3.0 Summary of Watershed Conditions

This section summarizes the *Pohick Creek Draft Watershed Workbook* (September 2008). The full Pohick Creek Draft Watershed Workbook can be found in the *Technical Appendices to Pohick Creek Watershed Management Plan* (see Appendix A).

3.1 Introduction

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 the 10 smaller watershed management areas (WMAs) identified in Table 3-1. Refer to **Map 3.1-1** for the locations of each WMA within Pohick Creek. For Fairfax County planning and management purposes, WMAs are further subdivided into smaller subwatersheds. Refer to **Map 3.1-2** for the locations of each of the subwatersheds within Pohick Creek.

Table 3-1: Pohick Creek Watershed Management Areas (WMAs)

WMA		Sq. Miles	Acres
1.	Pohick - Rabbit Branch	3.95	2,524.9
2.	Pohick - Sideburn Branch	3.61	2,307.9
3.	Pohick - Upper South Run	3.19	2,040.7
4.	Pohick - Middle South Run	2.95	1,889.1
5.	Pohick - Lower South Run	3.04	1,947.7
6.	Pohick - Middle Run	3.97	2,540.2
7.	Pohick - Upper	4.85	3,104.7
8.	Pohick - Middle	4.71	3,014.6
9.	Pohick - Lower	3.67	2,346.5
10.	Pohick - Potomac	2.39	1,532.4
	Total	**36.33**	**23,248.7**

The Pohick Creek watershed contains more than 180 miles of stream within the 10 WMAs, and included in the 10 WMAs are 13 named and numerous unnamed tributaries.

3.2 Current Conditions

Generally, Pohick Creek watershed is characterized by residential land uses, the most prevalent of which is 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 between the early 1960s and the mid 1980s, limited development in the watershed is on-going. Several areas within the watershed demonstrate significant redevelopment efforts. These areas include portions of George Mason University in the northern headwaters, to parts of Fort Belvoir and other federally managed lands, as well as a large redevelopment project at Laurel Hill in the watershed's southern region.

Map 2.1-1
Pohick Watershed

Map 3.1-2

Pohick Creek Subwatersheds

The Pohick Creek watershed contains six flood control lakes (Woodglen, Royal, Braddock, Barton, Huntsman and Mercer). These were 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. Substantial residential property development has occurred around these lakes. The western portion of the watershed contains Burke Lake Park, an 888-acre park built around Burke Lake, a 218-acre recreational lake. Additional infrastructure serving the Pohick Creek watershed includes a number of major transportation arteries in Fairfax County. Fairfax County Parkway bisects the watershed, route 123 traverses the western border of the watershed and Interstate 95 runs across the southern, downstream portion of the watershed.

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 (BMPs) that track with the watershed's development history. Some older developments contain stormwater management (SWM) facilities, consisting primarily of dry detention basins designed to curb peak storm flows (quantity management). For areas developed more recently, SWM facility types are more varied and are more likely to include a water quality component. Facilities found in these areas include wet detention facilities, underground chambers, infiltration devices and wetlands.

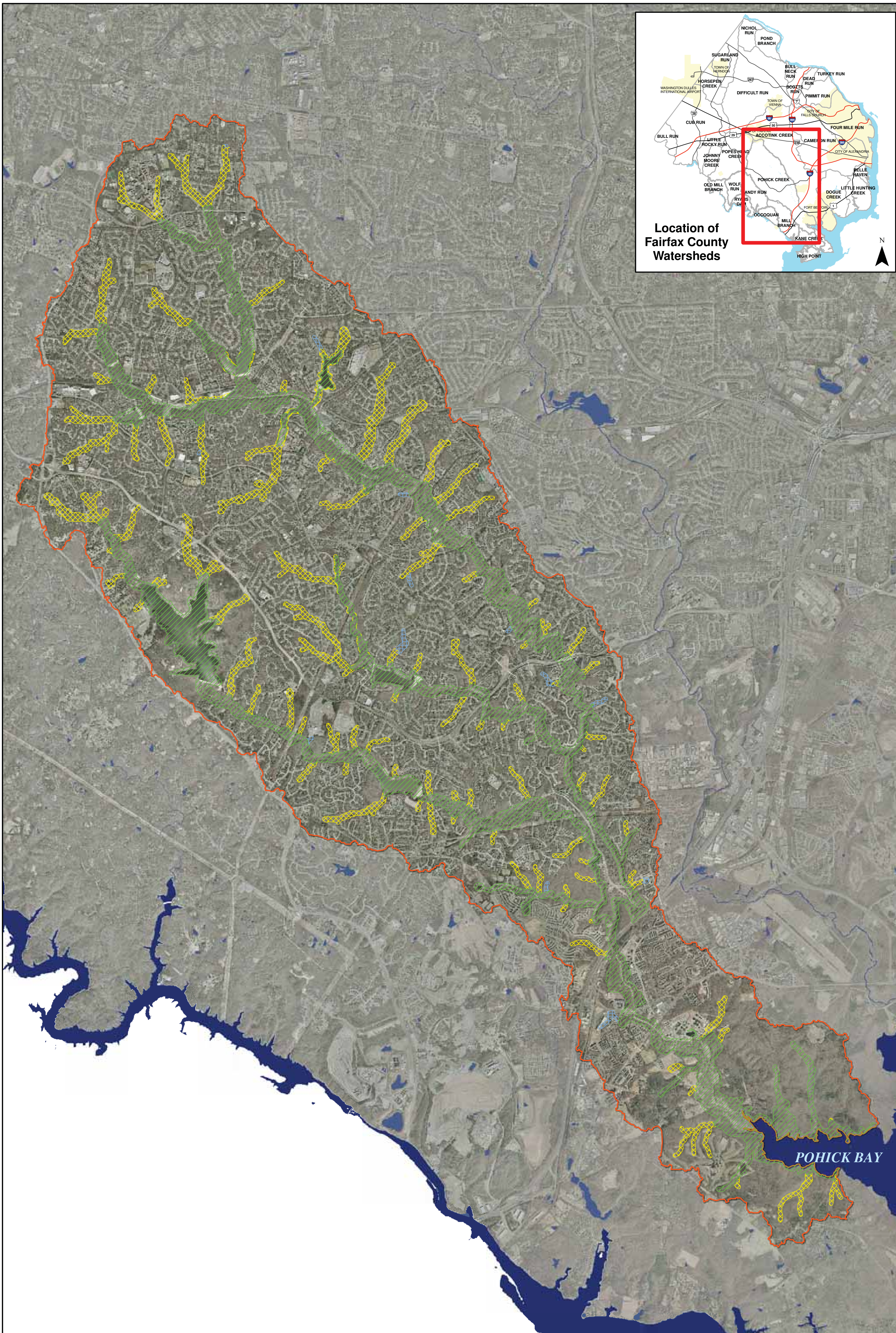
As one of many measures used to protect stream water quality, the County adopted the Chesapeake Bay Preservation Ordinance, which limits development on land that lies within a Resource Protection Area (RPA). RPAs are buffers adjacent to or near the shorelines of streams, rivers and other waterways that protect sensitive areas 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 3.2** indicates, almost 75 percent (134 of the 180 miles) of the streams within the Pohick Creek watershed lie within an RPA. (County GIS, 2008)

The *Pohick Creek Draft Watershed Workbook* (Appendix A, Technical Guide) includes a description of the findings in each WMA, including field reconnaissance findings, existing and future land use, stream conditions and stormwater infrastructure. Each WMA was examined at the subwatershed level.

3.3 Hydrology and Water Quantity and Quality Modeling

Modeling is a way to mathematically predict and spatially represent what will occur with a given rainfall event. The following modeling software was used in the watershed management plan:

1. The Environmental Protection Agency (EPA) Storm Water Management Model (SWMM) is a dynamic rainfall-runoff simulation model. It is used to track 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.
2. The Spreadsheet Tool for Estimating Pollutant Load (STEPL) was used to determine pollutant loads for Pohick Creek watershed. Also developed by the EPA, the STEPL worksheet calculates nutrient and sediment loads from various land uses and also calculates the load reductions that would result from the implementation of various BMPs.



Resource Protection Areas

- RPA 1993
- RPA 2003
- RPA 2005
- Watersheds
- Water

0 2,500 5,000 7,500 Feet

Map 3.2
Pohick Watershed
Resource Protection Areas

3. The U.S. Army Corps of Engineers' Hydrologic Engineering Centers River Analysis System (HEC-RAS) hydraulic model simulates the hydraulics of water flow through natural and/or manmade channels and rivers, with the objective of computing water surface profiles.

3.3.1 SWMM Results

Table 3-2 shows the peak flows from the WMAs. The two-year storm event is defined as the storm which has a 50 percent chance of occurring in any one year. The 10-year storm event has a 10 percent chance of occurring in any one year.

Table 3-2: SWMM Results

WMA Outlet Point	Stormwater Runoff Peak Flow Values	
	2-Year Storm (cubic ft/sec)	10-Year Storm (cubic ft/sec)
Pohick - Lower	613	1,560
Pohick - Lower South Run	360	1,075
Pohick - Middle	659	1,534
Pohick - Middle Run	430	907
Pohick - Middle South Run	36	78
Pohick - Potomac	205	659
Pohick - Rabbit Branch	147	205
Pohick - Sideburn Branch	271	554
Pohick - Upper	679	1,385
Pohick - Upper South Run	0	0
Pohick Watershed Totals	1,858	1,999

3.3.2 STEPL Results

A major cause for many streams' poor water quality is increased levels of two particular nutrients, nitrogen and phosphorous, as well as high levels of suspended sediments. While nitrogen and phosphorus 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 health of receiving waters. Increased phosphorus and nitrogen pollutants in urbanized areas primarily come from chemical lawn fertilizers, vehicle emissions and discharges from municipal wastewater treatment plants. High levels of suspended sediments are due to land and streambank erosion.

The data provided in Table 3-3 represents the results from the existing conditions STEPL model by WMA. The pollutant loads are heavily dependent on land-use distribution within the WMAs.

Table 3-3: Pollutant Loads – STEPL

WMA	Pollutant Loading			Pollutant Loading		
	Total Nitrogen (lb/yr)	Total Phosphorus (lb/yr)	Total Suspended Solids (tons/yr)	Total Nitrogen (lb/ac/yr)	Total Phosphorus (lb/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
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	0.732	0.1321
Middle Run	17,170.58	2,620.80	401.41	6.7596	1.0317	0.158
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**			

3.3.3 HEC-RAS Results

Hydraulic models were created for the major channels in the watershed. These major channels extend from the basin outlet to the most upstream sub-basins in the watershed. Cross sections were aligned based on representative channel sections, and upstream and downstream of bridges. Structures along these streams were identified based on county GIS road shapefiles and the most recent aerial photos provided by the county, and surveyed using GIS equipment. Flow data was entered from the SWMM model.

Three flood events were modeled in HEC-RAS: the 100-year, 10-year and 2-year events. These are the events that have, respectively, a 1 percent, 10 percent or 50 percent chance of occurring in any given year. The 100- and 10-year floodplains were mapped to determine the extent of the flooding. The impact of the flooding on the watershed was determined by examining roads that are overtopped or buildings that are located within the floodplain.

3.4 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 goals are:

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 list of objectives allows for a countywide evaluation that addresses stakeholder concerns while providing an efficient and effective means of assessment.

Table 3-4: 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 was updated based on issues and problem areas identified during the introductory and issues scoping forum and advisory group meetings. The resultant data is then used to identify key issues and proceed with projects that will achieve the County’s watershed management goals and objectives.

Three basic indicator categories were used to rank subwatershed conditions, as identified in Table 3-5.

Table 3-5: Subwatershed Ranking Indicators

Indicator Type	Description
Watershed Impact	Diagnostic measures of environmental conditions (e.g., water quality, habitat health biotic integrity) that 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 were weighted and combined into composite scores that are used in the subwatershed ranking and project prioritization process.

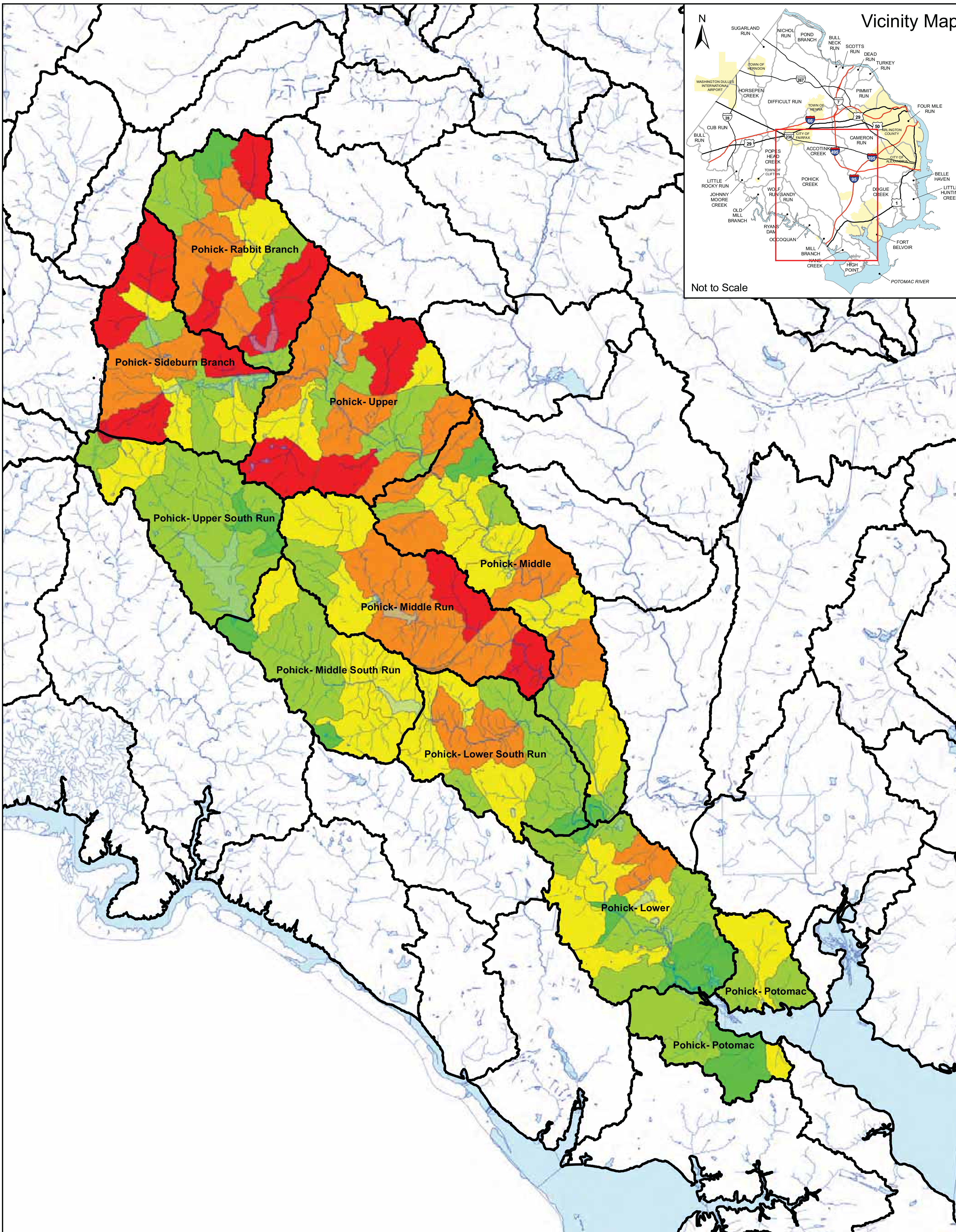
3.5 Pohick Creek Results

The Pohick Watershed Impact Composite Score is shown in **Map 3.5-1**. This map displays an overall composite score that itself is a weighted average of composite scores of the individual impact indicators for each subwatershed. The scale on the map ranks the subwatersheds from high (green) to low (red) quality.

In the Pohick Creek watershed, various portions differ considerably in quality as measured by the overall watershed impact indicator composite score. Generally, the watershed's southern portion (Potomac and Lower WMAs) has above-average watershed quality as compared to the rest of the watershed. A few of the subwatersheds in the I-95 corridor of this southern section are poorer quality. The entire southwestern edge of the watershed (Upper South Run, Middle South Run and Lower South Run WMAs) also generally has good watershed quality. Areas in the vicinity of Burke Lake in the Upper South Run WMA are 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) has 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.

The source composite score rankings are shown in **Map 3.5-2**. Unlike the watershed impact score, the source composite score was computed as a simple average of approximately a dozen individual source indicator scores. The scale establishes the bounds on the gradation from generally good quality (green) to comparatively poor quality (red) on the map. Since the source composite score was computed with a distinct set of indicators from the overall watershed impact score, the subwatersheds with good quality or poor quality may be significantly 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.



N

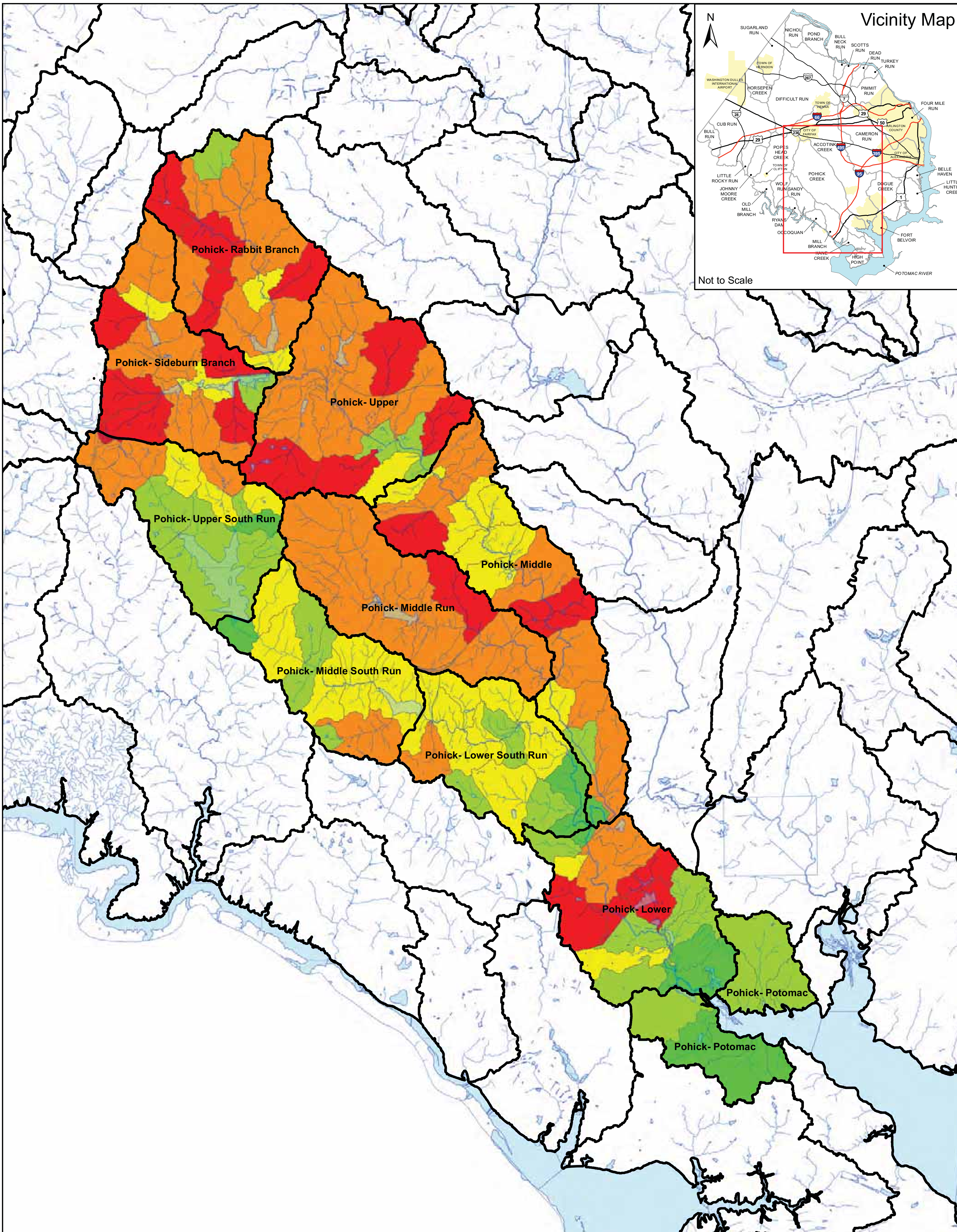
0 0.2 0.4 0.8 1.2 1.6 2 Miles

Legend

- Streams & Rivers
- Watershed Boundaries
- Lakes & Ponds
- High Quality
- Low Quality

Map 3.5-1

Pohick Watershed Impact Composite Score



Legend

- Streams & Rivers
- Watershed Boundaries
- Lakes & Ponds

High Quality

Low Quality

0 0.2 0.4 0.8 1.2 1.6 2 Miles

Map 3.5-2

Pohick Watershed Source Composite Score