POHICK CREEK
DRAFT
Watershed Workbook
September 2008

Fairfax County
Watershed Planning & Assessment Branch
Stormwater Planning Division
Department of Public Works & Environmental Services

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1.0COMPILATION OF OVERALL WATERSHED CONDITION DATA

1.1 General Watershed Characteristics

The Pohick Creek watershed comprises more than 9% of Fairfax County covering more than 36 square miles (23,248 acres**)** making it one of Fairfax County's largest watersheds. Pohick Creek watershed is situated in the center of the County and includes 3.2 square miles of land outside its jurisdiction, either in the City of Fairfax or Fort Belvoir. See **Map 1.1** and **Map 1.2** for Fairfax County, and Pohick Creek watershed respectively.

Pohick Creek is oriented northwest to southeast and drains southeast into Pohick Bay, then into Gunston Cove, ultimately discharging into the Potomac River. Pohick Creek watershed is bound by Accotink Creek watershed to the north and east, Popes Head Creek to the northwest, and Sandy Run, Mill Branch, and Kane Creek watersheds to the southwest. Pohick Creek watershed is a long and fairly narrow watershed. The watershed falls 460 feet in elevation from the highest point near the City of Fairfax in the northeast section to sea level at the southeast point (Flood Plain report, 1977).

Pohick Creek lies within two main physiographic provinces, or distinct geologic regions. Interstate-95 generally follows the fall line, which is the divide between the Coastal Plain and the Piedmont Provinces. The soft, flat Mesozoic and Tertiary sedimentary rocks indicative of the Coastal Plain lie to the east of the fall line while the hard, Paleozoic metamorphic rocks of the Piedmont lie to the west. Both provinces have characteristic gently sloping landscapes; however, the streams of the Coastal Plain are dominated by low-velocity pool-and-glide habitats while the streams of the Piedmont have higher-velocity riffle-run habitats. According to the Virginia Department of Quality (VDEQ), the "Coastal Plain region is the only one in Virginia that is composed mostly of unconsolidated deposits, primarily alternating layers of sand, gravel, shell rock, silt, and clay and more ground water is stored in these very permeable materials than in any other province in the state(VDEQ, Physiographic Provinces of Virginia)".

1.2 Population Growth and Watershed History

Fairfax County's original boundary lines were drawn in 1741, yet over the next 50 years, portions of the County would become areas of the District of Columbia and Loudoun County. From 1750 to 1930, Fairfax County was largely considered agricultural, with a large population of tobacco and dairy. Over the next 20 years the population would grow from 25,000 in 1930 to almost 100,000 by 1950. The availability of the automobile and the expansion of the federal government were key factors for the County's population boom to 450,000 by the 1970's. Over the next 20 years, as even more job opportunities became available, the population nearly doubled to 800,000, and by 2005, Fairfax County had exceed 1 million residents.

In September 1969, the Board of Supervisors adopted the final Report, a *Restudy of the Pohick Creek* Watershed. The report planned the population growth through the year 2000. According to the report, the Pohick Creek watershed was designed to accommodate a population of 161,000 by 2000. Since the U.S. Census Bureau does not capture population data by watersheds, current population information for Pohick Creek watershed has not been identified to verify the 1969 assumptions.

Fairfax County as a whole is expected to experience more than a 37% population increase over the next 20 years. See Table 1 below for County growth trends

Table 1: Growth Trends in Fairfax County 1990-2025

Year	Population (thousands)	Households (thousands)	Employment (thousands)
1990	818.6	292.3	403.7
2000	968.2	353.4	526.4
2010	1,112.9	412.5	644.4
2020	1,184.1	438.1	701.3
2025	1,203.7	445.0	727.8

(Source: Metropolitan Washington Council of Governments 2006)

1.3 Existing & Future Land Use

According to the Fairfax County Stream Protection Baseline Study (SPS), in 2001, more than half of Pohick Creek was forested, with nearly 30% of the watershed serving low-density residential uses; see Table 2 below for Pohick Creek land usage. Refer to **Map 1.3** for existing and future land use.

Table 2: Existing Land Use (2001 SPS)

Land Uses in the Pohick Creek Watershed	Existing Conditions	
	Acres	Percent
Forested	11,139.68	50.5%
Field/Pasture	1,658.49	7.5%
Low Intensity Residential	6,336.23	28.7%
High Intensity Residential	13.23	0.1%
Commercial/ Industrial	1,601.15	7.3%
Exposed Land	460.94	2.1%
Wetlands	436.68	2.0%
Open Water	408.01	1.9%

Pohick Creek is also home to two distinct land areas, Fort Belvoir and Laurel Hill (formerly District of Columbia Department of Corrections Facility, located in Lorton). While Fort Belvoir is considered federal property, portions of the facility lie in the Pohick Creek watershed and with the implementation of the 2005 Base Realignment and Closure (BRAC), the ramifications could potentially impact the watershed.

1.3.1 Fort Belvoir Area

Located on a peninsula in southeastern Fairfax County along the Potomac River, Fort Belvoir military base covers approximately 13.5 square miles (8,656 acres). Established in 1935 as a military training facility, Fort Belvoir has expanded and transitioned into a military command post, housing over 7,000 people with more than 2,000 housing units. In the fall 2005 the Defense Base Closure and Realignment Commission (BRAC Commission) made numerous recommendations for realignment and closures for military installations located in the United

States. If fully implemented, Fort Belvoir could see an increase of 22,000 people working on base in the near future (Draft EIS, 2007).

1.3.2 Laurel Hill Area

The Laurel Hill Area comprises 3,211 acres and is located in the south eastern part of Fairfax County. The area is bounded by West Ox Road and Hooes Road to the west, the Occoquan River to the south, I-95 on the east, the South Run Stream Valley Park to the north. A small portion of the Laurel Hill Area extends into southern Pohick Creek, with the remaining area falling within the Lower Occoquan watersheds to the south. In July 2002 Fairfax County assumed ownership of the Laurel Hill area (EDAW, 2004). The County is currently engaged with the redevelopment of this area and is in the process of identifying multiple stormwater management strategies to enhance the land use and improve overall stream water quality. The Fairfax County Park Authority is managing the majority of the area, while about 10% was developed for residential uses. The County had worked with consultants to perform upland reconnaissance, Neighborhood Source Assessments (NSA), and Hot Spot Investigations (HIS) all of which provides the County with data to develop a plan of action for redevelopment of the Laura Hill area (KCI study, 2007). The focus of the study was to identify areas where innovative stormwater management techniques can be employed.

1.4 Impervious Areas

Impervious areas can be described as hard surfaces that stormwater (rain water) can not penetrate and consequently runs off into a collection system. Increased impervious surfaces can result in channel erosion and downstream degradation caused by the increased volume and velocity of new stormwater runoff reaching receiving waters. It has been shown that levels of 10-20% impervious surface significantly reduce stream health (Annual Report, 2005). Over the decades, Pohick Creek has experience population growth and consequently an increase in impervious surface due to new development and supporting infrastructure development.

Figure 1: Pohick Creek Impervious Areas

Currently, Pohick Creek is considered built out and future large scale new development is not planned outside of the Laurel Hill redevelopment. However, Pohick Creek watershed has been experiencing pockets of redevelopment. Generally these areas are already considered developed

and therefore do not typically create large tracks of new impervious areas, consequently the overall future impervious surface area is only predicted to increase by less than 150 acres. As permitted redevelopment construction occurs updates to the County's electronic Geographical Information Systems (GIS) land use layers will be populated and impervious areas may reflect an increase. Table 3 below identifies the historic and future planned imperviousness conditions throughout the Pohick Creek watershed.

Table 3: Pohick Creek Impervious Area

Year	Area (sq. miles)	Area (%)
1980	2.8	7.6
1990	3.3	9.1
Current	8.36	22.9
Future	8.63	23.6

1.5 Existing Stormwater Controls

In the 1970s, a series of six impoundments began construction in the Pohick Creek watershed as part of a federally assisted pilot program Public Law 566 (PL-566) to attempt to control flooding and sedimentation ahead of anticipated development. Approved in 1967, the Pohick Watershed Project resulted in Woodglen, Royal, Braddock, Barton, Huntsman, and Mercer lakes being built. In 1967 the County adopted the Erosion and Sediment Control Ordinance which became the model for the State Erosion and Sediment Control Law. In addition to the PL-566 impoundments, the western portion of the watershed contains Burke Lake Park, an 888 acre park built around a 218 acre recreational lake, Burke Lake. The Burke Lake Park is operated by the Fairfax County Park Authority and the lake itself is co-managed by the Authority and the Virginia Department of Game and Inland Fisheries. Below provides further detail of the dams in the Pohick Creek watershed.

1.5.1 PL-566 Dams

The Federal Watershed Protection and Flood Prevention Act of 1953 (Public Law 83-566) funded the construction of six large dams within the Pohick Creek watershed. These dams, more commonly referred to as PL-566 dams, were built decades ago and were designed as structural measures to reduce flood damage within Pohick Creek. In addition to flood control, the dams are also used as sediment control measures.

The Virginia Department of Conservation and Recreation Division of Dam Safety and Floodplain Management administers the Virginia Dam Safety Act which regulates all dams that meet one of the following two requirements: (1) 25 feet or greater in height and create an impoundment capacity of 15 acre-feet or greater and/or (2) all dams that are six feet or greater in height and create an impoundment capacity of 50 acre-feet or greater. Each of the six PL-566 dams within Pohick Creek meets one of the two requirements. The Fairfax County Department of Public Works and Environmental Services (DPWES) Dam Safety Program, under the authority of the Fairfax County Public Facilities Manual (PFM), is responsible for maintaining these dams.

1.5.2 Current Stormwater Controls

In addition to the flood control capacity of these lakes, the watershed also contains a wide variety of additional stormwater infrastructure and best management practices which track with the

watershed's development history. For example, in areas that developed earlier, stormwater management facilities, where present, consist primarily of dry detention basins designed to curb peak storm flows (quantity management). For areas that developed more recently, stormwater management facilities are more likely to include a water quality component, and the variety of facility types increases. Facilities found in these areas include wet detention facilities, underground chambers, infiltration devices, and wetlands.

In 2005, the County released the Stream Physical Assessment (SPA) report which documented the instream conditions of more than 800 stream miles. Both habitat assessment and some infrastructure assessment (if found instream) were captured. The infrastructure assessment was included to determine the impacts on streams from specific infrastructure and problem areas. For each watershed, a visual evaluation of infrastructure such as road culverts and stormwater outfalls was performed; any potential impacts to the stream were documented with an impact score. The impact scores ranged from zero to ten (10) or greater, with zero indicating no impact and ten indicating extreme conditions. An extreme condition would include such things as impervious encroachment near the stream severe erosional areas and large obstructions in the channel. See photo below for an example of stream bank erosion located along the South Run stream in Pohick Creek.

Figure 2: Pohick Creek Bank Erosion

In Pohick Creek a total of 871 inventory points were visually assessed. The most significant problems were related to four head cuts, two exposed utility lines and one pipe, which were each given an impact score of 10, with the two highest impacts both being deficient buffers, each scoring a five. Table 4 below identifies the full scoring for the Pohick Creek watershed.

Table 4: Pohick Creek Inventory Points (SPA, 2005)

Inventory Type	Impact Score												
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**>10**	**Total**
Deficient Buffers	0	0	18	26	64	48	14	9	4	0	0	N/A	183
Crossings	136	66	50	21	10	10	2	1	1	0	0	N/A	297
Ditches and Pipes	162	17	12	10	20	24	6	4	1	3	1	N/A	260
Erosion	0	0	0	0	2	7	15	13	8	2	0	N/A	47
Head Cut	0	0	1	0	4	4	2	0	0	1	4	N/A	16
Obstruction	8	7	5	12	12	5	0	0	0	1	0	N/A	50
Utility	0	0	0	1	4	4	5	1	1	0	2	0	18
Total	**306**	**90**	**86**	**70**	**116**	**102**	**44**	**28**	**15**	**7**	**7**	**0**	**871**

1.6 Stream Habitat

In 2001, the County released the Stream Protection Strategy Baseline (SPS) Study. This study documented the current stream conditions throughout the County using physical, chemical and biological evaluations. The County collected biological and habitat data from 114 stream sites and developed a ranking of overall quality for each of site. The rankings were based on the following four components of stream/watershed condition:

- Index of Biotic Integrity (IBI) incorporating 10 separate measures of benthic macroinvertebrate (insect) community integrity,
- General evaluation of the site's habitat features (including vegetation and instream features) as well as a more specific evaluation of 10 parameters,
- Fish taxa richness (number of distinct species present), and
- Overall percent impervious cover within a contributing drainage area

While numeric scores were given to each of the above individual components, a composite value was determined and a qualitative category of: Excellent, Good, Fair, Poor and Very Poor; was assigned to each of the sites.

The streams within Pohick Creek watershed represented some of the poorest and best quality watersheds in all of Fairfax County. The fish community rating and biological integrity rated as generally moderate and fair, respectively. The results for Pohick Creek watershed are summarized in the Table 5 below.

Table 5: Pohick Creek Biological Integrity Rating (2001 SPS)

Stream Name & Site Code	Environmental Variables			Composite
	Index of Biotic Integrity	Habitat	Fish Taxa	Site Condition Rating
Rabbit Branch 1 (PCRA01)	Fair	Fair	Low	Fair
Rabbit Branch 2 (PCRA02)	Fair	Poor	High	Fair
Sideburn Branch (PCSI01)	Very Poor	Poor	High	Very Poor
Pohick Creek 1 (PCPC01)	Fair	Fair	High	Fair
Pohick Creek 2 (PCPC02)	Poor	Fair	Low	Poor
South Run 1 (PCSR01)	Fair	Good	Low	Good
South Run 2 (PCSR02)	Poor	Poor	Moderate	Fair
Middle Run (PCMI01)	Fair	Fair	Moderate	Good
Pohick Creek 3 (PCPC03)	Poor	Poor	Moderate	Poor
South Run 3 (PCSR03)	Fair	Fair	Moderate	Excellent
Pohick Creek 4 (PCPC04)	Poor	Poor	High	Good

Following up from the 2001 SPS, the County released the SPA study which, in addition to identifying stormwater structural inventory documented the visual habitat assessments of the stream conditions throughout the County. Using information based on habitat conditions, impacts on streams, general stream characteristics and geomorphic classification, a length-weighted total habitat score was calculated for each watershed and categorized into one of five habitat assessment rating categories:

- Excellent (142-168): Minimally impaired habitat with a relatively high potential for supporting a diverse biological community
- Good (114-141): Slightly degraded habitat with a moderate potential for supporting a diverse biological community
- Fair (87-113): Moderately degraded habitat with a fair potential for supporting a diverse biological community
- Poor (59-86): Significantly degraded habitat with a low potential for supporting a diverse biological community
- Very poor (32-58): Severely degraded habitat with little potential for supporting a diverse biological community

Overall the County stream habitats were rated as 'fair' with scores ranging from 32 to 168 out of a possible 200 with an average length-weight total habitat score of 104. Pohick Creek watershed had an average length-weight total habitat score of 95 slighly below the County average. Approximately two miles of stream were categorized as having "very poor" habitat conditions, 20 miles as "poor", 37 miles as "fair", and ten miles as "good". Table 6 below shows Pohick Creek stream conditions.

Table 6: Habitat Assessment Summary (2005 SPA)

Stream Habitat Condition	Linear Feet	Percent of Stream
Excellent	0	00.00%
Good	53,618	14.63%
Fair	197,539	53.88%
Poor	102,945	28.08%
Very Poor	12,514	03.41%
Total	**366,615**	**100%**

1.7 Stream Water Quality

In addition to collecting and analyzing biological data, the 2001 SPS classified each subwatershed into management categories which outline key strategies and goals for future stream restoration and protection. Three management categories were established based on overall stream rankings and projected development within the watersheds. These categories were developed as management planning tools. Table 7 below identifies the management categories and the associated goals.

Table 7: Management Category (SPS, 2001)

Management Category	Goal
Watershed Protection Areas	Preserve the quality rating of the streams
Watershed Restoration Level I (WRL I)	Take measures to re-establish a healthy biological community
Watershed Restoration Level II (WRL II)	Maintain areas to prevent further degradation, improve water quality to comply with Chesapeake Bay initiatives & TMDL regulations

Since Pohick Creek watershed contains the range of biological and habitat conditions from high to low, areas of Pohick range from Watershed Protection Areas to Watershed Restoration Level II (WRL II). The majority of Middle Run and Lower South Run watershed management areas fall under WMA and are considered the lowest levels of degradation in the watershed. Excluding a small portion of Upper South Run and Middle South Run watershed management areas, the remainder of the watershed is classified as WRL II.

1.7.1 Resource Protection Areas

As one of many measures used to protect stream water quality, the County adopted the Chesapeake Bay Preservation Ordinance, which imposes restrictions on development for any land that lies within a Resource Protection Area (RPA). Resource protection areas are buffers which protect sensitive areas adjacent to or near the shorelines of streams, rivers and other waterways from the excessive influx of pollutants. The sensitive areas include tidal and nontidal wetlands, tidal shorelines, floodplains and perennial streams (waters flowing year round). As **Map 1.4** indicates a majority, or more than 75% (134 of the 180 miles) of the streams within the Pohick Creek watershed lie within a RPA. (County GIS, 2008)

1.7.2 Impaired Waters

In 1972, the Clean Water Act was established to provide a regulatory framework to protect the waters of the U.S. Under the Clean Water Act, water quality standards were developed to protect the public health and enhance the quality of surface waters. To meet these standards, *designated uses* have been developed to define the water quality needed to support each usage. In Virginia, "all State waters, including wetlands, are designated for the following uses: recreational uses, e.g., swimming and boating; the propagation and growth of a balanced, indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources, e.g., fish and shellfish" (2007, 9 VAC 25-260 Virginia Water Quality Standards).

To meet these standards, the county and the VDEQ regularly monitor water quality at various locations in the watershed. These sampling data reflect that Pohick Creek watershed has some of the best and worst water quality in the County; this is due in part to the multiple large impoundments located throughout the watershed. While many streams in the Pohick Creek watershed are considered "fair", areas further downstream of the impoundments experience high levels of E coli. See **Map 1.5** and Table 8 below for complete impairments.

Table 8: Pohick Creek Impaired Waters

	Aquatic Life	**Fish Consumption**		**Recreation**		
	Submerged Aquatic Plants	Benzo[k] fluor-anthene	PCB in Fish Tissue	E. coli	Fecal Coliform	Total
Pohick Bay Estuarine	0.6		0.6		0.6	0.6 mi^2
Pohick Bay Estuarine	0.3		0.3		0.3	0.3 mi^2

	Aquatic Life	**Fish Consumption**		**Recreation**		
	Submerged Aquatic Plants	Benzo[k] fluor-anthene	PCB in Fish Tissue	E. coli	Fecal Coliform	Total
Pohick Creek Riverine		3.2	3.2	3.2		3.2 mi
Pohick Creek Riverine				1.5		1.5 mi

(Annual Report, 2006)

Stream conditions are assessed through bacteria, physical, chemical and biological sampling at multiple monitoring stations through the County's stream monitoring program. These monitoring stations are randomly selected each year throughout the county to capture water quality and biological health data for various drainage areas and stream sizes. In 2006, the County had four monitoring stations located within the Pohick Creek watershed. See Table 9 below for monitoring results. While the majority of upper Pohick Creek is considered fair, portions of lower Pohick Creek was impaired for aquatic plants, PBC in fish, and E. coli (Annual Report, 2006).

Table 9: Pohick Creek Monitoring Results*

Pohick Creek Watershed				**Benthics**		**Fish**		**Bacteria**
WMA	Site ID	Stream Order	Drainage Area (mi)	IBI	Rating	IBI	Rating	Sample Exceeding
Middle	PC0501	4	15.25	37	Poor	29	Fair	0 of 6
Upper	PC0502	4	8.04	51	Fair	29	Fair	2 of 6
Upper	PC0503	1	0.14	18	Very Poor	N/A		3 of 4
Upper	PC0504	1	0.14	14	Very Poor	N/A		1 of 4

(Annual Report, 2006 * monitoring results for 2005 sample year)

Section 303(d) of the Clean Water Act requires states to develop a list of impaired waters, commonly referred to as the "303(d) list." If a water body fails to meet the numeric or narrative criteria in a water quality standard or does not achieve its designated use, then a water body is considered impaired. Every two years, states are required to submit a list of impaired waters to EPA for approval.

Over the past few years, Pohick Creek has experienced an increase in the number of impaired waterbodies. By 2006, Pohick had four impaired waterbodies, two of which have been listed on EPA's 303(d) list of impaired waterbodies.

In 2006, Virginia's Department of Environmental Quality (DEQ) developed an Impaired Waters list which was released to the public in draft form for a 30-day comment period. After receiving and reviewing comments, the list was revised and resubmitted to EPA. The following streams within Pohick Creek watershed are considered Category 5 waters, or waters requiring a Total Maximum Daily Load (TMDL) Study. A TMDL is designed to identify the amount of pollution a specific stream can receive and still meet its designated use. See Table 10 below for Category 5

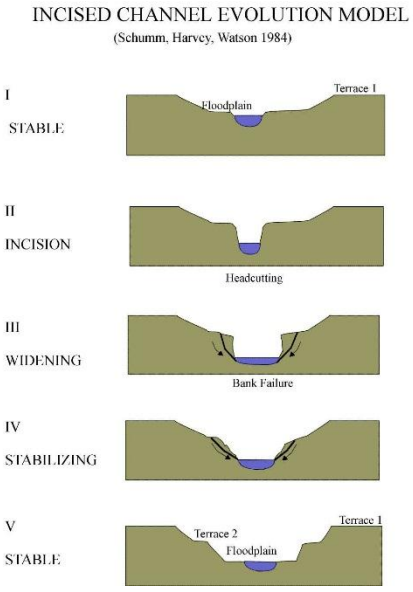
waters. Information is currently being compiled capturing data from the past two years (through 2008) and should be released for public review in early 2009.

Table 10: Pohick Creek TMDL (2006 VDEQ Virginia 305(b)/303(d) list)

TMDL Group ID	Use	Impairment	Size	TMDL Development Date
Pohick Creek 00799	Fish Consumption	Total Size Benzo[k]fluoranthene	3.20 River miles	2014
Pohick Creek 60046	Recreation	Total Size Escherichia coli	4.72 River miles	2018

1.8 Stream Geomorphology

Over time, stream morphology naturally evolves and changes. These natural dynamics can be drastically affected by human land use changes. To identify and track these physical changes, the Channel Evolution Model (CEM) (Schumm et al. 1984), was developed in the early 1980s. Based on visual observations, the CEM classifies a stream evolution into five channel stages. Figure below provides a visual representation of the steam evolution. A Stage I stream/channel is characterized as the most stable system in the group with a well developed flow and strong vegetation coverage – this is a stream in which the watershed has never been disturbed from its naturally-formed character. As flow rates increase (from land use changes), down-cutting occurs in the channel bottom creating a Stage II channel – which is typified by a very narrow, deeply incised channel.



Heavy erosion begins to widen the channel bottom until stream bank failure occurs. This is a Stage III channel, which is the most unstable and typically generates the most issues. As stream bank erosion begins to decrease and the channel begins to re-stabilize according to the new flow regime, the channel is classified as a Stage IV. Finally at Stage V, the channel returns to a stable system with two floodplain terraces. Once a stream has reached this "dynamic equilibrium" it will remain in this stage until the watershed characteristics are once again changed (i.e.: increase in storm flows due to increased runoff from greater impervious area creation). This process can take decades. If the land uses are continuously changing, then the stream never quite reaches equilibrium and will continue to respond to changes in the flow (runoff) regime.

Using the CEM, nearly 75% of Pohick Creek's stream channels are classified as Stage III. Stage III is generally characterized as unstable, showing erosion signs of widening and deepening (in response to altered hydrologic characteristics of the watershed – usually a result of changing land uses). A small percentage of Pohick Creek' stream channels are classified as Stage II, indicating

incising head cuts (vertical erosion) that produces harmful amounts of instream sediments and could ultimately lead into Stage III. The remaining streams are classified Stage IV, which is much more stable and easily recognized by its two terraced stream banks. See Table 11 for CEM results.

Table 11 : Pohick Creek CEM Results (SPA, 2005)

CEM Stage	Linear Length of Stream (ft)	Linear Length of Stream (%)
Stage I	0	0
Stage II	16,965	5
Stage III	264,729	74
Stage IV	76,533	21
Stage V	0	0
Total	**358,226**	**100**

1.9 Concerns Identified By the Public

In the late 1970's the County began documenting and logging publicly reported drainage related complaints. Today, the County is still documenting and logging stormwater management complaints in a Microsoft Access database. This database allows the County to identify areas that may require additional County attention and helps prioritize Capital improvement projects. The complaints database can also help the County identify target areas for public outreach projects. Over the years, Pohick Creek watershed has experienced 2,834 complaints. The primary complaints were erosion control and damage to infrastructure such as cave-ins/sinkholes. Many other complaints related to either tree/brush related issues or flooding or standing water.

Chapter 2:
Watershed Management Area Characterization

2.0WATERSHED MANAGEMENT AREA CHARACTERIZATION

2.1 Introduction

The Environmental Protection Agency (EPA) considers, a **watershed** as "the area in which all water, sediments, and dissolved materials flow or drain from the land into a common river, lake, ocean, or other body of water (EPA, http://www.epa.gov/owow/watershed/what.html)". Watersheds are also known as drainage basins and can be defined by the topography of the land. The Chesapeake Bay watershed which spans more than 64,000 square miles and falls within Virginia, West Virginia, Maryland, Delaware, New York, Pennsylvania, and the entire District of Columbia and is one of the largest watersheds in the county. Each State has a unique approach to managing their smaller watersheds within the Chesapeake Bay. The Pohick Creek watershed is located in the Chesapeake Bay watershed and is one of 30 major watersheds within Fairfax County.

Consisting of more than 36 square miles, the Pohick Creek watershed is one of the larger watersheds in the County. Based on the terrain, the watershed is naturally divided into ten (10) smaller **watershed management areas** (WMAs). WMAs typically consist of a small area approximately 4 square miles which drains to a specific stream or tributary. Table 12 below identifies the 10 WMAs within Pohick Creek. Refer to **Map 2.1-1** for the locations of each WMA within Pohick Creek. For Fairfax County planning and management purposes, WMA are further subdivided into smaller **subwatersheds,** typically 100-300 acres. Refer to **Map 2.1-2** for the locations of each of the subwatersheds within Pohick Creek. These areas can be used to identify specific projects or opportunities to enhance the overall stream conditions, as well as serving as the basic units for watershed modeling and other evaluations.

Table 12: Pohick Creek Watershed Management Areas

WMA:		**Sq. Miles**	**Acres**
1	Pohick - Rabbit Branch	3.95	2524.90
2	Pohick - Sideburn Branch	3.61	2307.90
3	Pohick - Upper South Run	3.19	2040.74
4	Pohick - Middle South Run	2.95	1889.12
5	Pohick - Lower South Run	3.04	1947.69
6	Pohick - Middle Run	3.97	2540.17
7	Pohick - Upper	4.85	3104.70
8	Pohick - Middle	4.71	3014.60
9	Pohick - Lower	3.67	2346.46
10	Pohick - Potomac	2.39	1532.42
Total		**36.33**	**23,248.71**

2.1.1 Tributaries /Streams

Pohick Creek watershed contains more than 180 miles of stream within the 10 watershed management areas. Included in the 10 watershed management areas are 13 named tributaries. A tributary is considered a stream or a river that flows into a mainstem or a larger river. In addition

to the 13 named tributaries, there are numerous unnamed tributaries; however the 13 named tributaries collect the majority of the water for the watershed.

In the northern portions of the watershed two main tributaries converge into Pohick Creek stream, the mainstem for the watershed. The Rabbit Branch tributary begins in the highly developed areas of George Mason University and Fairfax City while Sideburn Branch tributary begins in the highly developed area southwest of George Mason University. These two tributaries are considered Pohick Creek's main contributories. The Middle Run tributary drains Huntsman Lake and moderately-developed residential areas. The South Run tributary drains Burke Lake and Lake Mercer, as well as the low-density southwestern portion of the watershed. Both Middle Run and South Run contribute substantially to the mainstem's (Pohick Creek) volume. Hydraulic and hydrological modeling results of the streams can be found in Section 2.4

2.1.2 Perennial Streams and Resource Protection Area

While Pohick Creek has more than 180 miles of streams, only 66% or 121 miles are considered perennial streams. A perennial stream can be defined as a stream which has continuous flow in its channel year round. The remaining streams are either intermittent streams which flow during normal rainfall and can continue to flow for a few weeks or months or ephemeral streams which typically only flow for only a few hours during and after a rain event. Many of the streams in the Pohick Creek watershed are protected under the Chesapeake Bay Preservation Act. Under the Act, Resource Protection Area (RPAs) were established to help protect perennial streams from degradation and to reduce pollutants reaching the Chesapeake Bay. Table 13 below illustrates the break out of stream miles per watershed management area of perennial streams and RPAs. Since the County adoption of the Chesapeake Bay Preservation Ordinance in 1993, throughout the years, additional RPA areas have been identified and added to the County inventory and are reflected in the table below.

Table 13: WMA Perennial & RPA streams*

WMA	Total Stream Miles	Perennial Stream Miles	Stream miles within 1993 RPA	Added Stream miles within 2003 RPA	Added Stream miles within 2005 RPA
Rabbit Branch	15.50	11.68	7.78	5.37	0.04
Sideburn Branch	15.40	9.43	4.51	6.64	0.04
Upper South Run	12.90	5.01	1.81	4.31	0.00
Middle South Run	16.06	8.64	5.12	4.92	0.07
Lower South Run	23.81	15.15	13.77	3.88	0.07
Middle Run	20.23	11.33	8.66	4.99	0.32
Upper	21.48	14.23	10.12	6.75	0.23
Middle	29.84	22.61	19.24	5.21	0.56
Lower	16.28	12.47	10.60	1.41	0.25
Potomac	11.30	10.60	6.05	1.36	0.00
Total	**182.80**	**121.15**	**87.65**	**44.84**	**1.58**

*Stream miles: FFX Co. GIS data layers

2.2 Current Conditions

Field reconnaissance was conducted to update/supplement existing Fairfax County geographic data so current field conditions would be accurately represented. Once this data was acquired, spatial analysis was performed to characterize county watersheds as they currently exist using the county's geographic information system (GIS). The reconnaissance effort included the identification of pollution sources, current stormwater management and potential restoration opportunities across the various watersheds.

Field maps, photos and data forms were used to capture current watershed conditions. Below provides an example of one of the field maps used to identify unique issues within the WMA.

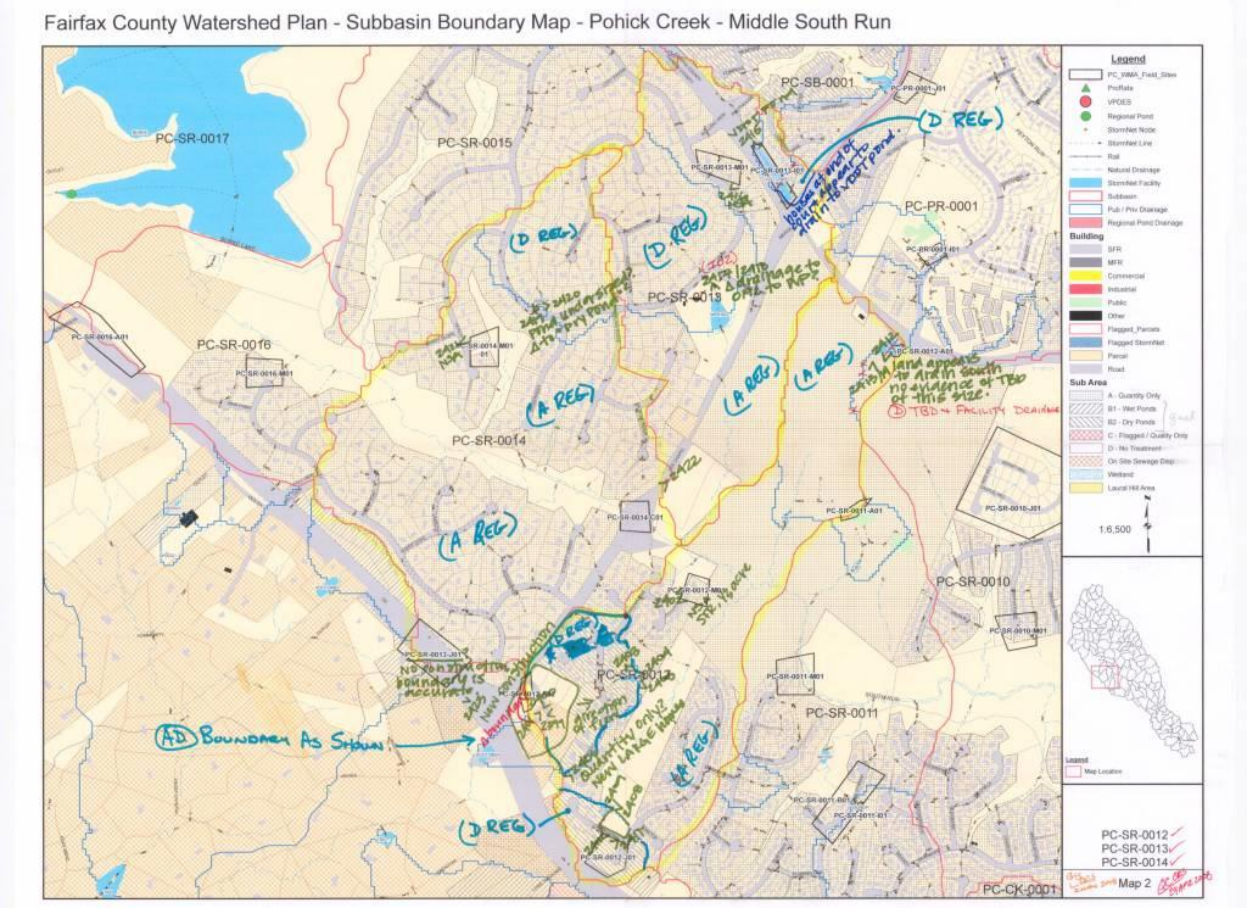


Figure 3: Sample of Field Reconnaissance Map

Generally, Pohick Creek watershed is characterized by residential land uses, the most prevalent of which appears as single family detached housing units. Commercial and limited industrial uses are also found in the watershed, primarily centered on the service industries that support residential development, such as shopping centers, transit facilities, and schools. Although the watershed was primarily developed during the period between the early 1960's and the mid 1980's, limited development in the watershed has continued into the present day. Several areas within the watershed demonstrate significant, redevelopment efforts. These areas include portions of George

Mason University in the northern headwaters, to portions of Fort Belvoir and other federally managed lands in close proximity, to a large redevelopment project at Laurel Hill in the watershed's southern region.

The Pohick Creek watershed contains six flood control lakes, built by the United States Department of Agriculture, Natural Resources Conservation Service under the authority of Public Law 83-566 (PL-566) as part of the Pohick Creek Watershed Protection and Flood Prevention Project, around which substantial residential property development has taken place. The western portion of the watershed contains Burke Lake Park, an 888 acre park built around a 218 acre recreational lake, Burke Lake. Additional infrastructure serving the Pohick Creek watershed includes a number of major transportation arteries in Fairfax County, including the Fairfax County Parkway, which bisects the watershed, and Interstate 95, running across the southern, downstream portion of the watershed.

A description of the findings in each WMA is listed in the following sections including field reconnaissance findings, existing and future land use, stream conditions, and stormwater infrastructure. Each WMA was examined at the subwatershed level in order to capture as much data as possible.

2.2.1 Rabbit Branch

Field Reconnaissance

The Rabbit Branch WMA is located in the northern portion of the Pohick Creek watershed and contains a total of 15 subwatersheds. The Rabbit Branch WMA includes several major arterial roadways, including Braddock Road, which bisects the WMA in the northern portion and Guinea Road, which forms a portion of the WMA's southern and eastern border. The upper reaches of the Rabbit Branch WMA, north of Braddock Road, include a portion of the City of Fairfax and a portion of the George Mason University campus. While both the City and the University operate independent of Fairfax County, each manages property in the upstream reaches of the Rabbit Branch WMA, and as such, impacts the watershed. George Mason University's campus includes multiple institutional structures with associated impervious areas (sidewalks, parking lots, etc). The City of Fairfax's portion of the WMA is characterized by intensely developed residential and associated service industry development.

The Fairfax County portion of the Rabbit Branch WMA is comprised primarily of single family detached residential properties. The majority of the observed single family detached dwellings were constructed on estimated ¼ acre lots configured in multiple subdivisions, including some larger subdivisions such as Kings Park West, the Twinbrook area, and the Reserve at Martin's Point. The residential development, while primarily featuring ¼ acre lots sizes, proves fairly dense as many of the subdivision design layouts include street patterns terminating in cul-de-sacs (i.e. not as many through streets). The age of development in this WMA ranges from an estimated 40 years old up to new construction (within the past two to three years), including some evidence of recent infill development. Land cover consists primarily of impervious surface associated with residential development (i.e. rooftops, streets and driveways, sidewalks, etc.) and associated landscaping, including managed turf. Curb and gutter on streets was observed as almost universally present in the Rabbit Branch WMA.

The Rabbit Branch WMA includes Lake Royal, a PL-566 flood control structure completed in 1977, as well as several stream valley parks, including Pohick Stream Valley Park and Crooked Creek Park. Observed stormwater management facilities in the Rabbit Branch WMA consist primarily of dry detention basins, typically designed for stormwater volume control and not for water quality treatment. Among the non-residential land uses observed, Rabbit Branch contains some commercial developments, primarily associated with industries/activities supporting residential development, including the Twinbrook shopping center. The most significant institutional facilities observed in this WMA is a southern portion of the George Mason University campus; Robinson Secondary School to the west along Sideburn Road, and Laurel Ridge Elementary School.

Impervious Areas and Treatment Types

Increased impervious surfaces can result in channel erosion and downstream degradation. Water discharging from an impervious surface does not have time to slow down or infiltrate into the ground. This increases the quantity and velocity of stormwater runoff. This increased discharge into receiving waters begins to degrade the banks of the streams and instream habitat. It has been shown that levels of 10-20% impervious surface can significantly reduce the overall health of a

stream (Annual Report, 2005). As one method of preventing stream degradation, stormwater management detention facilities are used throughout Fairfax County. By utilizing land use data and the contributing areas which drain to these stormwater management detention facilities, the County can identify areas of impervious surfaces and trace the flow path of the resulting discharges and quantify the treatment provided by the specific type of stormwater management detention facility. Below are the four primary stormwater management facility types and treatment provided.

- *Quantity* -Detention storage facilities that only provide quantity control
- *Quality*: -Detention storage facilities that only provide quality control
- *Quantity & Quality*:-Detention storage facilities that provide quantity + quality control
- *None*: -Areas that do not drain to detention facilities (uncontrolled runoff/no treatment), however some of these areas also are undeveloped open space and parks and therefore were not designed to capture and treat rainfall runoff.

Utilizing the Technical Memorandum 3 guidance document, Table 14 below identifies the current and future impervious surface areas based on the existing and future land use conditions for Rabbit Branch as well as the associated treatment types. See **Map 2.2.1-1** for existing and future land use for Rabbit Branch. As expected Rabbit Branch WMA is fully developed and contains a large percentage of impervious areas. In addition, much of stormwater management treatment consists of quantity only which is consistent with older development.

Table 14: Rabbit Branch Impervious Areas and Treatment Types

WMA Name	Percent Impervious				Current Treatment Types			
	Current Condition		Ultimate Condition		Quantity	Quality	Quantity/ Quality	None
	(acres)	*%*	(acres)	*%*	(acres)	(acres)	(acres)	(acres)
Rabbit Branch	701.93	*27.80*	707.03	*28.00*	107.53	14.12	90.43	2312.82

Stormwater Infrastructure

During the watershed's development, a series of flood control lakes were constructed in the watershed between 1970 and 1985 under the federal Watershed Protection and Flood Prevention Act (PL 566) of 1954. These lakes (Lake Royal, Lake Barton, Woodglen Lake, Lake Braddock, Lake Mercer, and Huntsman Lake) all provide significant flood control capacity in residentially developed areas.

Map 2.2.1-2 demonstrates the observed stormwater infrastructure conditions in the Rabbit Branch WMA. Stormwater infrastructure consists primarily of curb and gutter stormwater collection leading to a piped network of storm drains discharging to either dry detention basins or directly into Rabbit Branch and its associated stream valleys and tributaries on the way downstream to Lake Royal. The Rabbit Branch WMA contains approximately 25 dry detention facilities designed to manage stormwater quantity. In addition, the WMA contains two underground chambers, which store stormwater runoff in underground vaults and release the water at a slower pace (much like the peak flow attenuation employed in dry detention basins) and one infiltration trench, which is a stormwater quality component designed to allow for the infiltration of

stormwater into the ground rather than having the stormwater runoff directed to a control structure for treatment.

Stream Conditions

The Stream Conditions **Map 2.2.1-3** denotes the generally observed stream conditions as documented in the 2005 SPA and through additional, windshield level field reconnaissance performed for this study. The Stream Conditions Map demonstrates the general conditions of the main stem streams and tributaries in the WMA along with a series of features that typically impact stream condition, including stream channel erosion, channel widening, stream buffer condition, discharge pipe and ditch impacts, and utility and road crossing impacts.

In the Rabbit Branch WMA, the most prevalent stream condition features noted include disturbed stream buffers and stream channel erosion and/or widening. In addition, pipe discharge and ditch discharge into the WMA's streams have a demonstrated impact as well, as these pipes and ditches discharge stormwater runoff directly into the streams in many instances, contributing to the observed widening and erosive conditions. Utility and crossing impacts in the Rabbit Branch WMA are generally minor. Instances of demonstrated stream head cutting, or an abrupt vertical drop in the bed of a stream channel that demonstrates active erosion (NC DWQ, 2005), were limited, with two instances recorded in the south western portion of the WMA at points where streams made significant turns.

2.2.2 Sideburn Branch

Field Reconnaissance

The Sideburn Branch WMA is located in the north western portion of the Pohick Creek watershed and contains a total of 16 subwatersheds. The Sideburn Branch WMA is bordered on the west by Ox Road (Route 123) and is bisected in the southern portion by Burke Centre Parkway, with the Fairfax County Parkway forming a portion of the WMA's southern boundary. The upper reaches of the Sideburn Branch WMA include a portion of the intersection Route 123 and Braddock Road, including the University Mall development. The Sideburn Branch WMA is comprised primarily of single family detached residential properties. While the majority of the observed single family detached dwellings were constructed on estimated ¼ to ½ acre lots, the residential development in this WMA is largely characterized by street patterns terminating in cul-de-sacs (i.e. not as many through streets). The Sideburn Branch WMA includes the Burke Centre subdivision, which also includes the Burke Centre Conservancy, which manages several stream valley parks in the area. The age of development in this WMA ranges from an estimated 30 plus years up to approximately 10 to 15 years. Very little evidence of recent infill was observed. Land cover consists primarily of impervious surface associated with residential development (i.e. rooftops, streets and driveways, sidewalks, etc.) and associated landscaping, including managed turf. Curb and gutter was almost universally observed in this area.

The Sideburn Branch WMA includes two PL-566 flood control structures built in the 1970's and early 1980's; Lake Barton, built in 1978 and Woodglen Lake, completed in 1981. In addition, the Sideburn Branch WMA includes several stream valley parks, including a portion of the Pohick Creek Stream Valley Park and the Woodglen Lake Park. Observed stormwater management facilities in the Sideburn Branch WMA consist primarily of dry detention basins. Among the non-residential land uses observed, Sideburn Branch contains several commercial developments, primarily associated with industries/activities supporting residential development, including the University Mall, just outside George Mason University, as well as the Burke Centre Shopping Center. The most significant institutional facilities observed in this WMA are a Virginia Railway Express (VRE) parking facility that was undergoing an expansion in spring 2008; Bonnie Brae Elementary School; and Terra Centre Elementary School.

Impervious Areas and Treatment Types

Increased impervious surfaces can result in channel erosion and downstream degradation. Water discharging from an impervious surface does not have time to slow down or infiltrate into the ground. This increases the quantity and velocity of stormwater runoff. This increased discharge into receiving waters begins to degrade the banks of the streams and instream habitat. It has been shown that levels of 10-20% impervious surface can significantly reduce the overall health of a stream (Annual Report, 2005). As one method of preventing stream degradation, stormwater management detention facilities are used throughout Fairfax County. By utilizing land use data and the contributing areas which drain to these stormwater management detention facilities, the County can identify areas of impervious surfaces and trace the flow path of the resulting discharges and quantify the treatment provided by the specific type of stormwater management detention facility. Below are the four primary stormwater management facility types and treatment provided.

- *Quantity* -Detention storage facilities that only provide quantity control
- *Quality*: -Detention storage facilities that only provide quality control
- *Quantity & Quality*:-Detention storage facilities that provide quantity + quality control
- *None*: -Areas that do not drain to detention facilities (uncontrolled runoff/no treatment), however some of these areas also are undeveloped open space and parks and therefore were not designed to capture and treat rainfall runoff.

Utilizing the Technical Memorandum 3 guidance document, Table 15 below identifies the current and future impervious surface areas based on the existing and future land use conditions for Sideburn Branch as well as the associated treatment types. See **Map 2.2.2-1** for existing and future land use for Sideburn Branch. As expected Sideburn Branch WMA is fully developed and contains a large percentage of impervious areas. In addition, much of stormwater management treatment consists of quantity only which is consistent with older development.

Table 15: Sideburn Branch Impervious Areas and Treatment Types

WMA Name	Percent Impervious				Current Treatment Types			
	Current Condition		Ultimate Condition		Quantity	Quality	Quantity/ Quality	None
	(acres)	%	(acres)	%	(acres)	(acres)	(acres)	(acres)
Sideburn Branch	756.91	*32.61*	757.49	*32.63*	331.37	11.37	78.70	1899.83

Stormwater Infrastructure

During the watershed's development, a series of flood control lakes were constructed in the watershed between 1970 and 1985 under the federal Watershed Protection and Flood Prevention Act (PL 566) of 1954. These lakes (Lake Royal, Lake Barton, Woodglen Lake, Lake Braddock, Lake Mercer and Huntsman Lake) all provide significant flood control capacity in residentially developed areas.

Map 2.2.2-2 demonstrates the observed stormwater infrastructure conditions in the Sideburn Branch WMA. The upstream portions of the WMA contain stormwater infrastructure consisting primarily of curb and gutter stormwater collection leading to a piped network of storm drains discharging directly into the streams and tributaries leading to Woodglen Lake. Only five stormwater management facilities are evident upstream of Woodglen Lake, including three dry detention basins, one underground chamber, and one sand filter, which is a type of underground device that provides water quality treatment along with quantity control.

The observed stormwater infrastructure condition upstream of Lake Barton is similar to that of Woodglen Lake in that the upstream portions of the Lake Barton area contain stormwater infrastructure consisting primarily of curb and gutter stormwater collection leading to a piped network of storm drains discharging directly into the streams and tributaries leading the lake. Only two confirmed stormwater management facilities, both dry detention basins, exist in the upstream areas of Lake Barton.

Moving downstream to the east, the Sideburn Branch WMA contains approximately 15 dry detention facilities designed to manage stormwater quantity. In addition, the downstream portions of the WMA contain one infiltration trench, which is a stormwater quality component designed to allow for the infiltration of stormwater into the ground rather than having the stormwater runoff directed to a control structure for treament; one rooftop detention device, which essentially stores rainwater on the roof of a structure and allows for a slower release; and one sand filter.

Stream Conditions

The Stream Conditions **Map 2.2.2-3** denotes the generally observed stream conditions as documented in the 2005 SPA and through additional, windshield level field reconnaissance performed for this study. The Stream Conditions Map demonstrates the general conditions of the main stem streams and tributaries in the WMA along with a series of features that typically impact stream condition, including stream channel erosion, channel widening, stream buffer condition, discharge pipe and ditch impacts, and utility and road crossing impacts.

In the Sideburn Branch WMA, the most prevalent stream condition features noted include disturbed stream buffers and stream channel erosion and/or widening. Upstream of Woodglen Lake, significant channel erosion has been documented, along with subsequent channel widening. Buffer disturbances and channel widening conditions have also been documented upstream of Lake Barton. In addition, pipe discharge and ditch discharge into the WMA's streams have a demonstrated impact as well, as these pipes and ditches discharge stormwater runoff directly into the streams in many instances, contributing to the observed widening and erosive conditions. Utility and crossing impacts in the Sideburn Branch WMA are generally minor, with some notable exceptions for significant utility impacts in the downstream tributaries in the eastern portion of the WMA. Instances of demonstrated stream head cutting, or an abrupt vertical drop in the bed of a stream channel that demonstrates active erosion (NC DWQ, 2005), were limited, with one example recorded in the eastern portion of the WMA at a significant turn in the Sideburn Branch tributary. Finally, one potential dump site obstruction was noted at the downstream confluence of the Lake Barton discharge point and the main stem of Sideburn Branch

2.2.3 Upper South Run

Field Reconnaissance

The Upper South Run WMA is located in the western portion of the Pohick Creek watershed and contains a total of 11 subwatersheds. The Upper South Run WMA is roughly bounded on the west and south by Ox Road (Route 123) and to the north by the Fairfax County Parkway, which also bisects the WMA in the northeastern portion. The Upper South Run WMA is comprised primarily of single family detached residential properties. The majority of the observed single family detached dwellings were constructed on estimated ¼ to one acre lots, with the denser developments typically appearing in the northern and northeastern portions of the WMA (north of the Fairfax County Parkway). The majority of the residential development in the WMA has been constructed on larger lots (i.e. estate residential). The age of development in this WMA ranges from an estimated 20 to 25 years old (1980's) up to approximately 10 to 15 years old (1990's) with little evidence of recent infill development. Land cover consists primarily of impervious surface associated with residential development (i.e. rooftops, streets and driveways, sidewalks, etc.) and associated landscaping, including managed turf for the larger residential lots. Curb and gutter for streets were intermittently present in the WMA.

The Upper South Run WMA includes Burke Lake, a 218 acre recreational lake that is managed by the Virginia Department of Game and Inland Fisheries (DGIF) and around which the 888 acre Burke Lake Park has been developed. Burke Lake was constructed in the early 1960's for recreational uses, primarily fishing. Burke Lake Park is managed cooperatively by DGIF and the Fairfax County Park Authority. The Upper South Run WMA also includes South Run Stream Valley Park, adjacent to the Fairfax County Parkway. Observed stormwater management facilities in the Upper South Run WMA consist primarily of dry detention basins, typically designed for stormwater volume control and not for water quality treatment. Upper South Run contains some non-residential land uses, including limited commercial development, primarily associated with industries/activities supporting residential development. The most significant institutional facilities observed in this WMA are Burke Lake Park and the Fairfax Baptist Temple and Academy at the intersection of Burke Lake Road and the Fairfax County Parkway.

Impervious Areas and Treatment Types

Increased impervious surfaces can result in channel erosion and downstream degradation. Water discharging from an impervious surface does not have time to slow down or infiltrate into the ground. This increases the quantity and velocity of stormwater runoff. This increased discharge into receiving waters begins to degrade the banks of the streams and instream habitat. It has been shown that levels of 10-20% impervious surface can significantly reduce the overall health of a stream (Annual Report, 2005). As one method of preventing stream degradation, stormwater management detention facilities are used throughout Fairfax County. By utilizing land use data and the contributing areas which drain to these stormwater management detention facilities, the County can identify areas of impervious surfaces and trace the flow path of the resulting discharges and quantify the treatment provided by the specific type of stormwater management detention facility. Below are the four primary stormwater management facility types and treatment provided.

- *Quantity* -Detention storage facilities that only provide quantity control
- *Quality*: -Detention storage facilities that only provide quality control
- *Quantity & Quality*:-Detention storage facilities that provide quantity + quality control
- *None*: -Areas that do not drain to detention facilities (uncontrolled runoff/no treatment, however some of these areas also are undeveloped open space and parks and therefore were not designed to capture and treat rainfall runoff.)

Utilizing the Technical Memorandum 3 guidance document, Table 16 below identifies the current and future impervious surface areas based on the existing and future land use conditions for Upper South Run as well as the associated treatment types. See **Map 2.2.3-1** for existing and future land use for Upper South Run. As expected Upper South Run WMA has a relatively lower percentage of impervious area than the majority of Pohick Creek. This is due to the development of Burke Lake and associated surround parklands.

Table 16: Upper South Run Impervious Areas and Treatment Types

WMA Name	Percent Impervious				Current Treatment Types			
	Current Condition		Ultimate Condition		Quantity	Quality	Quantity/ Quality	None
	(acres)	*%*	(acres)	%	(acres)	(acres)	(acres)	(acres)
Upper South Run	219.39	*10.82*	227.48	*11.22*	133.49	112.71	103.03	1678.13

Stormwater Infrastructure

During the watershed's development, a series of flood control lakes were constructed in the watershed between 1970 and 1985 under the federal Watershed Protection and Flood Prevention Act (PL 566) of 1954. These lakes (Lake Royal, Lake Barton, Woodglen Lake, Lake Braddock, Lake Mercer and Huntsman Lake) all provide significant flood control capacity in residentially developed areas. In addition to the PL 566 facilities, the Pohick Creek watershed also includes Burke Lake, a 218 acre recreational lake that serves as the centerpiece of Burke Lake Park.

Map 2.2.3-2 demonstrates the observed stormwater infrastructure conditions in the Upper South Run WMA. Stormwater infrastructure consists primarily of open channel and overland stormwater collection leading to a limited upstream pipe network of storm drains discharging to either dry detention basins or directly into Upper South Run and its associated stream valleys and tributaries on the way downstream to Burke Lake. Many of the tributaries leading to Burke Lake directly are unimproved. The Upper South Run WMA contains approximately 11 dry detention facilities designed to manage stormwater quantity. In addition, the WMA contains two wet retention basins, which often serve to treat both water quantity and quality, and two infiltration trenches, which is a stormwater quality component designed to allow for the infiltration of stormwater into the ground rather than having the stormwater runoff directed to a control structure for treament. Roughly half of the stormwater management facilities observed in the Upper South Run WMA are located north of the Fairfax County Parkway in the more densely developed areas of the WMA

Stream Conditions

The Stream Conditions **Map 2.2.3-3** denotes the generally observed stream conditions as documented in the 2005 SPA and through additional, windshield level field reconnaissance

performed for this study. The Stream Conditions Map demonstrates the general conditions of the main stem streams and tributaries in the WMA along with a series of features that typically impact stream condition, including stream channel erosion, channel widening, stream buffer condition, discharge pipe and ditch impacts, and utility and road crossing impacts.

In the Upper South Run WMA, the most prevalent stream condition features noted include disturbed stream buffers upstream of Burke Lake, and stream channel incision and widening in the streams and tributaries closer to Burke Lake. As this WMA contains less curb, gutter, and pipe stormwater infrastructure than others in the Pohick Creek watershed, pipe discharge and ditch discharge into the WMA's streams does not show the impact in this WMA that it does in others in the watershed. However, the Upper South Run WMA does display several significant crossing impacts, particularly the road crossings for the Fairfax County Parkway north of Roberts Road and south of the Burke Lake Road intersection. Additional crossing impacts are seen on Burke Lake Road itself just south of the intersection with the Fairfax County Parkway. Instances of demonstrated stream head cutting, or an abrupt vertical drop in the bed of a stream channel that demonstrates active erosion (NC DWQ, 2005), were limited to two tributaries entering Burke Lake, recorded in the south eastern portion of the WMA.

2.2.4 Middle South Run

Field Reconnaissance

The Middle South Run WMA is located in the west central portion of the Pohick Creek watershed and contains a total of 10 subwatersheds. The Middle South Run WMA is bounded on the west by Ox Road (Route 123) and to the north and east by the Fairfax County Parkway. The WMA is essentially bisected by Lee Chapel Road, which runs from the northeast to the southwest. Silverbrook Road forms the extreme southern border of the Middle South Run WMA. The eastern border of the WMA runs to the dam at Lake Mercer, short of Hooes Road.

The Middle South Run WMA is comprised primarily of single family detached residential properties, with the majority of the observed single family detached dwellings were constructed on estimated ¼ to ½ acre lots, including several large subdivisions such as Barrington, Timber Ridge, the Woods at South Run, and South Run Oaks. The residential development in this WMA is largely characterized by street patterns terminating in cul-de-sacs (i.e. not as many through streets). The age of development in this WMA ranges from an estimated 20 to 25 years old (1980's) up to new construction (2005 or newer) with little evidence of infill development. Land cover consists primarily of impervious surface associated with residential development (i.e. rooftops, streets and driveways, sidewalks, etc.) and associated landscaping, including managed turf. Curb and gutter on streets was observed in several subdivisions, primarily those with smaller lot sizes.

The Middle South Run WMA includes Lake Mercer, a PL-566 flood control structure completed in 1985. This WMA also includes Lake Mercer Park, located around Lake Mercer; the South Run District Park, which covers 182 acres and includes ball fields and courts, and the South Run RECenter; and a portion of Burke Lake Park to the northeast. Observed stormwater management facilities in the Middle South Run WMA consist primarily of dry detention basins, which are typically designed for stormwater volume control and not for water quality treatment. Among the non-residential land uses observed, Middle South Run contains limited, low intensity commercial development, primarily associated with industries/activities supporting residential development. No significant institutional facilities were observed in the Middle South Run WMA aside from a portion of Silverbrook Elementary School, located on the south side of Silverbrook Road.

Impervious Areas and Treatment Types

Increased impervious surfaces can result in channel erosion and downstream degradation. Water discharging from an impervious surface does not have time to slow down or infiltrate into the ground. This increases the quantity and velocity of stormwater runoff. This increased discharge into receiving waters begins to degrade the banks of the streams and instream habitat. It has been shown that levels of 10-20% impervious surface can significantly reduce the overall health of a stream (Annual Report, 2005). As one method of preventing stream degradation, stormwater management detention facilities are used throughout Fairfax County. By utilizing land use data and the contributing areas which drain to these stormwater management detention facilities, the County can identify areas of impervious surfaces and trace the flow path of the resulting discharges and quantify the treatment provided by the specific type of stormwater management

detention facility. Below are the four primary stormwater management facility types and treatment provided.

- *Quantity* -Detention storage facilities that only provide quantity control
- *Quality*: -Detention storage facilities that only provide quality control
- *Quantity & Quality*:-Detention storage facilities that provide quantity + quality control
- *None*: -Areas that do not drain to detention facilities (uncontrolled runoff/no treatment), however some of these areas also are undeveloped open space and parks and therefore were not designed to capture and treat rainfall runoff.

Utilizing the Technical Memorandum 3 guidance document, Table 17 below identifies the current and future impervious surface areas based on the existing and future land use conditions for Middle South Run as well as the associated treatment types. See **Map 2.2.4-1** for existing and future land use for Middle South Run. While, Middle South Run is fully developed it is also home to Lake Mercer, and large forested areas. These two factors allow Middle South Run to have a relatively low impervious area in compared to other WMAs within Pohick Creek.

Table 17: Middle South Run Impervious Areas and Treatment Types

WMA Name	Percent Impervious				Current Treatment Types			
	Current Condition		Ultimate Condition		Quantity	Quality	Quantity/ Quality	None
	(acres)	*%*	(acres)	%	(acres)	(acres)	(acres)	(acres)
Middle South Run	320.37	*16.96*	320.72	*16.98*	158.24	72.84	100.09	1557.95

Stormwater Infrastructure

During the watershed's development, a series of flood control lakes were constructed in the watershed between 1970 and 1985 under the federal Watershed Protection and Flood Prevention Act (PL 566) of 1954. These lakes (Lake Royal, Lake Barton, Woodglen Lake, Lake Braddock, Lake Mercer and Huntsman Lake) all provide significant flood control capacity in residentially developed areas. In addition to the PL 566 facilities, the Pohick Creek watershed also includes Burke Lake, a 218 acre recreational lake that serves as the centerpiece of Burke Lake Park.

Map 2.2.4-2 depicts the observed stormwater infrastructure conditions in the Middle South Run WMA. The upstream portions of the WMA, west of Lee Chapel Road, contain a combination of curb and gutter stormwater collection and overland stormwater collection leading to a piped network of storm drains discharging directly into Middle South Run and its tributaries and directly to Lake Mercer. 11 stormwater management facilities are evident upstream of Lake Mercer, including 10 dry detention basins and one wet retention basin. Moving downstream to the east, the newer development in the Middle South Run WMA contains the majority of the stormwater management structures and facilities noted above, including more prevalent use of curb and gutter stormwater collection. Development east of Lee Chapel Road also tends to be more dense, with the majority of the single family residential development clustered onto smaller lots (1/4 acre and below).

Stream Conditions

The Stream Conditions **Map 2.2.4-3** denotes the generally observed stream conditions as documented in the 2005 SPA and through additional, windshield level field reconnaissance performed for this study. The Stream Conditions Map demonstrates the general conditions of the main stem streams and tributaries in the WMA along with a series of features that typically impact stream condition, including stream channel erosion, channel widening, stream buffer condition, discharge pipe and ditch impacts, and utility and road crossing impacts.

In the Middle South Run WMA, the most prevalent stream condition features noted include disturbed stream buffers and stream channel erosion and/or widening. Upstream of Lake Mercer, significant channel widening has been documented, along with some limited capture of channel incision and scour. In addition, pipe discharge and ditch discharge into the WMA's streams, numerous in the WMA, have an impact on the streams and tributaries as well, as pipes and ditches discharge stormwater runoff directly into the streams in many instances, contributing to the observed widening and erosive conditions. Several significant obstructions were documented in the WMA, and road crossing impacts in the WMA, while generally minor, were also documented at Lee Chapel Road as well as the interior of several of the WMA's subdivisions. Instances of demonstrated stream head cutting, or an abrupt vertical drop in the bed of a stream channel that demonstrates active erosion (NC DWQ, 2005), were limited, with one series of recorded examples on a minor tributary to Middle South Run in the center of the WMA.

2.2.5 Lower South Run

Field Reconnaissance

The Lower South Run WMA is located in the southern portion of the Pohick Creek watershed west of Interstate 95 and contains a total of 12 subwatersheds. The Lower South Run WMA is bounded by Pohick Road to the north and northeast, with the remaining portion of the northern border comprised of the Fairfax County Parkway. The southern border of the WMA essentially follows Silverbrook Road, with portions of the WMA running just to the south of the intersection of Hooes Road and Silverbrook Road. The Lower South Run WMA is comprised primarily of single family detached residential properties in a number of established subdivisions, including Newington Heights, Newington Commons, Chapel Acres, and South Run Forest.

The majority of the observed single family detached dwellings were constructed on estimated ¼ to ½ acre lots. The age of development in this WMA ranges from an estimated 35 to 30 years old (1970's) up to approximately 20 years old (1980's) with appreciable evidence of recent infill development in several areas. In addition, much of the southern portion of this WMA has been redeveloped as part of the Laurel Hill redevelopment project, including significant construction of residential structures and associated commercial and institutional development. In addition to the single family development, the Lower South Run WMA also contains a significant amount of single family attached (i.e. townhouses) development, especially along South Run Road, which bisects this WMA. These developments are characterized by their density, as well as street construction patterns that feature cul-de-sacs and dead end drives (i.e. limited through street access).

Among the observed infill/redevelopment evidence observed, the Lower South Run WMA lies within the Laurel Hill project in southern Fairfax County. Land cover consists primarily of impervious surface associated with residential development (i.e. rooftops, streets and driveways, sidewalks, etc.) and associated landscaping, including managed turf. Observed stormwater management facilities in the Lower South Run WMA consist primarily of dry detention basins. Among the non-residential land uses observed, Lower South Run contains limited, low intensity commercial development, primarily associated with industries/activities supporting residential development. No significant institutional facilities were observed in the Lower South Run WMA other than the Newington Forest Elementary School and the Silverbrook United Methodist Church, although several future school sites are located in the WMA.

The Lower South Run WMA also includes Lower South Run Stream Valley Park and the Newington Heights Community Park.

Impervious Areas and Treatment Types

Increased impervious surfaces can result in channel erosion and downstream degradation. Water discharging from an impervious surface does not have time to slow down or infiltrate into the ground. This increases the quantity and velocity of stormwater runoff. This increased discharge into receiving waters begins to degrade the banks of the streams and instream habitat. It has been shown that levels of 10-20% impervious surface can significantly reduce the overall health of a stream (Annual Report, 2005). As one method of preventing stream degradation, stormwater

management detention facilities are used throughout Fairfax County. By utilizing land use data and the contributing areas which drain to these stormwater management detention facilities, the County can identify areas of impervious surfaces and trace the flow path of the resulting discharges and quantify the treatment provided by the specific type of stormwater management detention facility. Below are the four primary stormwater management facility types and treatment provided.

- *Quantity* -Detention storage facilities that only provide quantity control
- *Quality*: -Detention storage facilities that only provide quality control
- *Quantity & Quality*:-Detention storage facilities that provide quantity + quality control
- *None*: -Areas that do not drain to detention facilities (uncontrolled runoff/no treatment), however some of these areas also are undeveloped open space and parks and therefore were not designed to capture and treat rainfall runoff.

Utilizing the Technical Memorandum 3 guidance document, Table 18 below identifies the current and future impervious surface areas based on the existing and future land use conditions for Lower South Run as well as the associated treatment types. See **Map 2.2.5-1** for existing and future land use for Lower South Run. The majority of Lower South WMA is built out however there is a small area within the WMA that fall in the Laurel Hill area. This area is in the process of being redeveloped and changing land use from institutional to golf course, residential, and other recreational land uses. Current stormwater management treatment type consists of none this is due to the large tracks of forested land use.

Table 18: Lower South Run Impervious Areas and Treatment Types

WMA Name	Percent Impervious				Current Treatment Types			
	Current Condition		Ultimate Condition		Quantity	Quality	Quantity/ Quality	None
	(acres)	%	(acres)	%	(acres)	(acres)	(acres)	(acres)
Lower South Run	315.12	*16.18*	319.09	*16.38*	170.43	10.80	78.99	1687.47

Stormwater Infrastructure

During the watershed's development, a series of flood control lakes were constructed in the watershed between 1970 and 1985 under the federal Watershed Protection and Flood Prevention Act (PL 566) of 1954. These lakes (Lake Royal, Lake Barton, Woodglen Lake, Lake Braddock, Lake Mercer and Huntsman Lake) all provide significant flood control capacity in residentially developed areas. In addition to the PL 566 facilities, the Pohick Creek watershed also includes Burke Lake, a 218 acre recreational lake that serves as the centerpiece of Burke Lake Park.

Map 2.2.5-2 demonstrates the observed stormwater infrastructure conditions in the Lower South Run WMA. Stormwater infrastructure consists primarily of curb and gutter stormwater collection leading to a piped network of storm drains discharging to either dry detention basins or directly into Lower South Run and its associated stream valleys and tributaries. The Lower South Run WMA contains approximately 26 dry detention facilities designed to manage stormwater quantity. In addition, the WMA contains one underground chamber. It should be noted that as part of the Laurel Hill redevelopment project, a number of additional stormwater management facilities

appear planned for construction. Given the current Fairfax County requirements for stormwater management, these facilities are likely to be designed to manage both the volume (quantity) of stormwater runoff as well as the quality of that runoff.

Stream Conditions

The Stream Conditions **Map 2.2.5-3** denotes the generally observed stream conditions as documented in the 2005 SPA and through additional, windshield level field reconnaissance performed for this study. The Stream Conditions Map demonstrates the general conditions of the main stem streams and tributaries in the WMA along with a series of features that typically impact stream condition, including stream channel erosion, channel widening, stream buffer condition, discharge pipe and ditch impacts, and utility and road crossing impacts.

In the Lower South Run WMA, the most prevalent stream condition features noted include disturbed stream buffers and stream channel erosion and/or widening. It should be noted, however, that with the Lower South Run WMA's wider stream valleys, the main stem of South Run and some of its tributaries have avoided the extremem widening and erosion/incision conditions plaguing other portions of the watershed. Channel wideing and incision conditions are noted in the head waters of the South Run main stem and Rocky Branch, a tributary, but the downstream main stem of South Run appears more stable. Pipe discharge into the WMA's streams have a demonstrated impact as well, as these pipes discharge stormwater runoff directly into the streams in many instances, contributing to the upstream widening and erosive conditions. Road crossing impacts in the Lower South Run WMA are generally minor, with the exception of a severe instance on Hooes Road to the west. Finally, a handful of obstructions are noted as moderate to severe, including areas to the north of Newington Forest Avenue and the area to the south in the Rocky Branch tributary.

2.2.6 Middle Run

Field Reconnaissance

The Middle Run WMA is located in the central portion of the Pohick Creek watershed and contains a total of 12 subwatersheds. The Middle Run WMA is bounded on the north by Old Keene Mill Road and to the northeast roughly by Sydenstricker Road. The Fairfax County Parkway bisects the WMA to the east, with Lee Chapel Road bisecting the WMA on the western side. The Middle Run WMA is comprised primarily of multi-family attached/detached residential properties along with single family detached residential properties, including a host of subdivisions such as Orange Hunt Estates, Rolling Valley, Lake Forest, Whisperwood, Newington Woods, and Cherry Run.

The majority of the observed multi-family dwellings were constructed on estimated ¼ or smaller lots, featuring dead end alleys and cul-de-sac street alignments, while the single family detached properties were constructed on estimated ¼ acre lots with similar street alignments. The age of development in this WMA ranges from an estimated 25 to 20 years old (1980's) up to approximately 15 to 10 years old (1990's) with little evidence of recent infill development. Land cover consists primarily of impervious surface associated with residential development (i.e. rooftops, streets and driveways, sidewalks, etc.), including more compact development associated with multi-family housing units, and associated landscaping, including managed turf. Curb and gutter on streets was observed as almost universally present in the Middle Run WMA.

The Middle Run WMA includes Huntsman Lake, a PL-566 flood control structure completed in 1973. Observed stormwater management facilities in the Middle Run WMA consist primarily of dry detention basins, which are typically designed for stormwater volume control and not for water quality treatment. The Middle Run WMA contains several stream valley and other smaller parks, including Middle Run Stream Valley Park, Huntsman Park, Orange Hunt Estate Park, and Rolling Valley West Park Among the non-residential land uses observed, Middle Run contains limited, low intensity commercial development, primarily associated with industries/activities supporting residential development, such as Huntsman Square. Institutional facilities in the Middle Run WMA include Cherry Run Elementary School, Sangster Elementary School, a park and ride facility along the Fairfax County Parkway, and several churches, including South Run Baptist Church and Sydenstricker Methodist Church.

Impervious Areas and Treatment Types

Increased impervious surfaces can result in channel erosion and downstream degradation. Water discharging from an impervious surface does not have time to slow down or infiltrate into the ground. This increases the quantity and velocity of stormwater runoff. This increased discharge into receiving waters begins to degrade the banks of the streams and instream habitat. It has been shown that levels of 10-20% impervious surface can significantly reduce the overall health of a stream (Annual Report, 2005). As one method of preventing stream degradation, stormwater management detention facilities are used throughout Fairfax County. By utilizing land use data and the contributing areas which drain to these stormwater management detention facilities, the County can identify areas of impervious surfaces and trace the flow path of the resulting discharges and quantify the treatment provided by the specific type of stormwater management

detention facility. Below are the four primary stormwater management facility types and treatment provided.

- *Quantity* -Detention storage facilities that only provide quantity control
- *Quality*: -Detention storage facilities that only provide quality control
- *Quantity & Quality*:-Detention storage facilities that provide quantity + quality control
- *None*: -Areas that do not drain to detention facilities (uncontrolled runoff/no treatment), however some of these areas also are undeveloped open space and parks and therefore were not designed to capture and treat rainfall runoff.

Utilizing the Technical Memorandum 3 guidance document, Table 19 below identifies the current and future impervious surface areas based on the existing and future land use conditions for Middle Run as well as the associated treatment types. See **Map 2.2.6-1** for existing and future land use for Middle Run. As expected Middle Run WMA is heavily developed and contains a large percentage of impervious areas. While Huntsman Lake is located in Middle Run, the WMA experiences one of the highest percentages of impervious areas within Pohick Creek.

Table 19: Middle Run Impervious Areas and Treatment Types

WMA Name	Percent Impervious				Current Treatment Types			
	Current Condition		Ultimate Condition		Quantity	Quality	Quantity/ Quality	None
	(acres)	*%*	(acres)	%	(acres)	(acres)	(acres)	(acres)
Middle Run	720.42	*28.36*	799.67	*31.48*	186.31	7.48	204.43	2141.96

Stormwater Infrastructure

During the watershed's development, a series of flood control lakes were constructed in the watershed between 1970 and 1985 under the federal Watershed Protection and Flood Prevention Act (PL 566) of 1954. These lakes (Lake Royal, Lake Barton, Woodglen Lake, Lake Braddock, Lake Mercer and Huntsman Lake) all provide significant flood control capacity in residentially developed areas. In addition to the PL 566 facilities, the Pohick Creek watershed also includes Burke Lake, a 218 acre recreational lake that serves as the centerpiece of Burke Lake Park.

Map 2.2.6-2 demonstrates the observed stormwater infrastructure conditions in the Middle Run WMA. Stormwater infrastructure consists primarily of curb and gutter stormwater collection leading to a piped network of storm drains discharging to either dry detention basins or directly into Middle Run and its associated stream valleys and tributaries. The Middle Run WMA contains approximately 37 dry detention facilities designed to manage stormwater quantity. In addition, the WMA contains two underground chambers and one infiltration trench for water quality management.

Stream Conditions

The Stream Conditions **Map 2.2.6-3** denotes the generally observed stream conditions as documented in the 2005 SPA and through additional, windshield level field reconnaissance performed for this study. The Stream Conditions Map demonstrates the general conditions of the

main stem streams and tributaries in the WMA along with a series of features that typically impact stream condition, including stream channel erosion, channel widening, stream buffer condition, discharge pipe and ditch impacts, and utility and road crossing impacts.

In the Middle Run WMA, the most prevalent stream condition features noted include disturbed stream buffers and stream channel widening. In addition, pipe discharge into the WMA's streams have a demonstrated impact as well, as these pipes discharge stormwater runoff directly into the streams in many instances, contributing to the observed widening conditions. Utility, road crossing, and obstructions noted in the Middle Run WMA generally had only a minor impact. No demonstrated stream head cutting, or an abrupt vertical drop in the bed of a stream channel that demonstrates active erosion (NC DWQ, 2005), were observed in this WMA

2.2.7 Pohick Creek-Upper

Field Reconnaissance

The Upper WMA is located in the northeastern headwaters of the Pohick Creek watershed and contains a total of 18 subwatersheds. The Upper WMA is bounded on the north by portions of Braddock Road; on the northeast by portions of Rolling Road, to the south by portions of Old Keene Mill Road; and on the west by portions of Guinea Road. The Upper WMA is bisected from southwest to northeast by Burke Lake Road and from east to west by the rail line that carries the Virginia Railway Express (VRE) through portions of Northern Virginia. The Upper WMA is comprised of the majority of the Burke area of Fairfax County, primarily of single family detached residential properties, with some significant multi-family residential development, in established neighborhoods including Lake Braddock, Dunleigh, Meadowbrook, Signal Hill, Rolling Valley West, Burke Heights, and Cardinal Glen.

The majority of the observed single family detached dwellings were constructed on lots estimated at ¼ acre or less with single family attached structures and multi-family developments more densely developed (well under ¼ acre per unit). As is the case in the majority of the Pohick Creek watershed, these developments are characterized by street patterns ending in cul-de-sacs with few through streets in the WMA. The age of development in this WMA ranges from an estimated 35 to 30 years old (1970's) up to approximately 5 to 10 years old (2000's) with some evidence of recent infill development in places. Land cover consists primarily of impervious surface associated with residential development (i.e. rooftops, streets and driveways, sidewalks, etc.) and associated landscaping, including managed turf. Curb and gutter are present almost universally in the Upper WMA.

The Upper WMA includes Lake Braddock, a PL-566 flood control structure completed in 1970. Observed stormwater management facilities in the Upper WMA include wet and dry detention/retention facilities as well as other facility types, including underground chambers. The Upper WMA also includes a portion of the Pohick Stream Valley Park and the Burke Station Park. Among the non-residential land uses observed, Upper contains commercial development, primarily associated with industries/activities supporting residential development, such as Burke Towne Plaza, Rolling Valley Mall, and Burke Village Center. Institutional facilities observed in the Upper WMA include the Burke Special Education Center, Lake Braddock High School, White Oak Elementary School, and the Rolling Road VRE station.

Impervious Areas and Treatment Types

Increased impervious surfaces can result in channel erosion and downstream degradation. Water discharging from an impervious surface does not have time to slow down or infiltrate into the ground. This increases the quantity and velocity of stormwater runoff. This increased discharge into receiving waters begins to degrade the banks of the streams and instream habitat. It has been shown that levels of 10-20% impervious surface can significantly reduce the overall health of a stream (Annual Report, 2005). As one method of preventing stream degradation, stormwater management detention facilities are used throughout Fairfax County. By utilizing land use data and the contributing areas which drain to these stormwater management detention facilities, the County can identify areas of impervious surfaces and trace the flow path of the resulting

discharges and quantify the treatment provided by the specific type of stormwater management detention facility. Below are the four primary stormwater management facility types and treatment provided.

- *Quantity* -Detention storage facilities that only provide quantity control
- *Quality*: -Detention storage facilities that only provide quality control
- *Quantity & Quality*:-Detention storage facilities that provide quantity + quality control
- *None*: -Areas that do not drain to detention facilities (uncontrolled runoff/no treatment), however some of these areas also are undeveloped open space and parks and therefore were not designed to capture and treat rainfall runoff.

Utilizing the Technical Memorandum 3 guidance document, Table 20 below identifies the current and future impervious surface areas based on the existing and future land use conditions for Upper as well as the associated treatment types. See **Map 2.2.7-1** for existing and future land use for Upper. As expected Upper WMA is fully developed and contains a large percentage of impervious areas. In addition, much of stormwater management treatment consists of quantity only which is consistent with older developments. Lake Braddock is located in Upper and along with many linear parks which follow the streams provide primarily the only open space in the WMA.

Table 20: Upper Impervious Areas and Treatment Types

WMA Name	Percent Impervious				Current Treatment Types			
	Current Condition		Ultimate Condition		Quantity	Quality	Quantity/ Quality	None
	(acres)	*%*	(acres)	%	(acres)	(acres)	(acres)	(acres)
Upper	901.36	*29.03*	910.15	*29.32*	224.71	25.05	168.06	2686.88

Stormwater Infrastructure

During the watershed's development, a series of flood control lakes were constructed in the watershed between 1970 and 1985 under the federal Watershed Protection and Flood Prevention Act (PL 566) of 1954. These lakes (Lake Royal, Lake Barton, Woodglen Lake, Lake Braddock, Lake Mercer and Huntsman Lake) all provide significant flood control capacity in residentially developed areas. In addition to the PL 566 facilities, the Pohick Creek watershed also includes Burke Lake, a 218 acre recreational lake that serves as the centerpiece of Burke Lake Park.

Map 2.2.7-2 demonstrates the observed stormwater infrastructure conditions in the Upper WMA. Stormwater infrastructure consists primarily of curb and gutter stormwater collection leading to a piped network of storm drains discharging to either dry detention basins or directly into the upper reaches of Pohick Creek and its associated stream valleys and tributaries. Some of the stormwater conveyance system in the Upper WMA consists of ditches as well. The Upper WMA contains a wide variety of stormwater management facilities and structures, including approximately 27 dry detention facilities designed to manage stormwater quantity. In addition, the WMA contains six underground chambers; four infiltration trench for water quality management; five rooftop detention facilities; seven wet retention basins; and one parking lot detention facility, which are typically designed to manage stormwater quantity only.

Stream Conditions

The Stream Conditions **Map 2.2.7-3** denotes the generally observed stream conditions as documented in the 2005 SPA and through additional, windshield level field reconnaissance performed for this study. The Stream Conditions Map demonstrates the general conditions of the main stem streams and tributaries in the WMA along with a series of features that typically impact stream condition, including stream channel erosion, channel widening, stream buffer condition, discharge pipe and ditch impacts, and utility and road crossing impacts.

In the Upper WMA, the most prevalent stream condition features noted include disturbed stream buffers and stream channel widening and erosion/incision. In addition, pipe and ditch discharge into the WMA's streams have a demonstrated impact as well, including some severe impacts on the main stem of Pohick Creek, as these pipes and ditches discharge stormwater runoff directly into the streams in many instances, contributing to the observed widening and erosion conditions. Upstream of Lake Braddock, several road crossing impacts are noted, with some severe. Road crossings and obstructions noted in the remainder of the Upper WMA generally had only a minor impact, with some notable exceptions upstream of a wet retention basin north of Burke Centre Drive. Isolated stream head cutting, or an abrupt vertical drop in the bed of a stream channel that demonstrates active erosion (NC DWQ, 2005), was observed at the confluence of a tributary to Pohick Creek and Pohick Creek itself downstream of Burke Lake Road.

2.2.8 Pohick Creek -Middle

Field Reconnaissance

Pohick Creek-Middle (Middle) extends over the eastern portion of the Pohick Creek watershed and contains a total of 19 subwatersheds. Middle WMA is bisected on the upstream end by Old Keene Mill Road and in the center by the Fairfax County Parkway. It is bounded on the west by portions of Sydenstricker Road and Pohick Road and on the extreme southern end by Interstate 95. A portion of the WMA's eastern border is formed by Rolling Road. The Middle WMA is comprised primarily of single family detached residential properties, with some significant single family attached (i.e. townhouses) and multi-family residential development.

As one of the larger WMAs in the Pohick Creek watershed, the Middle WMA includes a host of established subdivisions and neighborhoods, including Red Fox Estates, Center Park, Orange Hunt Estates, Rolling Valley, Keene Mill Station, Westwater Point, Pohick Hills, Pohick Creek Estates and Saratoga to the south (downstream end), to name a few. The majority of the observed single family detached dwellings were constructed on lots estimated at ¼ acre or less in size with single family attached and multi-family developments built at greater density (well under ¼ acre per unit). The age of development in this WMA ranges from an estimated 35 to 30 years old (1970's) up to approximately 5 to 10 years old (2000's) with some evidence of recent infill development in places. Land cover consists primarily of impervious surface associated with residential development (i.e. rooftops, streets and driveways, sidewalks, etc.) and associated landscaping, including managed turf. Curb and gutter are almost universally present in the Middle WMA.

The Middle WMA does not contain any PL-566 flood control lakes. Observed stormwater management facilities in the Middle WMA include wet and dry detention/retention facilities as well as other facility types, including underground chambers. The Middle WMA also contains a portion of the Pohick Stream Valley Park, which includes the Hidden Pond Nature Center; a portion of the Middle Run Stream Valley Park; the Greentree Village Park; and the Orange Hunt Estates Park. Among the non-residential land uses observed, Middle Pohick Creek contains commercial development, primarily associated with industries/activities supporting residential development, including several shopping centers (Saratoga Shopping Center). Significant institutional facilities observed in the Middle WMA include a portion of West Springfield High School, Saratoga Elementary School and a portion of Orange Hunt Elementary School.

Impervious Areas and Treatment Types

Increased impervious surfaces can result in channel erosion and downstream degradation. Water discharging from an impervious surface does not have time to slow down or infiltrate into the ground. This increases the quantity and velocity of stormwater runoff. This increased discharge into receiving waters begins to degrade the banks of the streams and instream habitat. It has been shown that levels of 10-20% impervious surface can significantly reduce the overall health of a stream (Annual Report, 2005). As one method of preventing stream degradation, stormwater management detention facilities are used throughout Fairfax County. By utilizing land use data and the contributing areas which drain to these stormwater management detention facilities, the County can identify areas of impervious surfaces and trace the flow path of the resulting

discharges and quantify the treatment provided by the specific type of stormwater management detention facility. Below are the four primary stormwater management facility types and treatment provided.

- *Quantity* -Detention storage facilities that only provide quantity control
- *Quality*: -Detention storage facilities that only provide quality control
- *Quantity & Quality*:-Detention storage facilities that provide quantity + quality control
- *None*: -Areas that do not drain to detention facilities (uncontrolled runoff/no treatment), however some of these areas also are undeveloped open space and parks and therefore were not designed to capture and treat rainfall runoff.

Utilizing the Technical Memorandum 3 guidance document, Table 21 below identifies the current and future impervious surface areas based on the existing and future land use conditions for Middle as well as the associated treatment types. See **Map 2.2.8-1** for existing and future land use. As expected Middle WMA is fully developed and contains a high percentage of impervious areas. In addition, much of stormwater management treatment consists of none, this is partly due to Pohick Creek stream flowing through the entire WMA. Small portions of the WMA has stormwater quantity and quality controls in place.

Table 21: Middle Impervious Areas and Treatment Types

WMA Name	Percent Impervious				Current Treatment Types			
	Current Condition		Ultimate Condition		Quantity	Quality	Quantity/ Quality	None
	(acres)	%	(acres)	%	(acres)	(acres)	(acres)	(acres)
Middle	773.75	*25.67*	783.47	*25.99*	63.99	75.66	176.80	2698.16

Stormwater Infrastructure

During the watershed's development, a series of flood control lakes were constructed in the watershed between 1970 and 1985 under the federal Watershed Protection and Flood Prevention Act (PL 566) of 1954. These lakes (Lake Royal, Lake Barton, Woodglen Lake, Lake Braddock, Lake Mercer and Huntsman Lake) all provide significant flood control capacity in residentially developed areas. In addition to the PL 566 facilities, the Pohick Creek watershed also includes Burke Lake, a 218 acre recreational lake that serves as the centerpiece of Burke Lake Park.

Map 2.2.8-2 demonstrates the observed stormwater infrastructure conditions in the Middle WMA. Stormwater infrastructure consists primarily of curb and gutter stormwater collection leading to a piped network of storm drains discharging to either dry detention basins or directly into the middle reaches of Pohick Creek and its associated stream valleys and tributaries. Some of the stormwater conveyance system in the Middle WMA consists of ditches as well. The Middle WMA contains a wide variety of stormwater management facilities and structures, including approximately 34 dry detention facilities designed to manage stormwater quantity. In addition, the WMA contains three underground chambers; eight infiltration trench for water quality management; two wet retention basins; and one constructed stormwater wetland, which are typically designed to manage stormwater quantity and quality.

Stream Conditions

The Stream Conditions **Map 2.2.8-3** denotes the generally observed stream conditions as documented in the 2005 SPA and through additional, windshield level field reconnaissance performed for this study. The Stream Conditions Map demonstrates the general conditions of the main stem streams and tributaries in the WMA along with a series of features that typically impact stream condition, including stream channel erosion, channel widening, stream buffer condition, discharge pipe and ditch impacts, and utility and road crossing impacts.

In the Middle WMA, the most prevalent stream condition features noted include disturbed stream buffers and stream channel widening and erosion/incision. In addition, pipe and ditch discharge into the WMA's streams have a significant impact on this WMA as well, including some severe impacts on the WMA headwaters and the main stem of Pohick Creek, as these pipes and ditches discharge stormwater runoff directly into the streams in many instances, contributing to the observed widening and erosion conditions. The more severe pipe, ditch, obstruction, and crossing impacts appear upstream of the Fairfax County Parkway. Road crossings, utilities lines, and pipe impacts noted in the remainder of the Middle WMA generally had only a minor impact, with some notable exceptions downstream of the Fairfax County Parkway. Isolated stream head cutting, or an abrupt vertical drop in the bed of a stream channel that demonstrates active erosion (NC DWQ, 2005), was observed in the headwaters of the Middle WMA near Old Keene Mill Road.

2.2.9 Pohick Creek -Lower

Field Reconnaissance

The Lower WMA is located in the southeastern portion of the Pohick Creek watershed and contains a total of 18 subwatersheds. Covering the area of Fairfax County known as Lorton, the Lower WMA's upstream boundary is found in the Laurel Hill redevelopment area west of Interstate 95. It is bounded to the north by Pohick Road and to the east by Fort Belvoir and Pohick Bay. Richmond Highway (U.S. Route 1) and Lorton Road both bisect the WMA in the upstream end. The Lower WMA is comprised of a larger variety of development than neighboring WMAs, including a host of institutional properties and commercial/industrial properties. Residential development in the Lower WMA consists of single family detached and multi-family attached residential properties, including apartment complexes, and a more significant presence of supporting commercial development. The majority of the observed single family detached dwellings were constructed on lots estimated at ¼ acre or less with multi-family developments consisting of more density (well under ¼ acre) in some established subdivisions, such as Pohick Village, South Point, and Summerhill. Some of the newer subdivisions in the WMA include the redeveloping Laurel Hill area west of I-95 and Pohick Estates.

The age of development in this WMA ranges from an estimated 35 to 30 years old (1970's) up to new construction (i.e. up to five years old, 2000's) with some minor evidence of recent infill development aside from the Laurel Hill project. The Lower WMA is essentially undeveloped east of Richmond Highway, with the primary land characteristics dominated by public institutional lands (federal lands, parks, etc). Land cover west of Richmond Highway in the WMA consists primarily of impervious surface associated with residential development (i.e. rooftops, streets and driveways, sidewalks, etc.), including some more intense, compact residential and commercial development, and associated landscaping, including managed turf. Curb and gutter are almost universally present in the developed areas upstream of Richmond Highway.

While the Lower WMA does not contain any PL-566 flood control lakes, the WMA does include a variety of stormwater management facilities, including wet and dry detention/retention facilities as well as other facility types, including constructed wetlands, infiltration facilities, and underground chambers. The Lower WMA contains a portion of Pohick Bay Regional Park, Joseph Plaskett Park, and a series of recreational fields. Among the non-residential land uses observed, the Lower WMA contains several significant commercial developments, primarily associated with industries/activities supporting residential development, including Gunston Plaza and the Lorton Town Center. The Lower WMA includes a host of institutional facilities, including the Norman M. Cole Jr. Pollution Control Plant, an AMTRAK train station, a VRE station in Lorton, the Lorton Station Elementary School, and First Baptist Church of Lorton.

Impervious Areas and Treatment Types

Increased impervious surfaces can result in channel erosion and downstream degradation. Water discharging from an impervious surface does not have time to slow down or infiltrate into the ground. This increases the quantity and velocity of stormwater runoff. This increased discharge into receiving waters begins to degrade the banks of the streams and instream habitat. It has been shown that levels of 10-20% impervious surface can significantly reduce the overall health of a

stream (Annual Report, 2005). As one method of preventing stream degradation, stormwater management detention facilities are used throughout Fairfax County. By utilizing land use data and the contributing areas which drain to these stormwater management detention facilities, the County can identify areas of impervious surfaces and trace the flow path of the resulting discharges and quantify the treatment provided by the specific type of stormwater management detention facility. Below are the four primary stormwater management facility types and treatment provided.

- *Quantity* -Detention storage facilities that only provide quantity control
- *Quality*: -Detention storage facilities that only provide quality control
- *Quantity & Quality*:-Detention storage facilities that provide quantity + quality control
- *None*: -Areas that do not drain to detention facilities (uncontrolled runoff/no treatment), however some of these areas also are undeveloped open space and parks and therefore were not designed to capture and treat rainfall runoff.

Utilizing the Technical Memorandum 3 guidance document, Table 22 below identifies the current and future impervious surface areas based on the existing and future land use conditions for Lower as well as the associated treatment types. See **Map 2.2.9-1** for existing and future land use. While Lower WMA is bisected by Route 1, which is heavily commercial/industrial, there are portions of Lower which contain the Accotink Bay Wildlife Refuge and Pohick Bay Regional Park. These areas experience relatively low impervious areas.

Table 22: Lower Impervious Areas and Treatment Types

WMA Name	Percent Impervious				Current Treatment Types			
	Current Condition		Ultimate Condition		Quantity	Quality	Quantity/ Quality	None
	(acres)	*%*	(acres)	%	(acres)	(acres)	(acres)	(acres)
Lower	427.96	*18.24*	458.08	*19.52*	163.57	43.60	42.47	2096.82

Stormwater Infrastructure

During the watershed's development, a series of flood control lakes were constructed in the watershed between 1970 and 1985 under the federal Watershed Protection and Flood Prevention Act (PL 566) of 1954. These lakes (Lake Royal, Lake Barton, Woodglen Lake, Lake Braddock, Lake Mercer and Huntsman Lake) all provide significant flood control capacity in residentially developed areas. In addition to the PL 566 facilities, the Pohick Creek watershed also includes Burke Lake, a 218 acre recreational lake that serves as the centerpiece of Burke Lake Park.

Map 2.2.9-2 demonstrates the observed stormwater infrastructure conditions in the Lower WMA. Stormwater infrastructure in the developed portion of the WMA consists primarily of curb and gutter stormwater collection leading to a piped network of storm drains discharging primarily to dry detention basins that manage the quantity of runoff before discharging into Pohick Creek and/or its associated stream valleys and tributaries. Some of the stormwater conveyance system in the Lower WMA consists of ditches as well. The Lower WMA contains approximately 17 dry detention facilities designed to manage stormwater quantity. In addition, the WMA contains one underground chamber. Of note, as development and redevelopment in and around the Lorton area

continues, the reader can anticipate the implementation of additional stormwater management controls for both quantity and quality in accordance with current Fairfax County development standards

Stream Conditions

The Stream Conditions **Map 2.2.9-3** denotes the generally observed stream conditions as documented in the 2005 SPA and through additional, windshield level field reconnaissance performed for this study. The Stream Conditions Map demonstrates the general conditions of the main stem streams and tributaries in the WMA along with a series of features that typically impact stream condition, including stream channel erosion, channel widening, stream buffer condition, discharge pipe and ditch impacts, and utility and road crossing impacts.

In the Lower WMA, the most prevalent stream condition features noted include disturbed stream buffers and stream channel widening, primarily in the main stem of Pohick Creek upstream of Richmond Highway and immediately downstream of the Norman M. Cole, Jr. Pollution Control Plant. A small tributary of Pohick Creek between Lorton Road and Richmond Highway also experienced some channel erosion and incision, as well as an isolated stream head cut, or an abrupt vertical drop in the bed of a stream channel that demonstrates active erosion (NC DWQ, 2005).

Pipe and ditch discharge into the WMA's streams have a significant impact on this WMA as well, including some severe impacts on the tributaries leading away from the Norman Cole facility. These pipes and ditches discharge stormwater runoff directly into the streams in many instances, contributing to the observed widening conditions. Additional pipe, ditch, obstruction, and crossing impacts are relatively minor throughout the remainder of the WMA.

2.2.10 Potomac

Field Reconnaissance

The Potomac WMA is located in the extreme southern portion of the Pohick Creek watershed and contains a total of 8 subwatersheds. The Potomac WMA bounded on the south by Gunston Road and is comprised primarily of public lands, including a portion of Fort Belvoir and the Pohick Regional Park. The Potomac WMA does contain limited single family detached residential properties. The majority of the observed single family detached dwellings were constructed on estimated lots of one acre or more. The age of development in this WMA ranges from an estimated 20 to 25 years old (1980's) up to approximately 5 to 10 years old (2000's) with little evidence of recent infill development.

Land cover consists primarily of woodland and tidal wetlands, with some impervious surface associated with residential development (i.e. rooftops, streets and driveways) and limited landscaping management. No stormwater management facilities or infrastructure was observed in the Potomac WMA, including curb and gutter on roadways. Among the non-residential land uses observed, Potomac contains primarily institutional properties associated with public lands and open space holdings, including the majority of Pohick Bay Regional Park on the south side of Pohick Bay and the Accotink Bay Wildlife Refuge and Fort Belvoir on the north shore of Pohick Bay.

Impervious Areas and Treatment Types

Increased impervious surfaces can result in channel erosion and downstream degradation. Water discharging from an impervious surface does not have time to slow down or infiltrate into the ground. This increases the quantity and velocity of stormwater runoff. This increased discharge into receiving waters begins to degrade the banks of the streams and instream habitat. It has been shown that levels of 10-20% impervious surface can significantly reduce the overall health of a stream (Annual Report, 2005). As one method of preventing stream degradation, stormwater management detention facilities are used throughout Fairfax County. By utilizing land use data and the contributing areas which drain to these stormwater management detention facilities, the County can identify areas of impervious surfaces and trace the flow path of the resulting discharges and quantify the treatment provided by the specific type of stormwater management detention facility. Below are the four primary stormwater management facility types and treatment provided.

- *Quantity* -Detention storage facilities that only provide quantity control
- *Quality*: -Detention storage facilities that only provide quality control
- *Quantity & Quality*:-Detention storage facilities that provide quantity + quality control
- *None*: -Areas that do not drain to detention facilities (uncontrolled runoff/no treatment), however some of these areas also are undeveloped open space and parks and therefore were not designed to capture and treat rainfall runoff.

Utilizing the Technical Memorandum 3 guidance document, Table 23 below identifies the current and future impervious surface areas based on the existing and future land use conditions for Potomac as well as the associated treatment types. See **Map 2.2.10-1** for existing and future land

use. As expected Potomac WMA has almost no development and is comprised primarily of Fort Belvoir and Pohick Regional Park and therefore experiences one of the lowest impervious conditions in the County. Since the majority of the area is undeveloped, stormwater management treatment is minimal.

Table 23: Potomac Impervious Areas and Treatment Types

WMA Name	Percent Impervious				Current Treatment Types			
	Current Condition		Ultimate Condition		Quantity	Quality	Quantity/ Quality	None
	(acres)	%	(acres)	%	(acres)	(acres)	(acres)	(acres)
Potomac	15.66	*1.02*	15.95	*1.04*	47.40	5.33	0.00	1479.69

Stormwater Infrastructure

During the watershed's development, a series of flood control lakes were constructed in the watershed between 1970 and 1985 under the federal Watershed Protection and Flood Prevention Act (PL 566) of 1954. These lakes (Lake Royal, Lake Barton, Woodglen Lake, Lake Braddock, Lake Mercer and Huntsman Lake) all provide significant flood control capacity in residentially developed areas. In addition to the PL 566 facilities, the Pohick Creek watershed also includes Burke Lake, a 218 acre recreational lake that serves as the centerpiece of Burke Lake Park.

In addition to the flood control capacity of these lakes, the watershed also contains a wide variety of additional stormwater infrastructure and best management practices which track with the watershed's development history. For example, in areas that developed earlier, stormwater management facilities, where present, consist primarily of dry detention basins designed to curb peak storm flows (quantity management). For areas that developed more recently, stormwater management facilities are more likely to include a water quality component, and the variety of facility types increases. Facilities found in these areas include wet detention facilities, underground chambers, infiltration devices, and wetlands.

Map 2.2.10-2 demonstrates the observed stormwater infrastructure conditions in the Potomac WMA. As the vast majority of this WMA remains undeveloped, no significant stormwater infrastructure was observed. Tributaries draining to Pohick Bay are almost exclusively open channel drainages

Stream Conditions

The Stream Conditions **Map 2.2.10-3** denotes the generally observed stream conditions as documented in the 2005 SPA and through additional, windshield level field reconnaissance performed for this study. The Stream Conditions Map demonstrates the general conditions of the main stem streams and tributaries in the WMA along with a series of features that typically impact stream condition, including stream channel erosion, channel widening, stream buffer condition, discharge pipe and ditch impacts, and utility and road crossing impacts.

In the Potomac WMA, the most prevalent stream condition features noted were stream channel widening and incision. Given the lack of development in this WMA, these conditions may be attributable to the fairly steep drop in elevation seen between points in Pohick Bay Regional Park and Pohick Bay itself. The elevation drop and soil conditions may give rise to excessive channel

incision and head cutting, which was also documented on two small tributaries in the park draining to Pohick Bay. No pipe infrastructure was documented in this WMA and no crossing or utility impacts were noted in this WMA.

2.3 Hydrology and Water Quantity and Quality Modeling

Storm events are classified by the amount of rainfall, in inches, that occurs over the duration of a storm. The amount of rainfall depends on how frequently the storm will statistically occur and how long the storm lasts. Based on many years of rainfall data collected, storms of varying strength have been established based on the duration and probability of that event occurring within any given year. In general, smaller storms occur more frequently than larger storms of equal duration. Hence, a 2-year, 24hr storm (having a 50% chance of happening in a given year) has less rainfall than a 10-year, 24hr storm (having a 10% chance of happening in a given year). Stormwater runoff (which is related to the strength of the storm) is surplus rainfall that does not soak into the ground. This surplus rainfall flows (or 'runs off') from roof tops, parking lots and other impervious surfaces and is ultimately received by storm drainage systems, culverts and streams.

Modeling is a way to mathematically predict and spatially represent what will occur with a given rainfall event. There are two primary types of models that are used to achieve this goal; hydrologic and hydraulic:

- Hydrologic models take into account several factors; the particular rainfall event of interest, the physical nature of the land area where the rainfall occurs and how quickly the resulting stormwater runoff drains this given land area. Hydrologic models can describe both the quantity of stormwater runoff and resulting pollution, such as nutrients (nitrogen and phosphorus) and sediment that is transported by the runoff.

- Hydraulic models represent the effect the stormwater runoff from a particular rainfall event has on both man-made and natural systems. These models can both predict the ability man-made culverts/channels have in conveying stormwater runoff and the spatial extent of potential flooding.

Below shows three storm events and the rationale for being modeled:

Table 24: Storm Event

Storm Event	Rationale for being Modeled
2-year, 24hr	Represents the amount of runoff that defines the shape of the receiving streams.
10-year, 24hr	Used to determine which road culverts will have adequate capacity to convey this storm without overtopping the road.
100-year, 24hr	Used to define the limits of flood inundation zones

2.3.1 PRELIMINARY SWMM and STEPL Results

The Environmental Protection Agency (EPA) Storm Water Management Model (SWMM) was first developed in the early 1970s. Over the past 30 years, the model has been updated and refined and is now used throughout the country as a design and planning tool for stormwater runoff.

Specifically, SWMM is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas. The runoff component of SWMM operates on a collection of subwatershed areas (or in our case, areas which pertain to the various treatment types previously described) on which rain falls and runoff is generated. The routing portion of SWMM transports this runoff through a conveyance system of pipes, channels and storage/treatment devices. SWMM tracks the quantity and quality of runoff generated within each subwatershed, and the flow rate, flow depth, and quality of water in each pipe and channel during a simulation period comprised of multiple time steps.

While the SWMM model can calculate pollutant loads, the Spreadsheet Tool for Estimating Pollutant Load (STEPL) was used to determine pollutant loads for Pohick Creek watershed. Also developed by EPA, the STEPL worksheet calculates nutrient and sediment loads from various land uses as well as calculating the load reductions that would result from the implementation of various BMPs. The nutrient loading is calculated based on the runoff volume and the pollutant concentrations in the runoff water as influenced by factors such as the land use distribution and management practices. Sediment loads are calculated based on the Universal Soil Loss Equation (USLE) and the sediment delivery ratio. The sediment and pollutant load reductions that result from the implementation of BMPs are computed using known BMP efficiencies.

A major cause for many streams' poor water quality is increased levels of two particular nutrients, nitrogen and phosphorous. While, these nutrients occur naturally in soil, animal waste, plant material, and even the atmosphere, the increase of nitrogen and phosphorus from manmade sources, can be detrimental to the overall heath of the streams. Increased phosphorus and nitrogen pollutants in urbanized areas primarily come from chemical lawn fertilizers, vehicle emissions, and discharges from municipal wastewater treatment plans.

The information presented in the following section is considered preliminary data results and will continue to be refined when a more accurate and calibrated SWMM model is finalized. The data below reflects current conditions only, in addition the model will be updated and results will be produced as the work progresses towards project identification/prioritization and the Draft Plan phases.

Preliminary SWMM results

Below, represents the results of the SWMM model at specific locations within the Pohick watershed. As shown below, flows were not captured at individual WMAs, therefore composite flows were used. See **Map 2.3.1** for specific point locations. The SWMM model will be further refined as additional information is captured in the Pohick Creek watershed planning effort.

Table 25: Preliminary SWMM Results

WMA Outlet Point[1]		Stormwater Runoff Peak Flow Values	
	Contributing Adjacent WMA(s)[2]	2-yr storm (cubic ft/sec)	10-yr storm (cubic ft/sec)
1 (41)	Rabbit Branch, Sideburn Branch,	552.000	11,411
2 (64)	Pohick Upper	1,295	16,101
3 (79)[3]	Middle Run, Pohick-Middle	2,177	14,324
4 (105)	Upper South Run	33	5,309
5 (119)	Middle Upper, Middle Run	2,747	22,252
WS Totals (181)	Middle Lower, Lower South Run	3,118	32,422

1. The "WMA Outlet Point" is a node that has the individual, cumulative peak flows (2 and 10 year) for the entire upstream drainage area. Example: The first confluence point with such a node is the "Upper" WMA
2. The "Contributing WMA(s)" are the upstream WMAs for which there is not a node that has the individual, cumulative peak flows (2 and 10 year) for the entire upstream drainage area. Example: The "Upper" WMA includes all the stormwater draining from the Cedar WMA and the Upper WMA
3. This point does not include the contribution of the entire Pohick Middle WMA. This is captured in the downstream node (#6).

Preliminary STEPL results

The data provided below represents the results from the STEPL model by WMA. The pollutant loads are heavily dependent on land use distribution within the watershed management areas. **Maps 2.3-2, 2.3-3**, and **2.3-4** illustrate the Total Nitrogen, Total Phosphorus, and Total Suspended Solids loads respectively throughout the watershed. As anticipated areas in the northern portion of the watershed experience higher levels of pollutant loading due to high urbanization while areas in the southern portions experience lower levels of pollutant loading. In addition, areas generally located downstream of the large lakes experience lower levels of nitrogen, phosphorus and total suspended solids loadings.

Table 26: Pollutant Loads - STEPL

WMA	Pollutant Loading			Pollutant Loading		
	Total Nitrogen (lbs/yr)	Total Phosphorus (lbs/yr)	Total Suspended Solids (tons/yr)	Total Nitrogen (lbs/ac/yr)	Total Phosphorus (lbs/ac/yr)	Total Suspended Solids (tons/ac/yr)
Rabbit Branch	14,606.80	2,254.41	395.86	5.7851	0.8929	0.1568
Sideburn Branch	16,247.31	2,425.25	392.12	7.0399	1.0509	0.1699
Upper South Run	6,930.11	1,136.01	202.94	3.3959	0.5567	0.0994

WMA	Pollutant Loading			Pollutant Loading		
	Total Nitrogen (lbs/yr)	**Total Phosphorus (lbs/yr)**	**Total Suspended Solids (tons/yr)**	**Total Nitrogen (lbs/ac/yr)**	**Total Phosphorus (lbs/ac/yr)**	**Total Suspended Solids (tons/ac/yr)**
Middle South Run	8,800.69	1,371.63	229.43	4.6586	0.7261	0.1214
Lower South Run	9,135.22	1,425.69	257.29	4.6903	0.7320	0.1321
Middle Run	17,170.58	2,620.80	401.41	6.7596	1.0317	0.1580
Upper	20,533.23	3,090.23	483.95	6.6135	0.9953	0.1559
Middle	18,919.12	2,891.53	466.47	12.3529	1.8846	0.3183
Lower	16,060.52	2,440.94	463.43	6.8445	1.0403	0.1975
Potomac	6425.03	1,338.11	464.77	4.1928	0.8732	0.3033
TOTALS	**134,828.61**	**20,994.60**	**3,757.67**			

2.3.2 PRELIMINARY HEC-RAS

The HEC-RAS hydraulic model was initially developed by the U.S. Army Corp of Engineers in the early 1990 as a tool to manage the rivers and harbors in their jurisdiction. HEC-RAS is a one dimensional program that provides no direct modeling of the hydraulic effect of cross section shape changes, bends, and other two- and three-dimensional aspects of flow. Aside from this limitation, the model has found wide acceptance in simulating the hydraulics of water flow through natural and/or manmade channels and rivers. HEC-RAS is commonly used for modeling water flowing through a system of open channels with the objective of computing water surface profiles. The data presented in the following section is considered preliminary and will continue to be refined as more accurate flow information is available from the SWMM model calibration effort. Updated results will be produced as the work progresses towards project identification/ prioritization and the Draft Plan phases.

Preliminary HEC-RAS Development

Using HEC-RAS, hydraulic models were created for the major channels in the Pohick Creek watershed. These major channels extend from the basin outlet to the most upstream subwatershed in the watershed. Cross sections were aligned based on representative channel sections, and locations upstream and downstream of bridges/culvert structures. Structures such as these were identified along various stream reaches using county GIS road and stream spatial data along with the most recent aerial photography. All major structures that were considered likely to impact the water surface elevation were surveyed.

Once the HEC-RAS model was set up as described above, flow data was entered from the SWMM model. It should be noted that, the SWMM model did not account for reduced flows based on storage in the several large reservoirs in Pohick watershed and should therefore be considered preliminary until additional data is obtained. Once the model was run, water surface elevations were exported to GIS and the floodplain maps were then generated

Preliminary HEC-RAS Results

Since the flow results from the SWMM model are not final, these floodplain maps should be considered preliminary, rough estimates of the final floodplains. While results are preliminary and are likely to change with final flows and revised modeling, the new floodplains were compared to the effective Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) in the area, where available. FEMA FIRMs in the Pohick watershed are either Zone AE (detailed study) or Zone A (approximate study). Zone AE areas are studied with hydraulic models and surveyed cross sections and structures. Zone A areas require less detailed hydraulic computation and generally require less detailed survey data.

In general, the newly modeled floodplains compare well with the effective AE zones, and are similar or narrower than the effective A zones. There are some exceptions: in the Pohick Lower WMA, the Pohick Creek modeled floodplain is generally wider than the effective Zone AE. In Pohick Middle South Run WMA, the South Run modeled floodplain is wider than the effective Zone A at the downstream end of Lake Mercer. In Pohick Middle Run WMA, the short section of Middle Run modeled floodplain appears to be wider than the effective Zone A. In Pohick – Sideburn Branch WMA, the upper section of Sideburn Branch modeled floodplain varies in relation to the effective Zone AE, with some portions wider and some portions narrower. The Woodglen Lake modeled floodplain is wider than the effective Zone A. In Pohick – Rabbit Branch WMA, the modeled floodplain for Lake Royal is wider than the effective Zone A.

Refer to **Maps 2.3.2.1 through 2.3.2.6** for draft modeled 100-year floodplain results.

2.4 Ranking of Subwatershed Areas

The County has developed goals and objectives to be applied to all watersheds during the workbook development process. The countywide goals and objectives allow recommendations to be linked to the countywide watershed assessment. The countywide watershed planning goals are to:

1. Improve and maintain watershed functions in Fairfax County, including water quality, habitat, and hydrology.
2. Protect human health, safety, and property by reducing stormwater impacts.
3. Involve stakeholders in the protection, maintenance and restoration of county watersheds.

The countywide objectives identified are linked to the above County goals. The list of objectives allows for a countywide evaluation that addresses stakeholder concerns while providing an efficient and effective means of assessment. In addition, watershed-specific goals and objectives that are recommended by local stakeholders may also be incorporated into the watershed workbook development process. The objectives listed under Category 5 (Stewardship) will be considered during countywide watershed assessment but are not addressed in the subwatershed ranking approach.

Table 27: Fairfax County Watershed Planning Final Objectives

Objective		Linked to Goal(s)
CATEGORY 1. HYDROLOGY		
1A.	Minimize impacts of stormwater runoff on stream hydrology to promote stable stream morphology, protect habitat, and support biota.	1
1B.	Minimize flooding to protect property and human health and safety.	2
CATEGORY 2. HABITAT		
2A.	Provide for healthy habitat through protecting, restoring, and maintaining riparian buffers, wetlands, and instream habitat.	1
2B.	Improve and maintain diversity of native plants and animals in the county.	1
CATEGORY 3. STREAM WATER QUALITY		
3A.	Minimize impacts to stream water quality from pollutants in stormwater runoff.	1, 2
CATEGORY 4. DRINKING WATER QUALITY		
4A.	Minimize impacts to drinking water sources from pathogens, nutrients, and toxics in stormwater runoff.	2
4B.	Minimize impacts to drinking water storage capacity from sediment in stormwater runoff.	2
CATEGORY 5 STEWARDSHIP		
5A.	Encourage the public to participate in watershed stewardship.	3
5B.	Coordinate with regional jurisdictions on watershed management and restoration efforts such as Chesapeake Bay initiatives.	3
5C.	Improve watershed aesthetics in Fairfax County.	1, 3

The purpose of the subwatershed ranking approach is to provide a systematic means of compiling available water quality and natural resources information. Ranking subwatersheds based on watershed characterization and modeling results provides a tool for planners and managers to aid in the project selection, types of projects, and prioritization processes. The ranking will be updated based on issues and problem areas identified during the introductory and issues scoping forum and advisory group meetings. The resultant data is then utilized to identify key issues and proceed with projects that will achieve the county's watershed management goals and objectives.

Three basic indicator categories identified below are used to rank subwatershed conditions:

Table 28: Subwatershed Ranking Indicators

Indicator Type	Description
Watershed Impact	Diagnostic measures of environmental condition (e.g. water quality, habitat health, biotic integrity) which are linked to the county's goals and objectives
Programmatic	Reports the existence, location or benefits of stormwater management facilities or programs
Source	Quantifies the presence of stressors and/or pollutant sources

These scores are rolled up into composite scores which are used in the prioritization and subwatershed ranking process. In the process of compiling the draft ranking for Pohick Creek, surrogate metric values were assigned to a subwatershed when a particular indicator or actual data was missing. The approach followed in assigning surrogate values was based on the current Fairfax County Watershed Management Plan Subwatershed Ranking Approach document. This guidance document provided several factors in priority which should be considered when assigning surrogate metric values.

2.4.1 Pohick Creek Results

The Pohick Watershed Impact Composite Score is shown in **Map 2.5-1**. This map displays an overall composite score that itself is a weighted average of composite scores of the individual impact indicator scores for each subwatershed. The scale on the map ranks the subwatersheds within the watershed from high (green) to low (red) quality.

In the Pohick Creek watershed, various portions of the watershed differ considerably in terms of watershed quality as measured by the overall watershed impact indicator composite score. The watershed's southern portion (Potomac and Lower WMAs), including its discharge to the Potomac, show generally above average watershed quality. A few of the subwatersheds in the I-95 corridor of this southern section show poorer watershed quality. The entire southwestern edge of the watershed (Upper South Run, Middle South Run and Lower South Run WMAs) also shows generally good watershed quality. Areas in the vicinity of Burke Lake in the Upper South Run WMA show very high quality, but the Lower South Run has some areas of lower quality. The more developed eastern portion of the watershed (Middle Run and Middle WMAs) shows a generally average watershed quality, but also a great deal of variation between individual subwatersheds. The heavily developed headwaters of the Pohick Creek watershed (Rabbit Branch, Sideburn Branch, and Upper Pohick WMAs) show the poorest watershed quality in

general. Some pockets of green and light-green subwatersheds still exist where there are suburban parks and undeveloped portions of institutional land.

As a caveat, the watershed impact scores contain some degree of uncertainty because the weighted composite score is derived from surrogate metric values, which are currently being refined.

The Source Composite Score rankings are shown in **Map 2.5-2**. Unlike the watershed impact score, it is computed as a simple average of approximately a dozen individual source indicator scores. The scale again establishes the bounds on the gradation from generally good quality (green) to comparatively poor quality (red) on the map. Since the source composite score is computed with a distinct set of indicators from the overall watershed impact score, the subwatersheds with good quality or poor quality may be very different than for the overall watershed impact map.

The sparsely developed area near the Pohick watershed's discharge generally has the best source quality in the watershed. The subwatersheds just to the East of I-95 in Pohick-Lower WMA, however, have generally low source quality. The western portion of the middle reaches of the watershed (along South Run) is characterized by above average to good source quality, with significant zones of average source quality. The more developed eastern portion of the middle of the watershed (Middle Run and Middle WMAs) is dominated by subwatersheds with below average watershed quality. The northern headwaters of the watershed have generally poor source quality as shown by the large regions of red and orange on the map. The source composite score has considerably less uncertainty than the overall watershed impact score because a much smaller percentage of the indicator scores (< 5%) were calculated based on surrogate metrics