2.0 FLOOD HISTORY, PREVIOUS STUDIES, AND FLOOD RISK

2.1 FLOOD HISTORY IN HUNTINGTON

Flooding has been a concern in the Huntington area for decades. As early as 1966, the Fairfax County Board of Supervisors adopted an ordinance for a regulated 100-year floodplain for Cameron Run. Previous studies and historical information confirm that the most significant type of flood event that would affect Huntington is riverine flooding from Cameron Run. Although the area is susceptible to storm surges from the Potomac River resulting from tropical systems, such as Hurricane Isabel in 2003, flood levels tend to reach higher elevations during riverine events. However, there were some complaints of houses flooding during Hurricane Isabel, but the number is unknown. During Hurricane Isabel, 2 to 3 inches of rainfall fell in the area, and riverine flows along Cameron Run were minimal. In contrast, past riverine events along Cameron Run have produced much higher flood levels in Huntington.

The majority of the residential structures in Huntington were built in the late 1940s and early 1950's. Since that time, and prior to the June 2006 flood event, there have been two significant storm events that have created the potential for riverine flooding in Huntington: Tropical Storms (or remnants thereof) Agnes (1972) and Eloise (1975).

Tropical Storm Agnes

For many years, Tropical Storm Agnes has been the storm of record in the Cameron Run watershed, as well as other watersheds in the mid-Atlantic and Northeast regions of the United States. Tropical Storm Agnes occurred between June 20 and June 25, 1972. Flood damages were recorded throughout the central part of Virginia, but were particularly heavy in the northern part, where Fairfax County reported damages estimated at $25 million (1972 dollars). In the Four Mile Run watershed, damage was estimated at $14 million (United States Geological Survey (USGS), 1975); however, no exact record of the amount of damages in the Cameron Run watershed could be found.

A rainfall gage at Washington National Airport recorded a total of 8.24 inches of rainfall over that 5-day period, with the heaviest rainfall occurring between June 21 and June 22, 1972. During that period, rainfall intensities of just over 1 inch per hour were recorded. This rainfall created a record flow of 19,900 cubic feet per second (cfs) at a USGS stream flow gage (01653000) along Cameron Run (see Figure 1.4).

This flow created flooding in Huntington, but the extent and cause is not well documented. No records of homes damaged during this event are on record with Fairfax County, the Federeal Emergency Management Agency (FEMA), the Corps, or any other entity. In a letter from a homeowner to the Fairfax County government, it is stated that "*Every home in the immediate neighborhood was flooded. Yards and streets were flooded and some homes received structural damage to their basements. One thing that did not become apparent until after the storm was the fact that not one of the homes was flooded by surface water. All flooding incidents were caused by either raw sewage backing into the basements or structural damage caused by severe water*

pressure upon the basements." A subsequent study showed that the sanitary sewer system was adequate; however, flood waters can still enter the sanitary sewer system through manholes and back up into the houses, causing flooding.

It is evident that Tropical Storm Agnes caused damages to Huntington, but the extent of flooding via overland flood flow is not apparent. It appears that the flood levels during Tropical Storm Agnes were lower than the June 2006 flood levels; however, peak flows of 19,900 cfs were recorded at the USGS stream flow gage during Tropical Storm Agnes, and the June 2006 flood event produced peak flows of 16,500 cfs at the same gage.

Tropical Storm Eloise

Rainfall associated with Tropical Storm Eloise occurred in the mid-Atlantic region between September 23 and September 27, 1975. The most significant damages resulting from Tropical Storm Eloise occurred on the tributaries to the Potomac River in and around Washington, D.C. (USACE, 1976), where nearly 400 people were evacuated along Four Mile Run. Rainfall totals of between 8 and 9 inches fell near the Cameron Run watershed. The USGS stream flow gage along Cameron Run recorded a peak flow of 14,400 cfs during the event, the third largest to date behind Tropical Storm Agnes (19,900 cfs) and the June 2006 flood event (16,500 cfs).

As with Tropical Storm Agnes, there is a lack of documentation of the extent of flooding in Huntington. Internal Fairfax County memos indicate that the County as a whole was hit hard by Tropical Storm Eloise, including: damage along Pike Branch; sanitary sewer line problems near Telegraph Road; outfall issues resulting in the flooding of five homes near Kathmoor Street; and storm sewer issues that resulted in homes flooding along Thornwood Drive.

Articles in local newspapers and letters from homeowners to the County verify that flooding was an issue in Huntington during Tropical Storm Eloise, especially in basements, although interviews with residents of Huntington did not confirm this. However, as with Tropical Storm Agnes, it is not apparent that the flooding of these homes was directly from overland flow from Cameron Run, or if it may have been from backed up sanitary sewer lines.

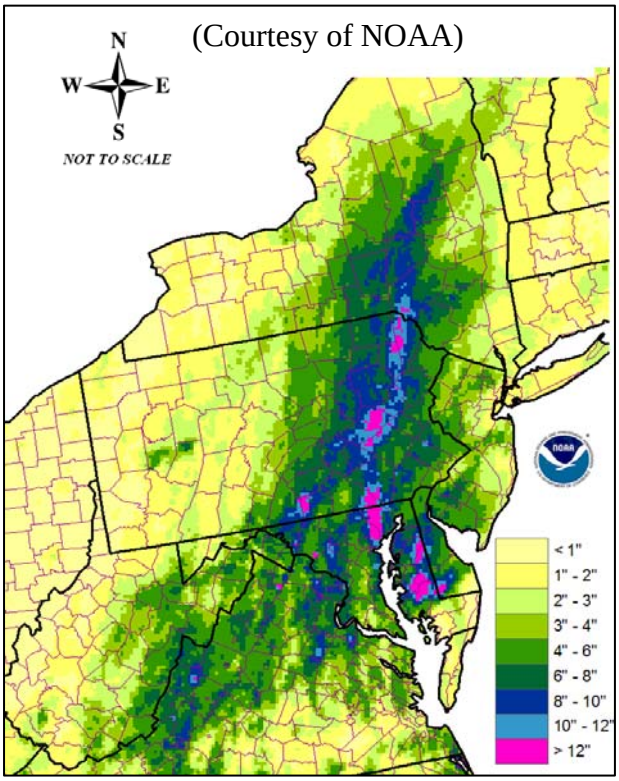
June 2006 Flood

Across the mid-Atlantic and Northeast, exceptionally heavy rainfall occurred during June 22-28, 2006. Rain amounts exceeded 10 inches in some areas (Figure 2.1), with numerous daily and monthly rainfall records set. Flooding was widespread throughout the greater Washington, D.C. area, northward through parts of Pennsylvania and New York (USACE, January 2007).

In the Cameron Run Watershed, the heaviest rainfall occurred between 7:00 pm on June 25 and 1:00 am on June 26. Rainfall intensities of 1.5 to 2.0 inches per hour were recorded at the Ronald Reagan National Airport precipitation gage. Fairfax County precipitation gages recorded 1.0 to 3.5 inches per hour in some locations in or near the watershed. A USGS stream flow gage along Cameron Run, just downstream of the confluence of Backlick Run and Holmes Run, recorded a peak flow of 16,500 cfs, the second largest on record.

The intense runoff from the rainfall created flooding issues throughout the Cameron Run watershed. Several roadways, including Interstate 495 (Capital Beltway) and Telegraph Road were overtopped; commercial and residential structures in the City of Alexandria reported significant flooding; stormwater infrastructure was inundated with larger than design flows causing deep ponding of water on roadways; and Cameron Run, between the George Washington Memorial Highway and the Capital Beltway experienced significant flooding. Huntington was the primary residential area in Fairfax County to receive flood damages during the June 2006 flood event. No fatalities were reported from the flooding; however, approximately 160 homes (per Fairfax County Stormwater Planning Division) suffered damages. News reports estimated damages near $10 million. Although Huntington is mapped as being within the 1% annual chance (100-year) floodplain on FEMA's Flood Insurance Rate Maps (FIRMs), the flood levels were unexpectedly high. Existing county data showed 1% annual chance flood elevations reaching an elevation of 10.8 feet (National Geodetic Vertical Datum of 1929 (NGVD29)) at the downstream end of Huntington, and 11.8 feet (NGVD29) at the upstream end. High water marks surveyed after the event showed that the June 2006 Flood Event was approximately 2.0 feet higher than the expected 100-year elevations. High water marks were recorded at 12.4 feet (NGVD29) at the downstream end of Huntington to 13.9 feet (NGVD29) at the upstream end.

Figure 2.1: Total Precipitation in the Mid-Atlantic, June 23 - June 27, 2006



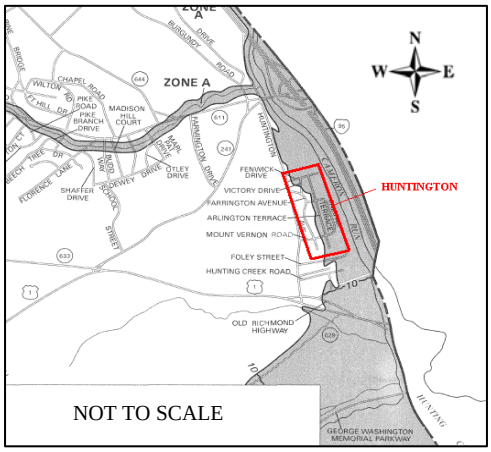
2.2 PREVIOUS STUDIES

Traditionally, the primary source for floodplain information is FEMA. FEMA publishes FIRMs and Flood Insurance Studies (FIS) that are used by local entities for floodplain management purposes. The floodplains for Cameron Run in Fairfax County are delineated as Zone A. Zone A means no detailed hydrologic and hydraulic analyses have been completed, so no exact 1% annual chance (or 100-year) floodplain elevations are shown for Huntington on the FEMA Fairfax County maps and study, which are dated March 5, 1990 (Figure 2.2). However, Zone A indicates the extent of the approximate 1% annual chance flood. FEMA is currently working to update the FIRMs and revise the FIS for Fairfax County. Preliminary revised FIRMS for Fairfax County are expected in Spring 2009.

The flooding in Huntington from Cameron Run has, however, been studied in the past. The earliest documented investigation was dated December 1970, with the most recent being in

January 2007. A summary of previous investigations along Cameron Run that directly impact Huntington are listed below. There have been other studies related to flooding within the Cameron Run watershed; however, the results of those investigations do not directly impact Huntington.

Figure 2.2: Effective FEMA FIRM for Fairfax County, Virginia (dated March 5, 1990)



December 1970: Alexandria, Virginia, Flood Insurance Study, completed by the U.S. Army Corps of Engineers, Baltimore District

The purpose of this investigation was to analyze the flood potential and the damages related thereto in the City of Alexandria, Virginia. The study involved hydrologic and hydraulic studies to create elevation-frequency curves and tables, flood profiles, and floodplain maps along Cameron Run to assist in establishing flood insurance rates within the City of Alexandria. The Immediate Regional Flood elevations, which are equivalent to the 100-year flood elevations, ranged from 12.0 feet mean sea level (msl) at the confluence of Hoofs Run (just downstream of the downstream end of Huntington) to 15.0 feet msl at Telegraph Road (upstream of Huntington) as shown in Figure 2.3. It is assumed, due to the date of this study, that msl is equal to NGVD29.

No modeling is available from the December 1970 study. It is assumed that the results of this study were used to create the effective flood insurance rate maps for the City of Alexandria, dated May 15, 1991 (Figure 2.4). FEMA has not published a flood insurance study for the City of Alexandria; however, water surface elevations and the floodplain presented on the FIRM are consistent with the results of the Corps study. Note that the FIRM maps for the City of Alexandria are currently being revised to reflect better topographic data provided by the City.

Figure 2.3: Flood Profile from December 1970 Flood Insurance Study For Alexandria, Virginia

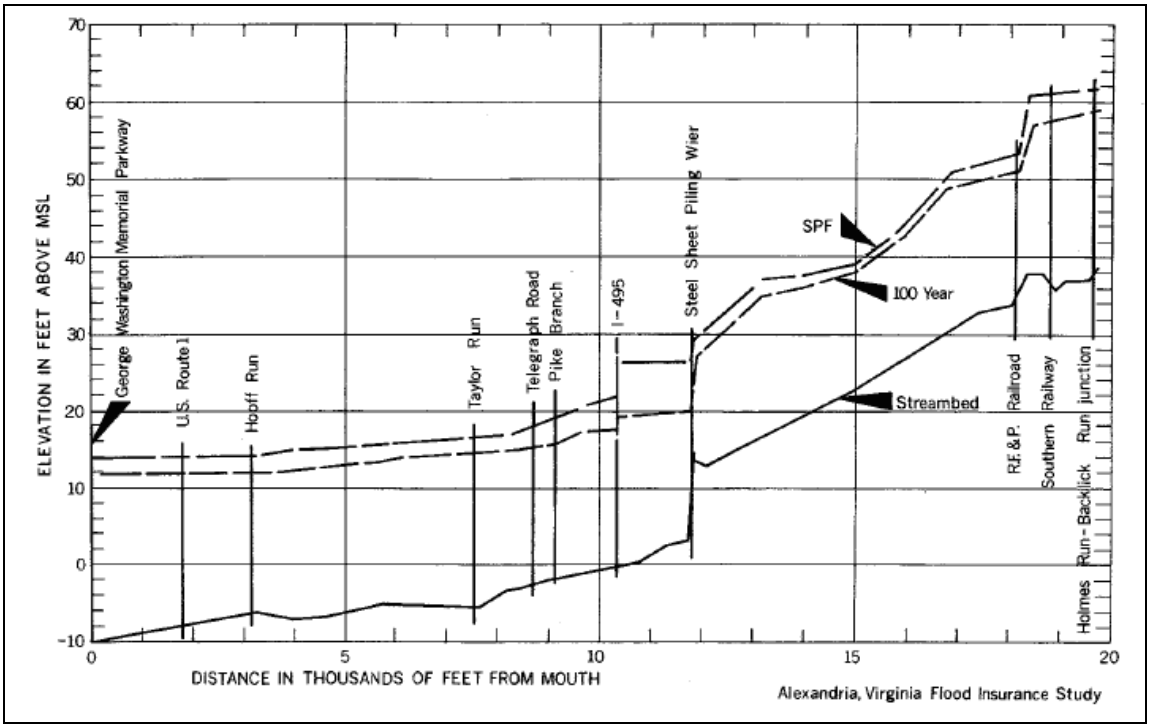
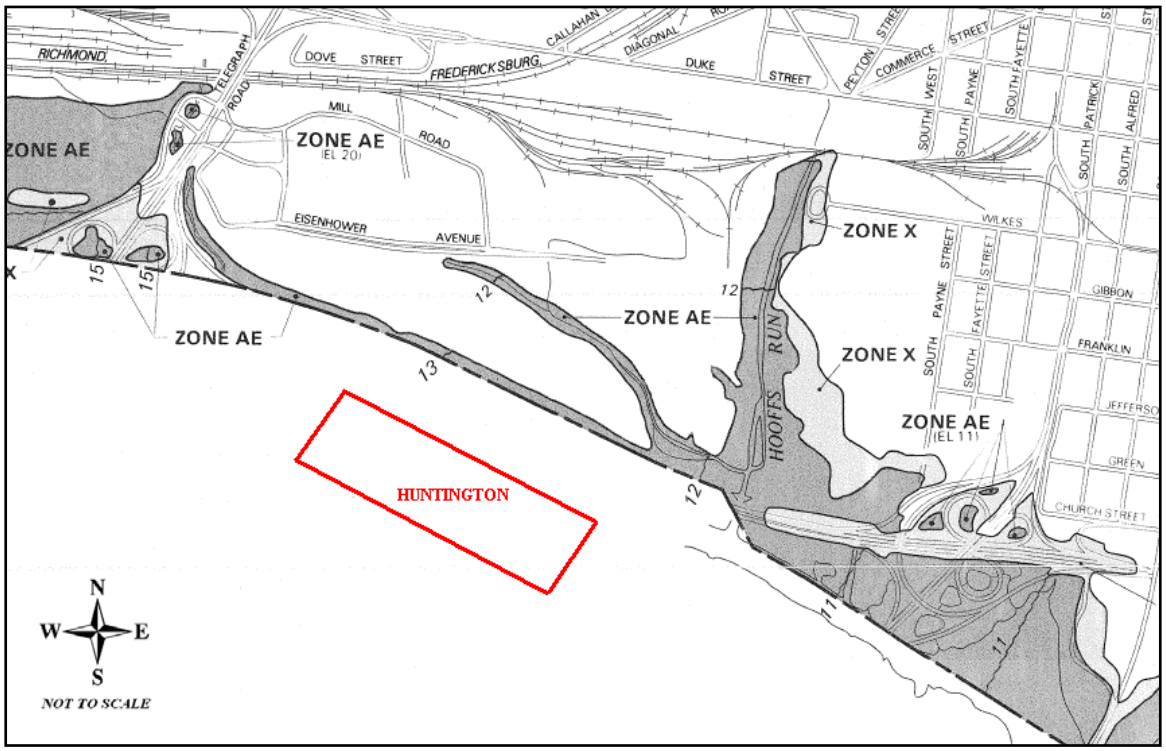


Figure 2.4: Effective FEMA FIRM for Alexandria, Virginia (dated May 15, 1991)



March 1971: Cameron Run, City of Alexandria and Fairfax County, Virginia, Review Report on Flood Control, completed by the U.S. Army Corps of Engineers, Baltimore District

The purpose of this report was to determine the feasibility of providing a project for flood damage reduction along streams that flow through the City of Alexandria, Virginia, with particular reference to Cameron Run and its tributaries. The tasks for this study included: soil surveys; elevation surveys; damage surveys to determine the extent and magnitude of damages caused by flooding; real estate investigations; economic evaluation; hydraulic studies; and analysis of flood protection measures to alleviate flood damages.

Huntington is located in Reach CA-1 in this investigation. The flood of record prior to this investigation was flash flooding that occurred September 14, 1966, which caused a peak flow of 9,300 cfs at the USGS stream gage. Based upon calculations in the investigation, only five residential structures and one commercial structure in Huntington would have been inundated by this 1966 flood, causing minimal damages. The result of this study was the recommendation of a Federal flood damage reduction project along Cameron Run to address flooding issues. However, no flood improvements were made in the Huntington area. In a USACE memo dated September 1977, Survey Report, Potomac River Streams Draining Alexandria Area, Virginia (USACE, 1977), the reason is explained:

"A report on Cameron Run was prepared… which represents a positive recommendation for a Federal flood control project along Cameron, Holmes, and Backlick Runs. Because of the inability to obtain required assurances of local cooperation, the report was not processed further. In 1969, Cameron Run formed part of the boundary between Fairfax County and the City of Alexandria; thus, both jurisdictions were required to provide the local assurances. However, nearly all of the benefits of the proposed project would accrue to the City of Alexandria and, for this reason, Fairfax County would not provide their assurances. In order to overcome this problem, a land transfer was agreed to by the local jurisdictions and became effective 1 January 1973. This land transfer and boundary change placed the entire project area within the City of Alexandria limits."

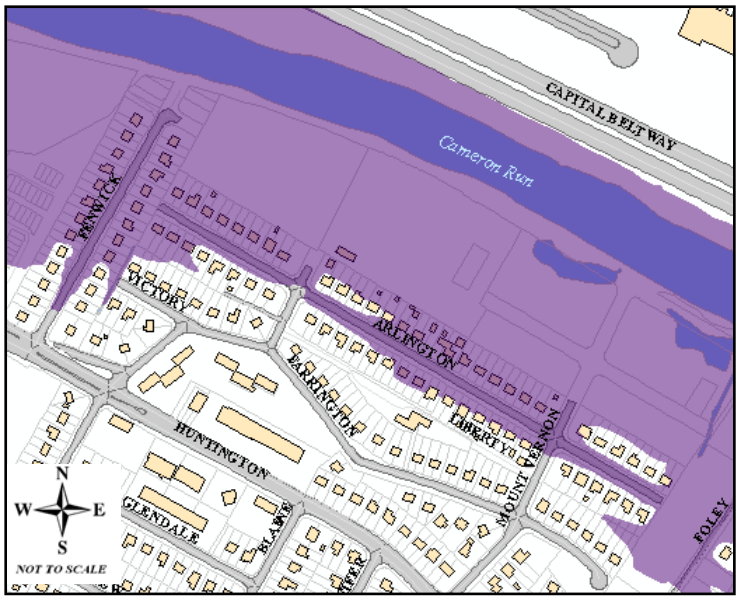
Subsequently, to expedite the construction of the project, the City of Alexandria decided to implement the plan of protection recommended in this report on their own initiative and cost. The recommended plan was to channelize a portion of Cameron Run. Thus, Cameron Run is now channelized upstream of the Capital Beltway; however, it is not a Federal project.

1976: Flood-Plain Delineation for the Cameron Run Basin, Fairfax County-Alexandria City, Virginia, Open File Report 76-443, completed by USGS

The results of this investigation were being used by Fairfax County at the time of the June 2006 event for the management of floodplains along Cameron Run. Floodplain mapping produced in this investigation was adopted by the County Board of Supervisors (Figure 2.5). The purpose of this investigation was to establish floodplain mapping for Cameron Run and its tributaries. It is noted, however, that although this study is dated 1976, the report documents that the field survey in the basin was done in 1961, with supplemental surveys made in 1965. The 100-year peak flows, using the Anderson method for ultimate built-out conditions, were estimated at 21,800 cfs

for the Huntington area. The 100-year flood elevations ranged from 10.3 feet (NGVD29 datum) just upstream of U.S. Route 1, to 13.2 feet just downstream of Telegraph Road.

Figure 2.5: 100-year Floodplain Limits for Huntington from 1976 USGS Study



April 1977: Huntington Drainage Study (Huntington Conservation District), completed by William H. Gordon Associates

The purpose of this study was to develop an updated storm drainage master plan for the Huntington area based upon current design standards and criteria. Although this study dealt more with stormwater infrastructure rather than riverine flooding, the report contains useful information on the history of flooding in Huntington. The report notes that "The houses along Arlington Terrace and closest to Cameron Run have evidently never experienced flooding due to an overflow of the creek's banks. Any flooding of the dwellings has occurred as a direct result of the storm sewer backup or the sanitary sewer backup." Flood waters can enter sanitary sewer pipes through manholes and can back up and flood the houses. Recommendations as a result of this investigation included improving the storm sewer infrastructure and installing subsurface interceptors, among others. It is unknown if any of the recommended improvements were implemented.

December 1977: Proposed Drainage Plan, Cameron Run Watershed, Task Order 3.2 Immediate Action Plan, completed by Parsons, Brinckerhoff, Quade and Douglas

The purpose of the Immediate Action Plan (IAP) was to recommend projects to enable the drainage ways in the Cameron Run Watershed to safely carry stormwater to the Potomac River with minimal disruption to areas adjacent to the streams. A total of 40 projects were recommended throughout the watershed. The study recommended the construction of an earth berm along Cameron Run to alleviate the flooding of homes and structures along Fenwick Drive

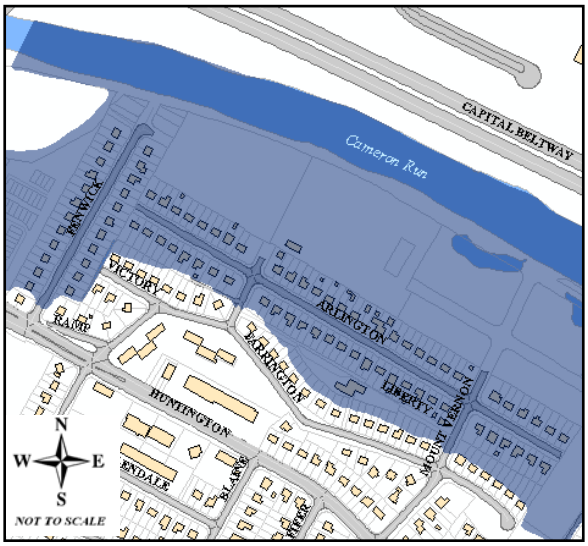
and Arlington Terrace in the Huntington community. The Huntington portion of the study was never implemented.

April 1982: Arlington Terrace Storm Drainage Study, Fairfax County, Virginia, completed by Camp Dresser & McKee (CDM)

The purpose of this study was to perform a comprehensive flood drainage feasibility study for the Huntington community. It includes a detailed definition of the flooding problem in the Huntington community caused by Cameron Run flood flows and Potomac River high tides, and the development of alternate flood control solutions with cost estimates to resolve the flooding problems in the Huntington area. Initial analysis during the investigation concluded that although tidal surge was a flood risk in Huntington, the type of flooding that would cause the most significant damage was riverine flooding from the Cameron Run watershed.

The hydrology for the project was completed using the MIT Catchment Computer Model (MITCAT) and "other well-supported methodology," with peak flows for a 100-year flood event estimated to be 37,785 cfs (for comparison, the 1976 USGS study estimated the 100-year peak flow to be 21,800 cfs). The hydraulic analysis was completed using the USACE HEC-2 program, with the following computed flood elevations for the Huntington community: 10-year flood elevation of 8.63 feet; 25-year elevation of 10.38 feet; 50-year elevation of 11.86 feet; and 100-year elevation of 14.34 feet (all elevations are NGVD29 datum). The study concluded that a 100-year flood event at elevation 14.34 feet would inundate approximately 167 homes in Huntington (Figure 2.6).

Figure 2.6: 100-year Floodplain Limits for Huntington from April 1982 CDM Study



The 1982 CDM study outlined potential flood damage reduction measures such as channelization, levees, floodwalls, floodproofing, dredging, and constriction relief.

The following is a list of the recommendations made in this investigation:

- No protection is required for a 10-year flood, and a levee would provide complete protection from a 25-year event at a lower cost than other alternatives.

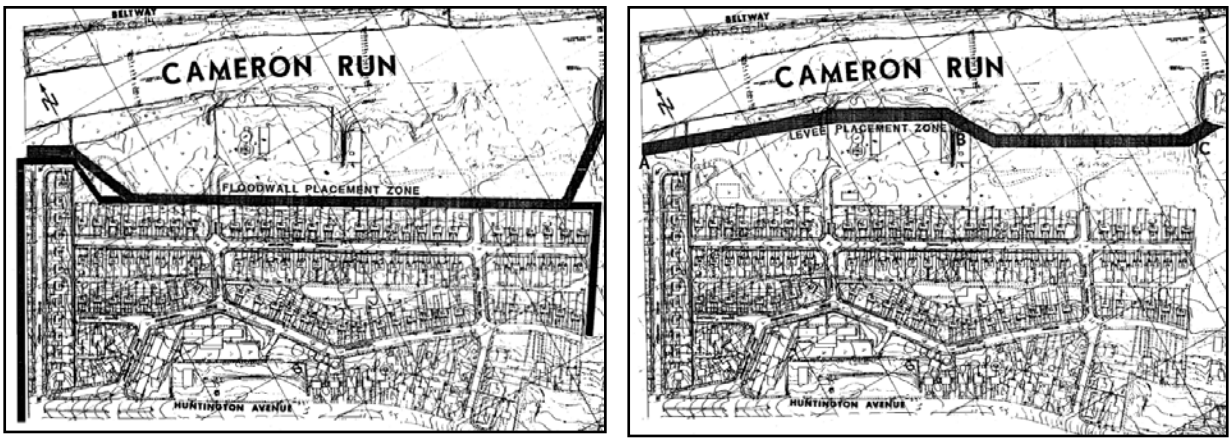
- For a 50-year flood, a levee provides complete protection at a lower cost than other alternatives.

- A floodwall is the only single flood control measure that performs satisfactorily during a 100-year flood, at a 1982 cost of $3,537,000. However, other viable options would be a floodwall and dredging the reach to a width of 100 feet, at a 1982 cost of $3,987,000, and a levee plus dredging to a 200 foot width, at a 1982 cost of $3,206,000 (Figure 2.7).

- Under any plans a channel maintenance program must be established to clear sediment from Cameron Run.

Although options for flood damage mitigation were presented in this report, none were implemented. The reason they were not implemented is uncertain.

Figure 2.7: Potential Floodwall and Levee Placement Zones from April 1982 CDM Study



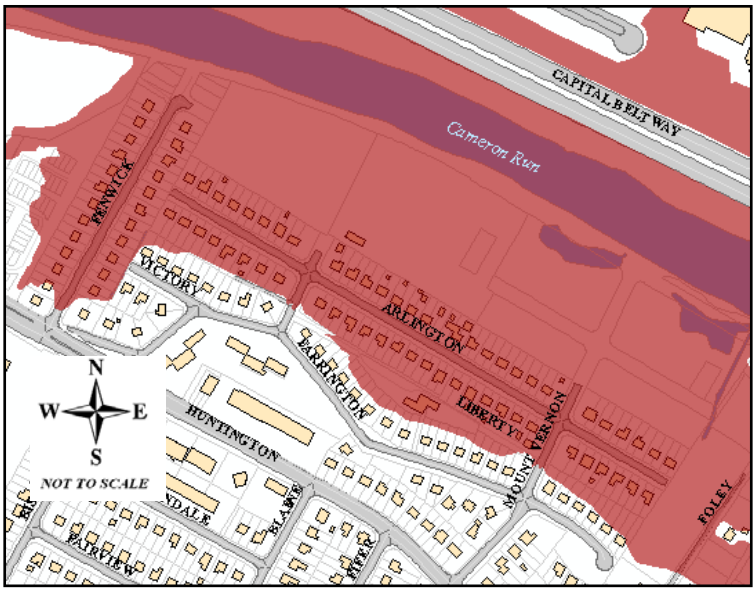
February 2002: Hydrologic and Hydraulic Analysis of Cameron Run, completed by Potomac Crossing Consultants (PCC) for Virginia Department of Transportation (VDOT)

The purpose of this study was to examine the impact that the proposed improvements associated with the Woodrow Wilson Bridge replacement project would have on the existing flood stages and profiles, and to provide necessary hydraulic data for scour computations at proposed bridges and crossings. The study was a compilation of results presented in the following reports: *I-95/Route 1 Interchange Improvement Project, Cameron Run Hydraulic Study Report*, prepared by HNTB in November 2001; and *Interstate 95/495/Telegraph Road Interchange, County of Fairfax/City of Alexandria, Project #0095-96A-105, Hydrologic and Hydraulic Analysis of Cameron Run*, prepared by Dewberry & Davis, LLC, in December 2001.

The report outlines results of a one-dimensional Hydrologic Engineering Center's River Analysis System (HEC-RAS) hydraulic model that starts at the confluence of Cameron Run at the Potomac River and extends upstream to approximately 400 feet west of the Capital Beltway bridge over Cameron Run. All field-surveyed cross-sections for the study were completed in 1999.

The study completed two separate HEC-RAS models. The existing-conditions model reflects the conditions of Cameron Run in 1999, before any improvements to U.S. Route 1, Telegraph Road, or the Woodrow Wilson Bridge were made (Figure 2.8). The proposed-conditions model reflects the conditions of Cameron Run once the entire project is completed.

Figure 2.8: Existing-Conditions 100-year Floodplain Limits for Huntington from 2002 VDOT Study



The hydrology for this study was based on the Anderson method, per FEMA guidance. The Anderson method computed a 100-year peak flow of 25,525 cfs at the U.S. Route 1 Interchange; 23,845 cfs at Telegraph Road; and 22,625 cfs at the Capital Beltway bridge. The hydraulic model was developed using HEC-RAS version 2.2, and the results were verified by other agencies using two-dimensional and three-dimensional modeling.

The results of this VDOT existing conditions modeling showed 100-year flood elevations ranging from 10.8 feet (NGVD29) just upstream of U.S. Route 1 to 18.4 feet just downstream of Telegraph Road; however, the results for Huntington in this study showed much higher 100-year elevations for Huntington than the 1976 USGS investigation. The 1976 USGS investigation computed 100-year flood elevations ranging from 10.8 feet (NGVD29) at the downstream end to 11.7 feet at the upstream end. The VDOT existing-conditions model computed 100-year flood

elevations of 13.7 feet at the downstream end to 14.6 feet at the upstream end. This is an increase of nearly 3 feet. It is noted that the USGS investigation used a 100-year peak discharge of 21,800 cfs, where the VDOT study used a peak discharge of 23,845 cfs.

Based upon the proposed design and construction, the maximum increase in the 100-year flood elevation as a result of the construction of the new U.S. Route 1 bridges is 0.8 feet approximately 300 feet west of the confluence of Hoofs Run. On average, the project will increase flood elevations by roughly 0.5 feet throughout this reach of Cameron Run and within Huntington. VDOT will re-analyze the impacts of the project when construction is complete to account for any design changes during construction.

The February 2002 study and associated modeling were considered the best available data that represented existing-conditions for Cameron Run at the time (pre-Woodrow Wilson Bridge activity). Copies of this report and modeling were not sent to Fairfax County. However, through written correspondence, it is evident that VDOT initiated coordination efforts with the Federal Highway Administration (FHWA), FEMA, and the City of Alexandria through the process. VDOT submitted their final model results to FEMA in December 2001. USACE and USGS were also contacted throughout the process for data coordination efforts.

Following the June 2006 event, Fairfax County adopted the 2002 VDOT 100-year floodplain for floodplain management purposes. They plan to use this floodplain data until FEMA revises the Fairfax County FIS and FIRM.

September 2006: Woodrow Wilson Bridge Project Report on Impacts on Cameron Run Flood Event of June 25, 2006, prepared by Potomac Crossing Consultants (PCC) for Virginia Department of Transportation

The PCC conducted an examination of the severe flooding experienced June 25, 2006 in the Huntington/Arlington Terrace area of Fairfax County. The purpose of the report was to investigate the possibility that the construction activities associated with the Woodrow Wilson Bridge (WWB) Project caused the flooding conditions on June 25 and 26, 2006 in the Huntington area. The study determined that the total impact of the WWB construction attributed to a 5 to 10 inch increase in peak flow elevation in Huntington.

January 2007: June 2006 Flood Investigation for Cameron Run, completed by U.S. Army Corps of Engineers (USACE), Baltimore District, Planning Division

At the request of the Fairfax County Stormwater Planning Division, under the Floodplain Management Services Program (FPMS), a study was conducted by the Corps, Baltimore District, Planning Division to determine specific causes of the higher than expected flood levels experienced during the June 2006 flood event in Huntington, VA. Significant flooding occurred in Huntington along Cameron Run on June 25 and June 26, 2006. Flood elevations were in excess of 2.0 feet higher than the expected county-adopted 100-year flood elevations (flood having a 1-percent chance of occurring in any given year). Based on a statistical analysis of the stream gage along Cameron Run, the June 2006 flood was estimated to have a recurrence interval of 60-70 years.

Based on the study, the factors determined to contribute to higher flood levels over time were channel sedimentation (1.2 to 2 feet), construction at the U.S. Route 1 Interchange which is a component of the Woodrow Wilson Bridge Project (0.5 to 0.9 feet), and development within the floodplain including Jones Point and the Metro Rail and Station (0.2 to 0.4 feet). Factors investigated but found not to contribute to the higher flood levels in Huntington during the June 2006 flood event were Lake Barcroft release rates, a barge blockage at the George Washington Memorial Parkway, and the Potomac River tide stages.

Channel sedimentation had a considerable impact on flood elevations in Huntington during the June 2006 flood event. Based on surveys, between 1965 and 1999 nearly 5 to 6 feet of sediment accumulated between Telegraph Road and U.S. Route 1. Had the channel been at its 1965 condition (same channel depth and width as in 1965), the study determined that flood elevations would have been approximately 1.2 to 2.0 feet lower in Huntington. As discussed later in Section 4.2.2, when the new Cameron Run channel was created during the construction of the Capital Beltway in the early 1960's, the downstream tie-in point had an inverted slope which may have contributed to an accelerated accumulation of sediment in this area.

The temporary construction activity at the U.S. Route 1 interchange caused between a 0.5-foot (at the upstream end) and 0.9-foot (at the downstream end) increase in flood elevations along the Huntington area, which were within the permitted limits established by FEMA. When the Woodrow Wilson Bridge project is completed, the maximum increase in the 100-year flood elevation is estimated to be 0.8 feet approximately 300 feet west of the confluence of Hoofs Run. Therefore, the temporary increase in flood level during the construction of the interchange is similar to the expected future increase in flood levels after the project construction is complete.

Development within the floodplain, including Jones Point and the Metro Rail and Station caused small but notable increases in the flood elevations. The floodplain development caused between a 0.2 and 0.4-foot increase in flood elevations along the Huntington area, which were within established FEMA permitted limits as well.

The results of the January 2007 study are valuable in that explanation is given as to why such high flood elevations were experienced in June 2006. Although the factors mentioned above each increased flood levels to varying degrees, their combination created a significant increase over time. It is of note, however, that some of the houses in Huntington still would have been flooded during the June 2006 flood even if the described activities had not occurred.

May 2007: Hydrologic and Hydraulic Analysis for the Cameron Run Watershed in Northern Virginia, completed by U.S. Army Corps of Engineers (USACE), Baltimore District, for FEMA Region III

The purpose of this investigation was to (1) develop a comprehensive rainfall-runoff model for the Cameron Run watershed to produce accurate, up-to-date peak flood flows and (2) develop a comprehensive hydraulic model to estimate up-to-date flood elevations for all significant flooding sources within the Cameron Run watershed. To determine the existing peak flows for the 10-, 25-, 50-, 100-, and 500-year flood events, the Corps' Hydrologic Modeling System (HMS), version 3.1.0, was used. Table 2.1 shows the peak discharges for various flood

frequencies at locations throughout the lower Cameron Run reach determined as part of this study. Discharges from this May 2007 report were used for the hydraulic analysis for this current study. Figure 1.2 shows the corresponding 1% annual chance floodplain based on these discharges. Based on the rainfall-runoff model developed as part of this study, the June 2006 flood was estimated to have a recurrence interval of 50 years (which differs slightly from the stream gage statistical analysis that was conducted as part of the USACE January 2007 study which determined the interval was 60 to 70 years.)

Table 2.1: Summary of Discharges for the Cameron Run Watershed (Corps, May 2007)

CAMERON RUN							
LOCATION	DRAINAGE AREA (sq. miles)	RIVER MILE	PEAK DISCHARGES (cfs)				
			10-YEAR	25-YEAR	50-YEAR	100-YEAR	500-YEAR
Upstream of U.S. Route 1 Interchange	44.49	0.40	11,203	15,919	20,400	25,414	39,189
At Telegraph Road (and Huntington Area)	39.14	1.78	10,820	15,869	20,400	25,398	39,056
At Confluence with Strawberry Run	36.03	2.10	10,814	15,856	20,397	25,350	38,372
At Railroad Bridge	33.96	3.45	10,434	15,218	19,555	24,275	36,650
At USGS Gage	32.62	3.59	9,922	14,407	18,498	22,944	34,657

2.3 ONGOING STUDIES

Cameron Run/Holmes Run Watershed Feasibility Study, currently underway by USACE, Baltimore District; Fairfax County; and the City of Alexandria

The purpose of this ongoing study, which was initiated in 2004, is to develop a watershed plan to evaluate potential improvements to the watershed. The study goals include restoration of aquatic and riparian habitat, reduction of flood damages, enhancement of channel aesthetics and habitat, development of strategies for maintenance of long-term viability of the recommended measures, and protection of the Potomac River and Chesapeake Bay. The study is expected to be completed in 2010.

2.4 FLOOD RISK

According to FEMA's Flood Insurance Rate Maps for Fairfax County, dated March 5, 1990, a portion of the Huntington Community is designated as Zone A, which means that the area is in the 1% annual chance floodplain (Figure 2.2). Zone A means that no detailed hydrologic and hydraulic analyses have been completed, so no exact 1% annual chance (or 100-year) floodplain elevations are shown for Huntington.

However, a number of the Huntington houses were subsequently removed from the 1% annual chance floodplain via the Letter of Map Amendment (LOMA) process, which revised the FIRM. If a residential structure is located in a floodplain on FEMA's FIRMs, the homeowner is required to purchase flood insurance through NFIP for any Federally-backed loan. Although FEMA uses the most accurate flood hazard information available, limitations of scale or topographic definition of the source maps used to prepare the FIRM may cause small areas that are at or above the 100-year flood elevation to be inadvertently shown within the floodplain boundaries. When this happens, structures or parcels of land may be inadvertently included in the 100-year floodplain on the FIRM. For such situations, the property owner or lessee may apply for a LOMA with FEMA. LOMAs are documents issued by FEMA that officially remove a property and/or structures from the 100-year floodplain limits. The issuance of a LOMA determines that the property/structures is not located in the 100-year floodplain, and eliminates the Federal flood insurance purchase requirement as a condition of Federal or Federally-backed financing; however, ultimately the mortgage lender retains the prerogative to require flood insurance as a condition of any loan. In addition, although a structure is removed from the floodplain, flood insurance may still be purchased by the homeowner at reduced costs.

For structures placed on natural ground or constructed prior to the issuance of the first FEMA maps (as are all structures in Huntington), the determination as to whether a structure would be removed from the floodplain is based upon the comparison of the 100-year flood elevation to the lowest adjacent grade (LAG) elevation. The LAG is the lowest ground touching the outside of the structure, including attached decks and garages. If the LAG is at or above the 100-year flood elevation, the structure may be removed from the floodplain. Note that for structures with basements built on natural ground, such as those in Huntington, the basement elevation is not used in the determination.

The procedure used by FEMA for issuing LOMAs involves obtaining a LAG elevation for the structure from a licensed land surveyor or professional engineer, or in some cases, using community-approved topographic mapping. Next, a 100-year flood elevation is determined at the property. If a 100-year flood elevation is published on the FIRM map or FIS, it will be used for the determination. If the floodplain is delineated as Zone A, meaning no detailed study was completed by FEMA, a 100-year flood elevation must be obtained from other sources. Note that the floodplain for Cameron Run at Huntington is delineated as Zone A.

Nearly 130 property owners in Huntington (note that many structures in Huntington are duplexes) applied for and were granted LOMAs between 1997 and 2000 (Figure 2.9). For these LOMAs, FEMA used the 1976 USGS study results as the source of 100-year flood elevations for the structures in Huntington, with flood elevations ranging from 10.9 feet to 11.8 feet (NGVD29). This was determined to be the best available data at the time for Cameron Run. Therefore, during the June 2006 flood event, many residents did not carry flood insurance.

Figure 2.9: Structures in Huntington with FEMA Letters of Map Amendment (LOMAs)

FEMA is currently revising the Fairfax County FIRMs and the preliminary maps are scheduled to be released in Spring 2009. The exact floodplain will not be known until the maps are released, however, based on current watershed conditions and the Corps' most recent modeling, the floodplain will likely be similar to that shown in Figure 1.2. The Corps' most recent hydraulic model was developed in 2007, which was a revised version of VDOT's 2002 model (PCC, 2002). Based on the Corps' model, the 1% annual chance flood elevation at Fenwick Drive is 15.4 feet and at Foley Drive is 14.3 feet. Figure 2.10 shows the cross sections along Cameron Run used in the model. Table 2.2 shows flood elevations for various flood frequencies at two different cross sections. Note that because Cameron Run slopes downward toward the Potomac River, the flood elevations are lower at the downstream end and higher at the upstream end. Many of the Huntington houses have low openings and first floor elevations in the 9-12 foot range. Table 2.3 shows the number of structures that will incur damages during frequency events. Note that 11 houses will incur some type of flooding (basement and/or first floor) during

a 10-year event (10% annual chance) and 132 will incur flooding during a 25 year event (4% annual chance). During a 100-year event (1% annual chance), 176 structures will be flooded.

Table 2.2: Flood Elevations at Cross Sections along Huntington (feet, NGVD29)

Cross Section	20% annual chance (5-yr)	10% annual chance (10-yr)	4% annual chance (25-yr)	2% annual chance (50-yr)	1% annual chance (100-yr)	0.4% annual chance (250-yr)	0.2% annual chance (500-yr)
660 (Near Foley Dr)	7.4	9.2	11.7	13.0	14.3	15.7	17.5
1389 (Near Fenwick Dr)	8.6	10.5	12.7	14.0	15.4	16.8	18.7

Table 2.3: Number of Structures with Damages During Various Flood Events

Event		Number of Structures with Damage (Basement or other floors)	Number of Structures with First Floor Damage
% Annual Chance	Recurrence Interval (Years)		
50	2	0	0
20	5	1	0
10	10	11	0
4	25	132	2
2	50	160	68
1	100	176	152
0.4	250	182	180
0.2	500	182	182

US Army Corps of Engineers
Baltimore District

Figure 2.10

Hydraulic Model Cross Sections

0 750 1,500 3,000 Feet

1 inch = 700 feet

Aerial Photograph dated 2004 courtesy of AerialExpress
Elevations referenced to NGVD29 datum

Legend

100-year Floodplain (USACE 2007 Model)