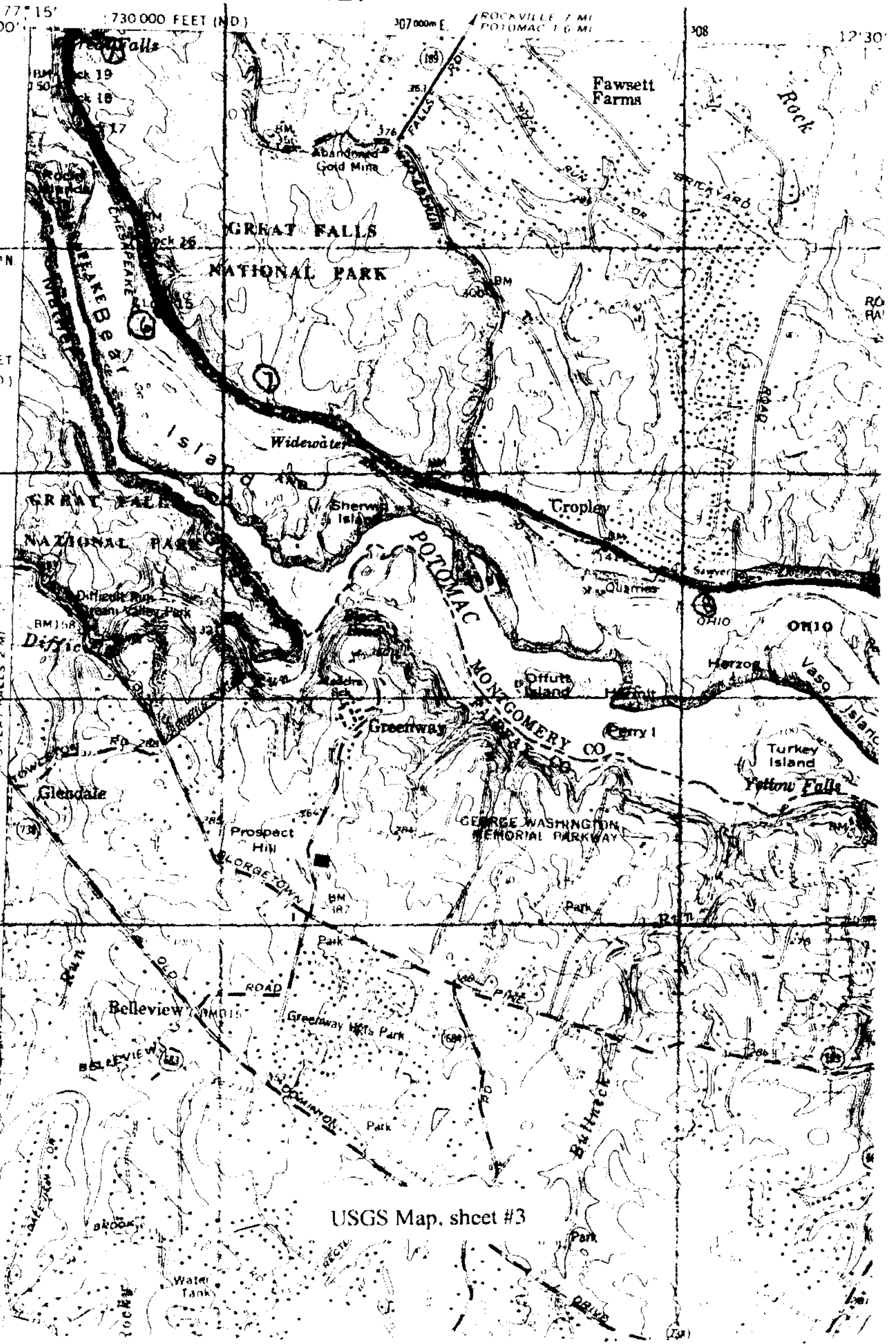
USGS Map, sheet #5



USGS Map, sheet #4

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

5562 III SE (SENECA)



USGS Map, sheet #3

Washington
Aqueduct
Maryland, D.C.

(5) 18 305440 4318945
(6) 305720 43
(7) 18
(8)
(9) 18
(10)
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(12) 18 311540 43159
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(14)
(15)
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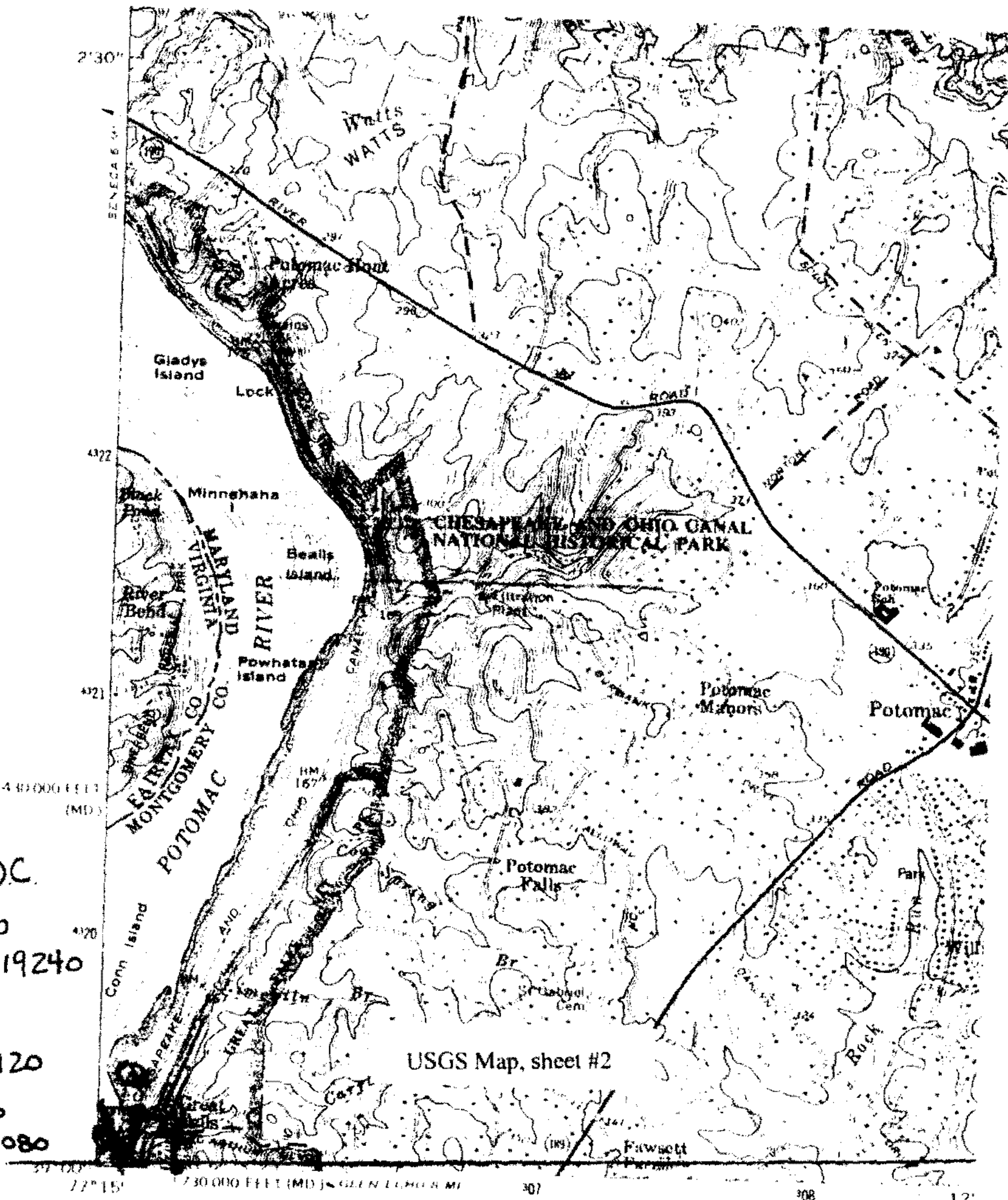


Washington Aqueduct
Maryland, D.C.

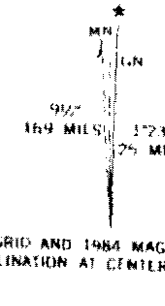
(2) = 18 305340
4319240

(3) 18 305480
4319120

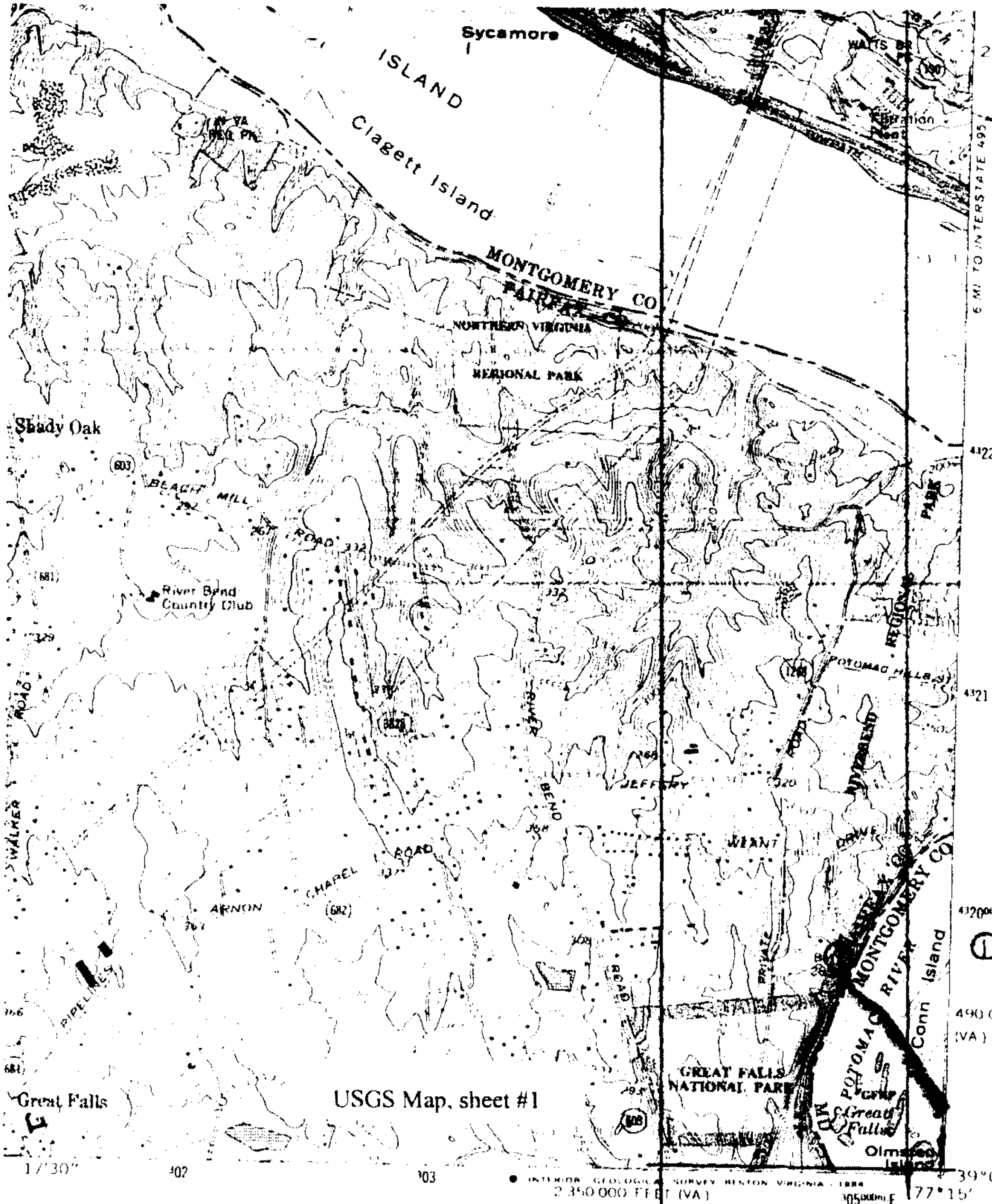
(5) 18 305220
4319080

VIENNA
5561 IV NE

Mapped, edited, and published by the Geological Survey
Control by USGS, NOS/NOAA, NCPS and WSSC
Topography by photogrammetric methods from aerial photographs taken 1955. Field checked 1956. Revised 1965
Polyconic projection. 10,000-foot grid ticks based on Maryland coordinate system, and Virginia coordinate system, north zone
1000-meter Universal Transverse Mercator grid ticks, zone 18, shown in blue
1927 North American Datum
To place on the predicted North American Datum 1983 move the projection lines 8 meters south and 26 meters west as shown by dashed corner ticks
Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked
Red tint indicates areas in which only landmark buildings are shown
Areas covered by dashed light-blue pattern are subject to controlled inundation
There may be private inholdings within the boundaries of the National or State reservations shown on this map



UTM GRID AND 1984 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET



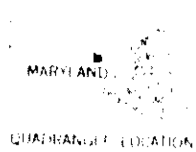
Washington Aqueduct
Maryland, D.C.

① = 18 304760
4319760

ROAD CLASSIFICATION

Primary highway, all weather, hard surface	Light-duty road, all weather, improved surface
Secondary highway, all weather, hard surface	Unimproved road, fair or dry weather

( ) State Route



Revisions shown in purple and woodland compiled in cooperation with Commonwealth of Virginia agencies from aerial photographs taken 1980 and other sources. This information not field checked. Map edited 1984

SENECA, MD. – VA.
39077-A3-TF-024

1968
PHOTOREVISED 1984
DMA 5562 III SE SERIES V833