



Accotink Creek Watershed Management Plan DRAFT

Watershed Workbook
October 2008

*Fairfax County Department of
Public Works and
Environmental Services*



Accotink Creek

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1 Watershed Condition

1.1 Introduction

The Fairfax County Department of Public Works and Environmental Services (DPWES) is in the process of developing Watershed Management Plans (WMPs) for the 30 watersheds that comprise the county. A watershed is an area of land that drains either directly or through tributary streams into a particular river or water body. Watersheds vary greatly in size from only a few acres to many square miles, and are generally defined by topography. Elevated landforms such as ridges or even roads can serve as watershed divides. For this study, each of these watersheds has been further subdivided into watershed management areas (WMAs) averaging four square miles in size. WMAs are subdivided into subwatersheds, generally ranging in size from 100 to 300 acres.

The successful development of a WMP requires the assessment of the interaction between pollutant sources, watershed stressors, and conditions within streams and other waterbodies. Each watershed must be evaluated in light of its unique conditions. Management opportunities should be identified based on the effects of pollutants and stressors on watershed functions, both in the immediate vicinity of these stressors, as well as farther downstream. The purpose of this document is to provide consistent methods for evaluating watershed management needs while ensuring that WMPs are developed with appropriate attention to watershed-specific conditions. The DPWES Stormwater Planning Division will use the information from these plans to prioritize watershed restoration and protection projects.

The county has developed goals and objectives to be applied to all watersheds during the WMP development process. The three main goals are:

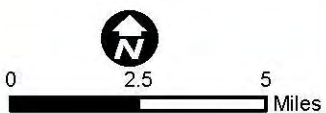
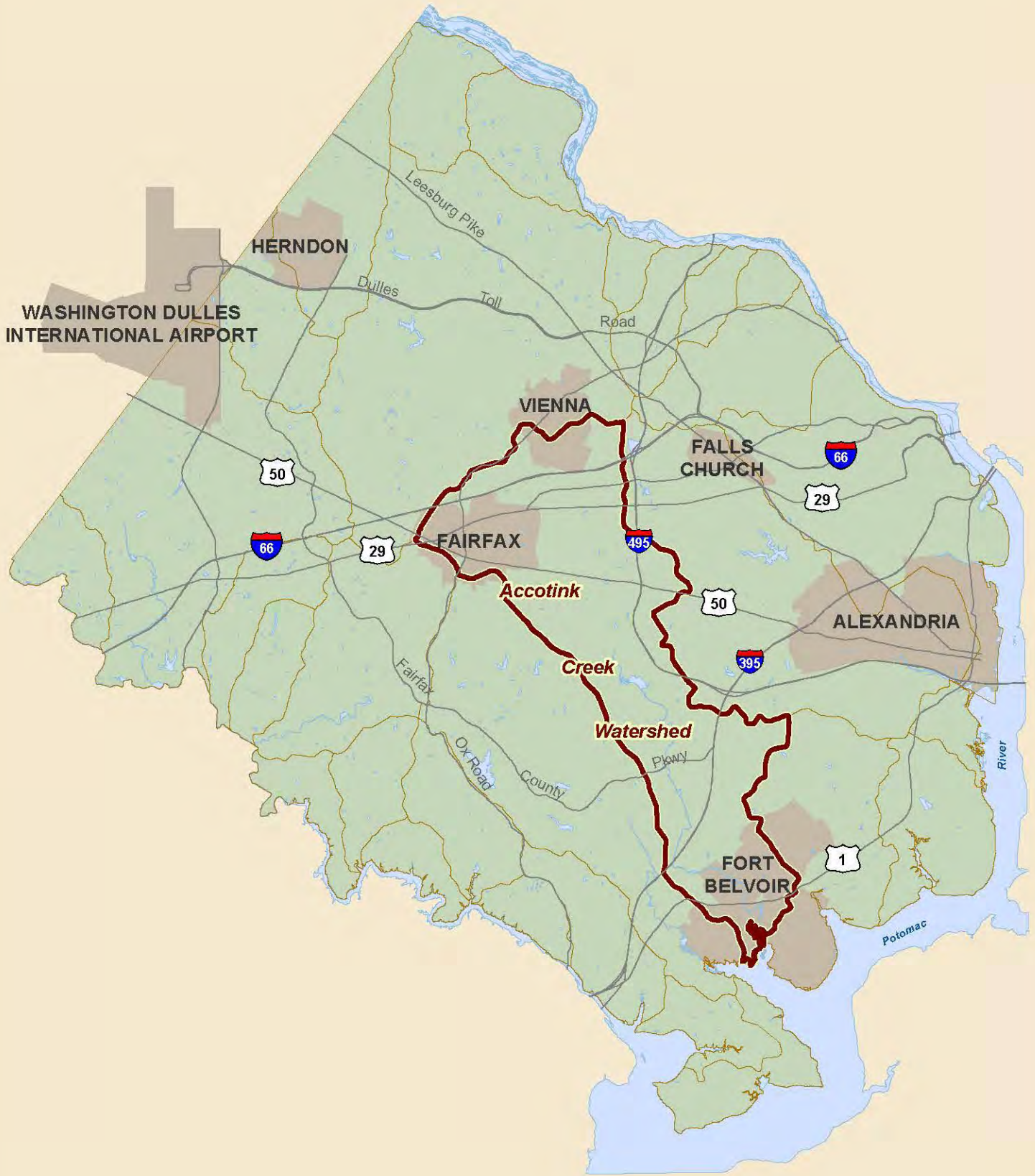
- 1) Improve and maintain watershed functions in Fairfax County, including water quality, habitat, and hydrology.
- 2) Protect human health, safety, and property by reducing stormwater impacts.
- 3) Involve stakeholders in the protection, maintenance and restoration of county watersheds.

The countywide objectives are linked to the above goals. These objectives were consolidated from the list of over 50 stakeholder-defined objectives from previous WMPs. The shorter list of objectives allows for a countywide evaluation that addresses stakeholder concerns while providing an efficient and effective means of assessment. The final objectives are presented in Table 1-1. This table also shows how each objective is linked to the three watershed planning goals. The countywide goals and objectives will be applied to all WMP assessments and recommendations. Additional watershed-specific goals and objectives that are recommended by local stakeholders may also be incorporated into the WMP 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 1-1 - 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

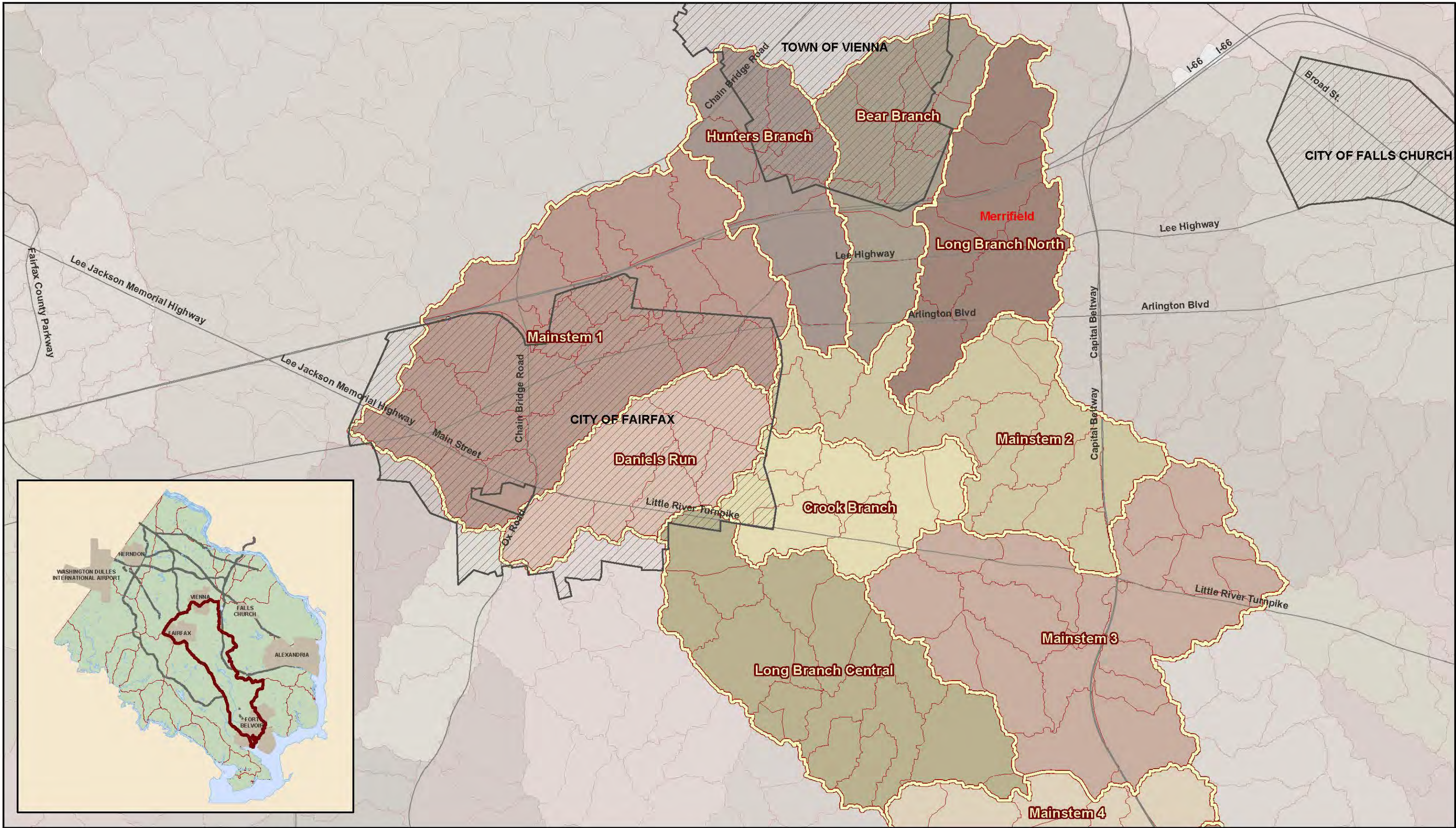
This watershed workbook describes the current and projected conditions for the Accotink Creek watershed, presenting both watershed-wide information and characterization in more detail in Watershed Management Areas (WMAs). The Accotink Creek watershed is located in central and southern Fairfax County, Virginia, as shown on Map 1-1. WMA and subwatershed boundaries are shown on Maps 1-2 and 1-3. The workbook combines information from field assessments of streams and upland areas, water quality monitoring data collected in past years, and watershed modeling conducted for this plan. The information is used to rank problem areas and identify potential sites for improvements.



Map 1-1

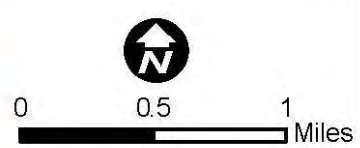
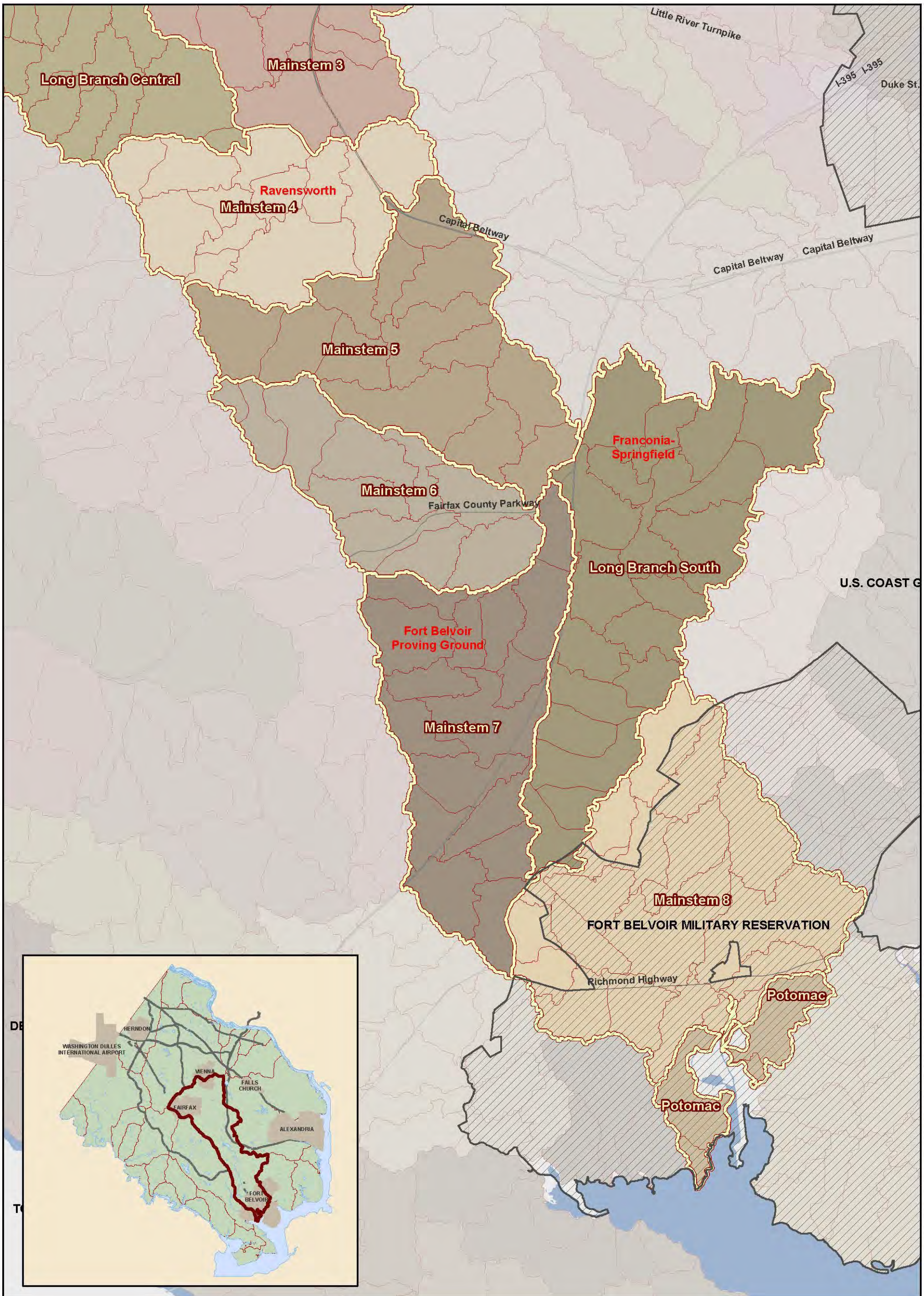
Watershed Location Map

Accotink Creek Watershed



0 0.5 1 Miles

- Lakes and Ponds
- Watershed Management Area (WMA) Boundary
- Subwatershed Boundary



- Watershed Management Area (WMA) Boundary
- Subwatershed Boundary
- Lakes and Ponds

1.2 Watershed Characteristics

The Accotink Creek watershed is approximately 52 square miles and is the second largest watershed in the county. Approximately 13.4 square miles (25 percent) of the watershed are located in areas outside of the county jurisdiction in the Town of Vienna (3 percent), City of Fairfax (10 percent), and Fort Belvoir Military Reservation and other U.S. government installations (12 percent). Major roads within the watershed include Shirley Highway (Interstate 95), Interstate 66, Arlington Boulevard (US 50), Lee Highway (US 29-211), Richmond Highway (US 1) and Little River Turnpike (Route 236). A portion of the Capital Beltway (Interstate 495) runs through the northeastern part of the watershed and the Norfolk Southern Railroad and the CSX Railroad traverse the southern portion.

The watershed is part of the Potomac River Basin and contains 111 miles of streams divided among the 16 WMAs listed in Table 1-2 below. The Mainstem 8 and Potomac WMAs are within the boundaries of Fort Belvoir Military Reservation and were not assessed.

Table 1-2 - Total Area and Stream Length by Subwatershed

WMA	WMA Area (ac)	WMA Area (sq mi)	Stream Length (mi)
Bear Branch	1,392	2.2	5.9
Crook Branch	1,099	1.7	3.0
Daniels Run	1,209	1.9	2.6
Hunters Branch	1,202	1.9	3.2
Long Branch Central	2,429	3.8	8.0
Long Branch North	1,487	2.3	3.9
Long Branch South	3,121	4.9	7.6
Mainstem 1	3,653	5.7	11.3
Mainstem 2	2,069	3.2	9.1
Mainstem 3	3,128	4.9	13.3
Mainstem 4	1,812	2.8	6.7
Mainstem 5	2,445	3.8	8.4
Mainstem 6	1,532	2.4	8.4
Mainstem 7	2,391	3.7	9.2
Mainstem 8	3,233	5.1	12.0
Potomac	480	0.8	0.8
Total Watershed	32,682	51.1	111.3

The mainstem (or principal watercourse) of Accotink Creek flows for 23 miles in a southeasterly direction from the City of Fairfax to Accotink Bay near Fort Belvoir. The principal tributaries to Accotink Creek are Long Branch South, which drains into Accotink in Fort Belvoir; Long Branch Central, which drains just downstream of Braddock Road; Long Branch North, which drains upstream of Prosperity Avenue; Cook Branch; Bear Branch; Hunters Branch; and Daniels Run, which lies entirely within the City of Fairfax. Lake Accotink is located in the center of the watershed. It has a surface area of 68 acres and exerts significant influence on the drainage characteristics of the watershed. See Maps 1-2 and 1-3 for WMA boundaries.

Approximately 87 percent of the watershed is developed, mainly north of Lake Accotink. Most of the development took place after the Flood Plain Ordinance of 1959, which preserved stream valleys and floodplains as open space and limited flooding of habitable buildings. Several problems, however, have been caused by development, including increased stream erosion and stream sedimentation due to concentrated points of stormwater runoff.

1.3 Watershed History and Population Growth

The watershed was primarily forested prior to settlement, with three major plant associations making up the forest. The oak-hickory subregions of the Piedmont oak-chestnut forests were present in the northwest, the subzones of the Coastal Plain forest of oak-pine in the southeast, and American beech forests along the fall line.

The City of Fairfax was founded in 1742, and in 1800 became the county seat. The City of Accotink, which is now in the middle of present-day Fort Belvoir, was also settled around this time. At the turn of the 20th century, as Washington, DC was developing into a major city, development pressures increased in the surrounding areas. By the late 1950s, development was beginning and sewer lines were being laid in the Accotink basin for residential development. Additional development followed through the 1960s, and by 1975 the watershed was approximately 69 percent developed. Predicted growth through 2030 can be seen in Table 1-3.

Table 1-3 - Growth Trends in Fairfax County

Year	Population (1,000s)	Percent Change	Households (1,000s)	Percent Change	Employment (1,000s)	Percent Change
1970	454.3	-	126.5	-	-	-
1980	596.9	31.4	205.2	62.2	-	-
1990	818.6	37.1	292.3	42.4	371.7	-
2000	969.7	18.5	353.1	20.8	518.8	39.6
2010	1,133.0	16.8	411.5*	16.5	683.6*	31.8
2020	1,193.4	5.3	462.4*	12.4	782.2*	14.4
2030	1,334.0*	11.8*	482.3*	4.3*	847.6*	8.4*

All population data provided by Fairfax County except * from Metropolitan Washington Council of Governments

1.4 Watershed Development Patterns

The Accotink Creek watershed was relatively undeveloped prior to World War II. Table 1-4 indicates the area of the watershed developed, by decade, based on the date of subdivision for each parcel. (Note that the large areas of Fort Belvoir and the Engineer Proving Ground are excluded from the total for the watershed.) The first significant residential subdivision development began construction in the 1950s in the more northern and eastern areas of the watershed, particularly within the Town of Vienna. The majority of the development took place in the 1960s, and it consisted primarily of medium-density residential housing.

Table 1-4 - Accotink Creek Watershed Development by Decade

Decade	Area (Acres)	Percent
Open, vacant, common areas, City of Fairfax	13,983	42.8
Ft. Belvoir / Proving Ground	3,883	11.9
1900 and earlier	200	0.6
1910s	11	0.0
1920s	41	0.1
1930s	77	0.2
1940s	423	1.3
1950s	2,889	8.8
1960s	5,652	17.3
1970s	2,522	7.7
1980s	1,757	5.4
1990s	1,020	3.1
2000s	247	0.8
Total Accotink Creek Watershed	32,704	100.0


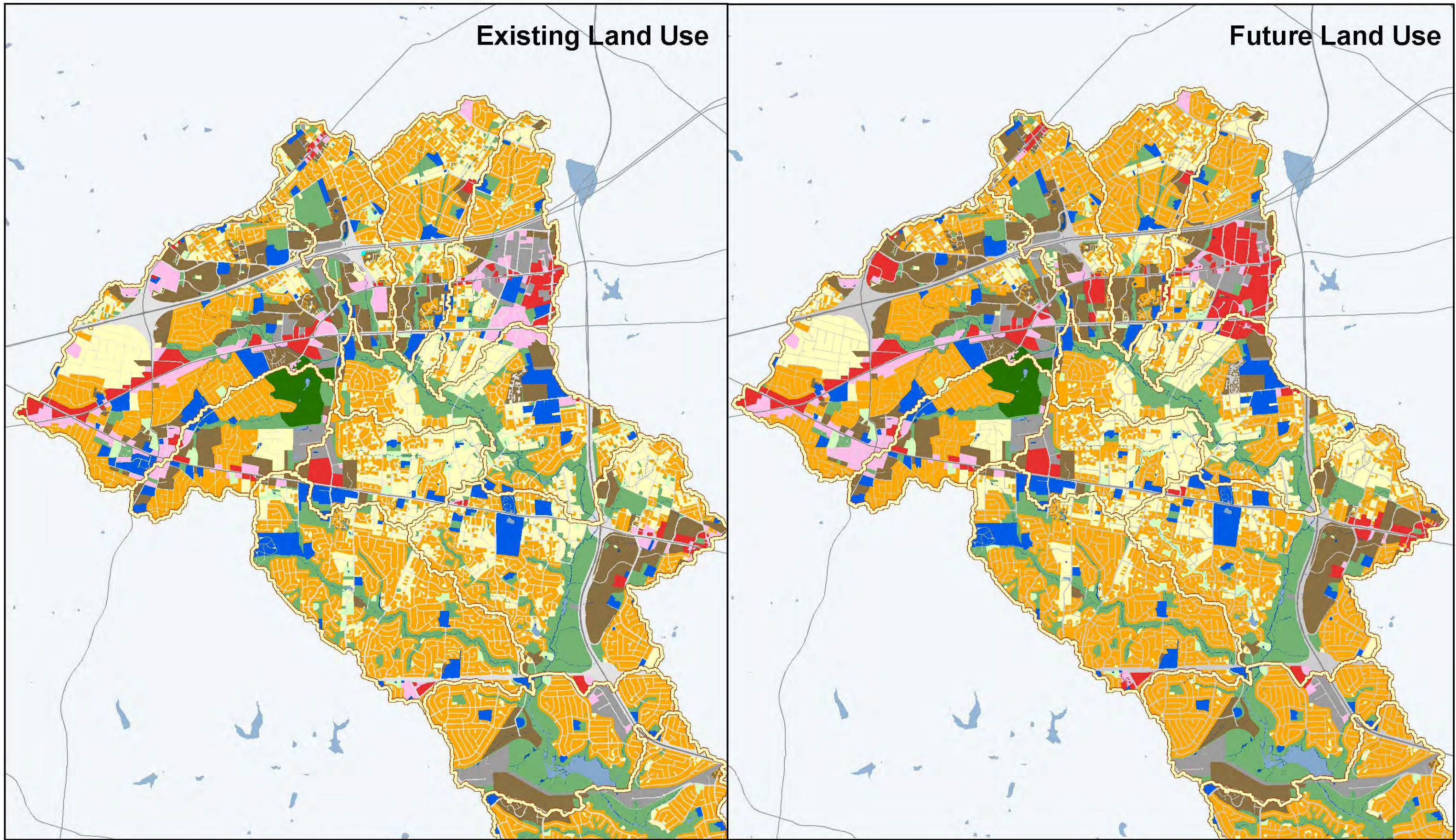
There are two significant commercial and industrial areas in the watershed. The northeastern portion of the watershed incorporates part of the commercial areas of Tyson's Corner, and the southern portion of the watershed along I-95 consists of industrial development. For the most part, these areas have been developed from the 1980s on.

1.4.1 Land Use


Current land-use mapping shows that the watershed is 87 percent developed, with 13 percent remaining as either open space or water. Table 1-5 and Maps 1-4 and 1-5 show the land use distribution throughout the Accotink Creek watershed. Thirty-nine percent of the watershed is residential and 21 percent is in industrial, commercial or transportation land uses. Fourteen percent of the watershed is in institutional uses; the majority of this area consists of Fort Belvoir and the Engineer Proving Ground, with the remainder in uses open to the public such as schools, churches, libraries and government office buildings. The City of Fairfax makes up another 11 percent of the area, primarily in residential, commercial and industrial uses.

Existing Land Use

Future Land Use



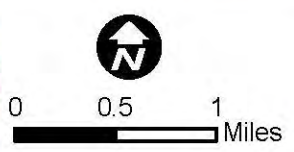
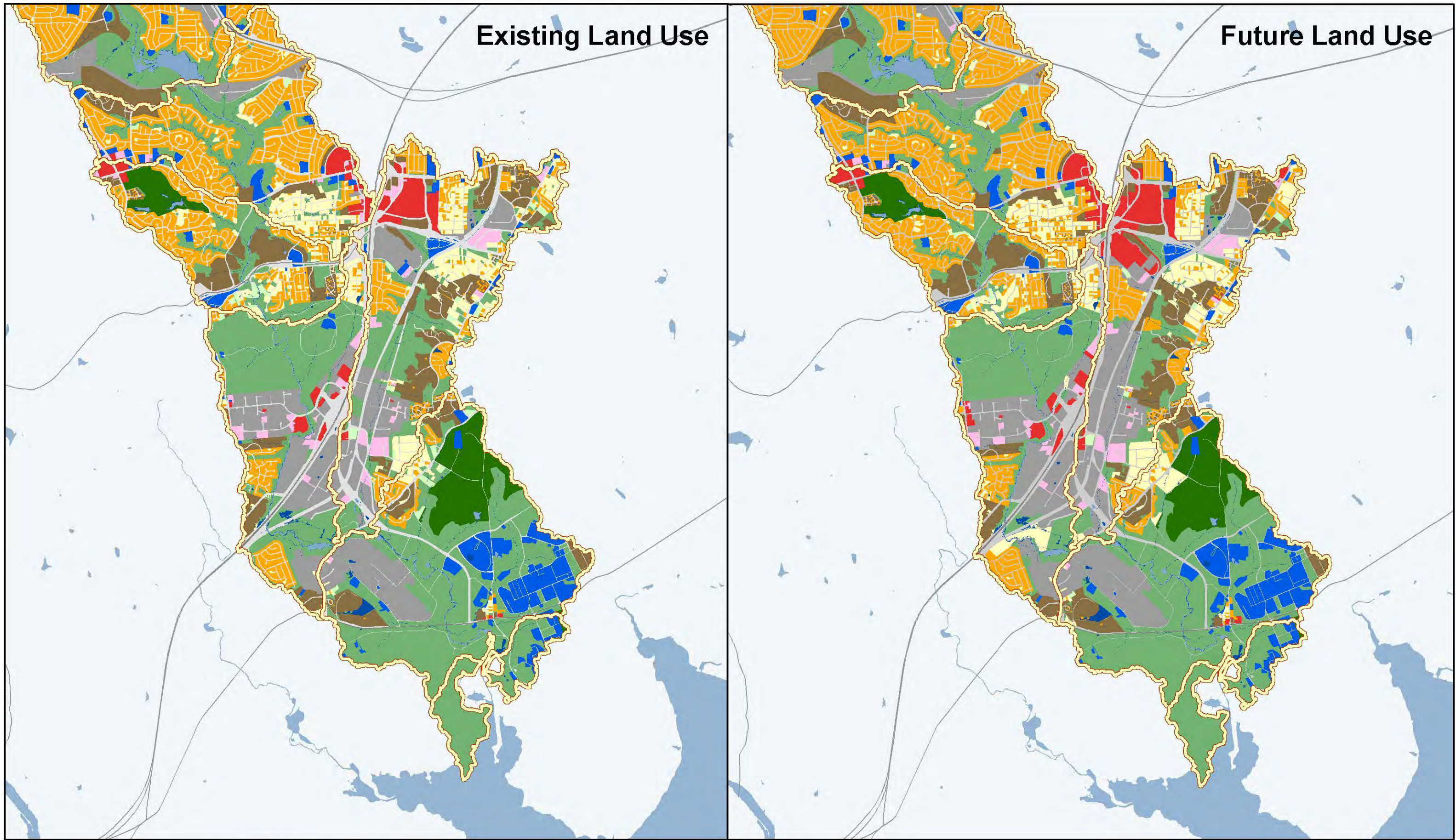
0 0.5 1 Miles



Land Use					
	Estate Residential		High Intensity Commercial		Low Density Residential
	Golf Course		Industrial		Low Intensity Commercial
	High Density Residential		Institutional		Medium Density Residential
					Open Space
					Transportation
					Water
					WMA Boundary

Existing Land Use

Future Land Use



Land Use

- | | | | | |
|--------------------------|---------------------------|----------------------------|----------------|--------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space | WMA Boundary |
| Golf Course | Industrial | Low Intensity Commercial | Transportation | |
| High Density Residential | Institutional | Medium Density Residential | Water | |

Map 1-5

Land Use Map

Accotink Creek Watershed - South

Future land use, also shown in Table 1-5, was derived from a compilation of zoning and general land use plan information. The existing land use data was used as the base data for future land use. In many cases, the planned land uses corresponded roughly to the zoning for the same parcels. Where the planned land use and the zoned land use differed, the classification that provided the greatest density was used.

Table 1-5 - Accotink Creek Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	6,826	21	6,025	18	-801	-12
Golf Course	762	2	762	2	0	0
Estate residential	386	1	266	1	-120	-31
Low-density residential	3,334	10	3,495	11	161	5
Medium-density residential	7,762	24	8,197	25	435	6
High-density residential	3,073	9	3,146	10	73	2
Low-intensity commercial	860	3	651	2	-209	-24
High-intensity commercial	773	2	1,299	4	526	68
Industrial	1,955	6	1,999	6	44	2
Institutional	1,842	6	1,725	5	-117	-6
Transportation	4,748	15	4,756	15	8	0
Water	361	1	361	1	0	0
Total Accotink Creek	32,682	100	32,682	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

The table shows that the Accotink Creek watershed is essentially built out. Only 4 percent of the land use, or 1,247 acres, is forecast to change. The major changes are conversion of 801 acres of open space and redevelopment of 209 acres of low-intensity commercial to 435 acres of medium-density residential and 526 acres of high-intensity commercial, nearly doubling the current amount of high-intensity commercial land use.

Along with development and redevelopment at the scale of subdivisions and large commercial parcels, Fairfax County has been experiencing redevelopment of single lots for larger structures and infill development of vacant and larger single-family residential lots to higher density.

In the late 1990s, concerned with potential problems related to these types of impacts on the surrounding areas, the county initiated a study to develop recommendations which would address commonly raised issues of infill and residential development, including lack of compatibility with the existing communities, added traffic and potential congestion, tree and open space loss and stormwater management and erosion control issues (Infill & Residential Development Study, 2000). The study made recommendations to address issues of site compatibility (12 recommendations), added traffic and potential congestion (five recommendations), loss of open space (four recommendations) and stormwater management and erosion control (13 recommendations).

As a result of the Infill Study, the Board of Supervisors approved some of the recommendations and made amendments to the Policy Plan and Public Facilities Manual addressing factors of site design, neighborhood context, environment, tree

preservation, transportation, public facilities, affordable housing, heritage resources, and stormwater management and sediment control. Further details of proposed actions can be found in county Environmental Improvement Program (EIP) documents on the EIP homepage (www.fairfaxcounty.gov/living/environment/eip/).

1.4.2 Impervious Area

As the area of impervious surfaces such as streets, parking lots and driveways increases within the watershed, the amount of rainfall that can be absorbed into the ground is reduced. This can cause more water to quickly run off the land and into the streams in a short period of time. The storm drainage system is designed to direct this excess stormwater runoff into the stream system, and consequently concentrates the flow. Peak flows during storm periods not only cause flooding but can change the shape of the channel by causing accelerated erosion of the stream banks. An increase in the stream channel width can change the aquatic environment within the stream. As the stream channel widens, the water become shallower, and sun protection from tree cover decreases as mature trees are lost due to bank failure. This can cause the water temperatures to rise and add stress to any aquatic life within the stream.

The acres of impervious surface in the watershed by WMA are shown in Table 1-6 and were calculated from geographic information system (GIS) planimetric layers provided by the county. Impervious surfaces include roads, parking lots, buildings, sidewalks and driveways.

Table 1-6 - WMA Imperviousness

WMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious
Bear Branch	1,392	397	29
Crook Branch	1,099	274	25
Daniels Run	1,209	260	22
Hunters Branch	1,202	444	37
Long Branch Central	2,429	640	26
Long Branch North	1,487	610	41
Long Branch South	3,121	1,025	33
Mainstem 1	3,653	1,421	39
Mainstem 2	2,069	434	21
Mainstem 3	3,267	841	26
Mainstem 4	1,673	582	35
Mainstem 5	2,445	694	28
Mainstem 6	1,532	378	25
Mainstem 7	2,391	651	27
Mainstem 8	3,233	304	9
Potomac	480	16	3
Total Accotink Creek Watershed	32,682	8,971	27

Overall, the Accotink Creek watershed is 27 percent impervious. Imperviousness among the WMAs in the watershed ranges from 3 percent in the Potomac WMA to 41 percent impervious in the Long Branch North WMA. Imperviousness across the watershed is

expected to increase by approximately 1.5 percent from future development. This estimate is based on standard land use impervious percentages applied to each expected future land use.

1.5 Aquatic Resources

The Accotink Environmental Baseline study completed in 1975 by Parsons, Brinckerhoff, Quade and Douglass indicated that the faunal quality of the streams in the Accotink Creek watershed ranged from very poor to good, with 11 of the 26 streams in the watershed in the good to fair range. As the Accotink Creek watershed has changed and developed over the years, the quality of the stream system has declined due to increased storm flow, reduced base flow, and pollutants washed off from urban areas.

In 1999, the county developed the Stream Protection Strategy program to:

- determine the extent of stream degradation and identify areas with the greatest need;
- develop strategies to minimize or prevent additional degradation;
- recommend preservation and restoration efforts;
- support comprehensive watershed planning;
- better integrate environmental policies and regulatory requirements; and,
- promote environmental stewardship and public education programs.

The goal of the Stream Protection Strategy is not to restrict new development, but to provide for more ecologically sensitive and sustainable development. Three watershed management categories were developed to provide more efficient watershed planning and future watershed management (Fairfax County Stream Protection Strategy Baseline Study, 2001). Categories apply to areas within the watershed that can be grouped for similar restoration treatments. Each category includes goals and recommendations to be implemented for watershed protection and restoration. The entire Accotink Creek watershed is categorized as Watershed Restoration Level II. The primary goal for Restoration Level II watersheds is to prevent further degradation and to implement measures to improve water quality.

The results of the data collected from the 12 sampling sites within the Accotink Creek watershed for the SPS Baseline Study are shown in Table 1-7 (listed generally upstream to downstream). Locations are shown on Figure 1, on the following page, with SPS monitoring locations labeled. The streams in the watershed are substantially degraded and most of the tributary streams exhibit poor habitat, poor biological conditions and a lack of fish diversity. Benthic macroinvertebrate community health was also poor throughout the watershed and nearly all of the insects collected were those tolerant of degraded conditions.

Geomorphological assessments also indicated poor conditions throughout most of the watershed, with severely incised stream channels and active stream widening in most of the smaller tributaries. Unstable habitat and sediment bars, eroded banks, tree falls and log jams are widespread throughout the watershed. The poor and very poor overall rankings are consistent with the fact that beginning at the headwaters, the stream flows through heavily urbanized areas with greater than 25 percent imperviousness.

In addition to monitoring conducted by the county, the Northern Virginia Soil and Water Conservation District (NVSWC) maintains a volunteer monitoring program throughout

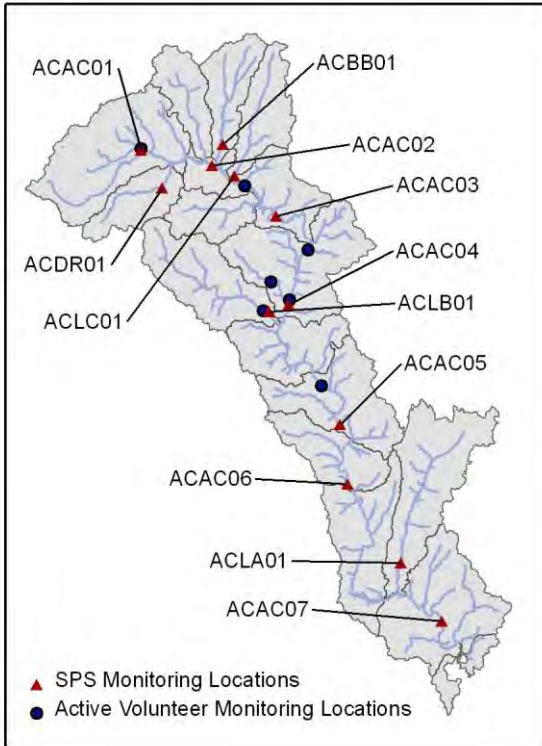


Figure 1 - SPS and Volunteer Monitoring Locations in Accotink Creek Watershed

assessment and collected infrastructure information for all streams in the watershed with a drainage area greater than 50 acres.

Fairfax County. All seven active volunteer monitoring sites in the Accotink Creek watershed received ratings of unacceptable in 2006, the most recent available data. Five of these monitoring sites are located on the mainstem of Accotink Creek. Two additional sites are located on tributaries that flow into the mainstem (one tributary in southern Long Branch Central WMA and one tributary in southwestern Mainstem 3 WMA).

To supplement the biological and habitat data collected by the Stream Protection Strategy Baseline Study, beginning in the fall of 2002, field crews conducted a detailed Stream Physical Assessment (SPA) on approximately 801 miles of streams throughout Fairfax County, including the Accotink Creek watershed. The results of the assessment will be used in the watershed planning process to

develop management strategies. As part of the SPA, field crews conducted a physical habitat assessment, a geomorphologic

Table 1-7 - Stream Protection Strategy Baseline Data Summary

Stream Name (Site Code)	Composite	Environmental Variables			Projected Percent Impervious	
	Site Condition Rating	Index of Biotic Integrity	Habitat Score	Fish Taxa Richness		Current Percent Impervious
Accotink Creek 1 (ACAC01)	Very Poor	Poor	Very Poor	Low	35.2	35
Daniels Run (ACDR01)	Very Poor	Very Poor	Poor	Very Low	25.5	25
Accotink Creek 2 (ACAC02)	Very Poor	Fair	Very Poor	Moderate	31.3	37
Bear Branch (ACBB01)	Very Poor	Very Poor	Poor	Low	25.1	43
Long Branch North (ACLC01)	Very Poor	Very Poor	Poor	Low	37.6	44
Accotink Creek 3 (ACAC03)	Very Poor	Poor	Poor	Moderate	29.7	36
Accotink Creek 4 (ACAC04)	Poor	Poor	Poor	Moderate	28.6	35
Long Branch Central (ACLB01)	Poor	Poor	Fair	Moderate	23.6	24
Accotink Creek 5 (ACAC05)	Poor	Very Poor	Good	Moderate	27.4	34
Accotink Creek 6 (ACAC06)	Poor	Poor	Good	Moderate	27.1	35
Long Branch South (ACLA01)	Poor	Poor	Good	Low	30.3	49
Accotink Creek 7 (ACAC07)	Poor	Poor	Poor	Moderate	26.3	36

Source: SPS Baseline Study Report, 2001. Sites are generally ordered from upstream to downstream.

1.5.1 Stream Habitat

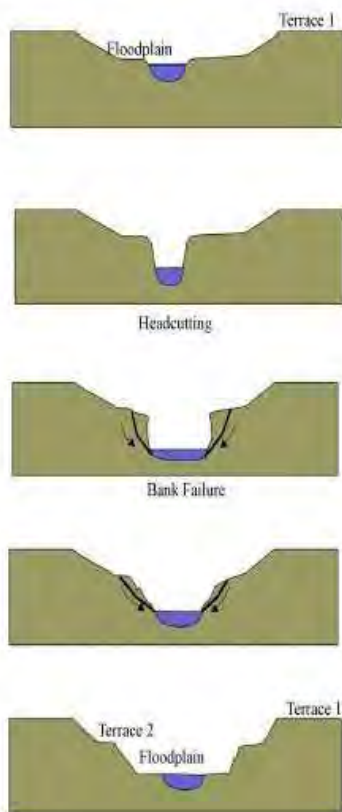
Habitat was assessed on 85 of the 111 miles of stream within the Accotink Creek watershed. In comparison with the rest of the county, the Accotink Creek watershed is in the lower middle range of quality. Of the assessed reaches, 1.5 miles (2 percent) of stream were rated as excellent, 18 miles (21 percent) as good, 23 miles (27 percent) as fair, 33 miles (39 percent) as poor, and eight miles (9 percent) as very poor for habitat conditions.

1.5.2 Stream Geomorphology

Stream geomorphology describes how a stream channel adjusts to changes in its watershed. Stream erosion is a natural process which occurs slowly in an undeveloped setting, with the stream forming a dynamically stable channel. The size and shape of the stream channel are dependent on the type of soils, the steepness of the grade and the amount of water that flows into the channel. If one of these conditions is changed, the channel will adjust itself to accommodate the new conditions and find a new stable size and shape. The most significant change that occurs with development in a watershed is an increase in the amount of water flowing in a channel during storm events because of concentrations of flow from impervious surfaces.

The geomorphologic assessment of the stream channels in the Accotink Creek watershed is based on the Channel Evolution Model (CEM) (Schumm et al. 1984), which

gives insight into how stream channels change after a disturbance such as a change in watershed land use. The CEM classifies streams into the five categories shown below in Figure 2, and can be useful for predicting future conditions:



Type I – This represents pre-disturbance condition, with well-vegetated streambanks.

Type II – This is the first stage after disturbances to the watershed. The dominant physical process in this stage is bed degradation, with the beginning stages of stream incision (downcutting).

Type III – At this stage bed degradation has led to overly steep banks, and bank failure is common. This stage is the most unstable of all CEM stages. Channel widening is the dominant physical process in a Type III channel.

Type IV – The dominant physical process in a Type IV channel is sediment aggradation. This stage is considered the beginning phase of stream stabilization after disturbance.

Type V – Type V channels are similar to the stream's Type I channel in dimension and capacity. The new channel is lower than the original channel and the original flood limit is now a terrace.

Figure 2 - CEM Categories

CEM stream channel evaluations resulted in classifying 91 percent of the channels in the Accotink Creek watershed as being Type III, indicating an unstable channel experiencing severe bank erosion.

1.5.3 Infrastructure Inventory

The infrastructure inventory conducted by field crews for the 2002 SPA study includes all structures and conditions that may have potential impacts on the stream, such as sources of contamination or pipes, ditches, stream obstructions, dump sites, head cuts, utilities, erosion problem areas, stream crossings and areas of deficient buffer.

An assessment of the infrastructure in the watershed was also conducted. Of the 1,211 inventory points, the most significant problems were 15 deficient buffers, four head cuts, two exposed utility lines and one pipe with an impact score of 10, indicating the pipe is causing severe erosion.

There are over 90 major stream crossings in Accotink Creek, including steel and wooden bridge overpasses and reinforced concrete and corrugated metal culverts.

1.5.4 Wetlands

According to National Wetland Inventory (NWI) data shown in Table 1-8, Accotink Creek watershed contains 1,043 acres of wetlands. Of this, approximately 880 acres are freshwater emergent and forested wetlands. These types of palustrine wetlands are often dry for at least part of the year.

Another 39 acres are riverine wetlands, which occur in floodplains and along stream corridors and are heavily influenced by stream flooding. There is generally water flowing in a riverine system.

The remaining 123 acres are either unclassified or are lacustrine wetlands associated with open water bodies such as lakes, reservoirs and other water impoundments.

There are approximately 239 wetlands in the watershed. Of these, 177 are less than three acres, 43 are between three and 10 acres, and 19 are greater than 10 acres. The largest of these are the marshes located near Lake Accotink and at Accotink Bay on the Potomac River.

Table 1-8 - NWI Wetlands by WMA in Accotink Creek watershed

WMA	Freshwater Emergent Wetland	Freshwater Forested/ Shrub Wetland	Freshwater Pond	Lake	Other	Riverine	Total
Bear Branch	-	13.8	0.6	-	-	-	14.3
Crook Branch	-	13.6	0.8	-	-	-	14.5
Daniels Run	-	3.4	7.2	-	-	-	10.5
Hunters Branch	-	9.9	0.3	-	-	-	10.2
Long Branch Central	2.4	42.5	2.7	-	-	-	47.6
Long Branch North	-	22.8	2.4	-	-	-	25.2
Long Branch South	0.2	61.3	3.3	-	2.0	0.3	67.1
Mainstem 1	-	2.9	0.9	-	0.2	-	4.1
Mainstem 2	2.2	179.8	1.3	-	-	-	183.3
Mainstem 3	11.8	84.4	9.0	-	-	-	105.2
Mainstem 4	17.7	90.8	2.6	61.0	4.2	8.2	184.7
Mainstem 5	-	112.0	2.0	0.4	-	13.2	127.6
Mainstem 6	-	51.6	8.1	-	-	8.4	68.1
Mainstem 7	-	56.0	5.5	-	0.1	3.9	65.5
Mainstem 8	11.0	74.1	8.4	-	-	3.1	96.6
Potomac	1.5	14.3	0.2	-	-	2.4	16.0
Total	46.8	833.3	55.4	61.3	6.6	39.6	1,043.0

1.5.5 Water Quality

The streams of the Accotink Creek watershed are regulated by water quality standards set by the Virginia State Water Control Board (SWCB). Waters in the Accotink Creek watershed are designated as Class III waters (Nontidal Waters Coastal and Piedmont Zones), with regulated criteria for dissolved oxygen (4.0 mg/L minimum), pH (6.0 – 9.0), and maximum temperature (32° C). Fecal coliform is also regulated with an allowable geometric mean limit of 200 fecal coliform bacteria per 100 ml of water for two or more samples in a calendar month with no more than 10 percent of monthly samples collected

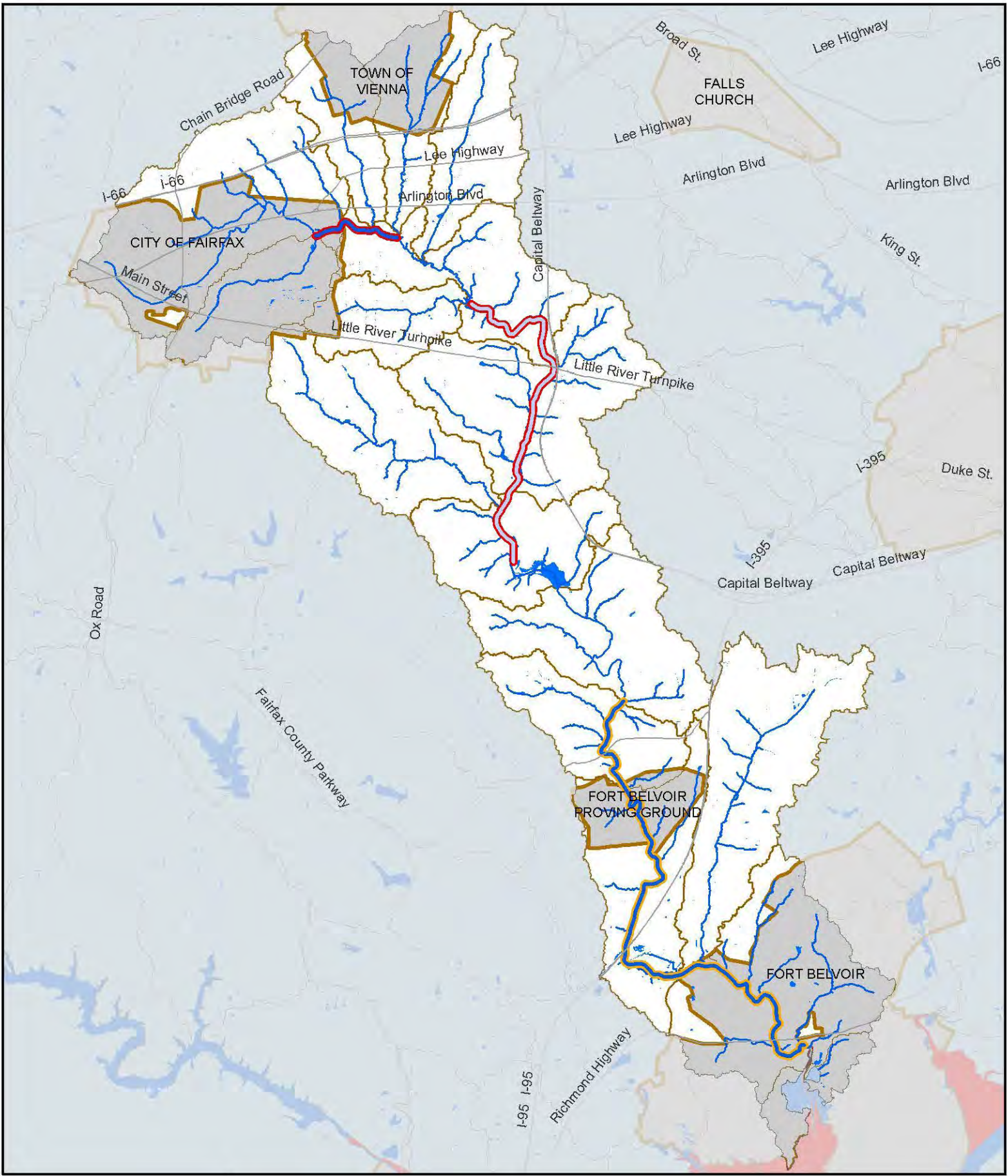
exceeding 400 colonies per 100 ml of water. *Escherichia coli*, a type of fecal coliform bacteria, is also regulated with an allowable geometric mean limit of 126 colonies per 100 ml freshwater sample for two or more samples take during any calendar month, and a single sample maximum of 235 colonies per 100 ml freshwater sample.

Fairfax County Sampling – Water quality data is collected through ongoing monitoring conducted by the county and various volunteer organizations. Available county data within the Accotink Creek watershed, ranging from June 1999 to March 2007, including SPS Baseline and more recently collected data, indicate one site with a pH below the acceptable range of 6.0 and one site with dissolved oxygen below the acceptable range of 4 mg/L.

The Fairfax Department of Health’s Division of Environmental Health has been sampling the waterways throughout Fairfax County since 1969. For data collected between 2000 and 2002 at the 14 sampling sites in the Accotink Creek watershed, pH was outside of criteria limits for only one percent of over 700 samples. Criteria exceedance for dissolved oxygen and temperature were also low, with 5 percent of samples below the allowable dissolved oxygen limit and no sample above the allowable temperature. However, fecal coliform samples exceeded the maximum allowable limit of 200 bacteria per 100 ml of water for 80 percent of the samples collected between 2000 and 2002.

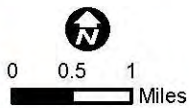
303(d) List and TMDL – Section 303(d) of the Clean Water Act requires the state to identify and report water bodies for which water quality standards are not being met. The list of impaired waters is compiled into the 303(d) Impaired Waters Report (this is often referred to as the 303(d) List). This report specifically describes the locations of the listed water body and the cause and source of pollutants causing the impairment. Once a water body is listed as impaired, a plan is developed to restore the water. This plan takes into account the total amount of pollution a water body can assimilate, or a total maximum daily load (TMDL). The restoration plan is often referred to as a TMDL and is accompanied by a target year for restoration. Impaired waters for which a TMDL is required is listed under Category 5 in the Impaired Waters Report.

Portions of the Accotink Creek watershed have been listed as impaired (Category 5) waters for benthic macroinvertebrate bioassessment (streams), fecal coliform and *E. coli* (see Map 1-6). Accotink Creek, from the confluence with Calamo Branch to the tidal waters of Accotink Bay, was first listed for benthic macroinvertebrate bioassessments in 1998 and has a Total Maximum Daily Load (TMDL) schedule of 2010. This same segment was listed in 2004 for a fecal coliform impairment, with a TMDL schedule of 2016. Also in 2004, the segment of Accotink Creek from its confluence with Daniels Run in the City of Fairfax to its confluence with Bear Branch was listed as impaired for *E. coli* with a TMDL schedule of 2014.



- Impairments for benthic macroinvertebrates (listed 1996, TMDL schedule 2010) and E. coli (listed 2004, TMDL schedule 2016)
- Impairment for E. coli (listed 2004, TMDL schedule 2014)
- Impairment for E. coli (listed 1998, TMDL approved 2002)

Map 1-6



In 2006, Accotink Bay was listed as impaired for aquatic plants (macrophytes), with a TMDL schedule of 2010. Several causes of the impairment include atmospheric deposition of nitrogen, industrial and municipal point source discharge, internal nutrient recycling, loss of riparian habitat, sediment resuspension and wet weather discharges.

The tidal waters of Accotink Creek near the confluence with the tidal waters of Pohick Bay/Gunston Cove were first listed in 2002 as impaired for PCB in fish tissue. This listing included a PCB fish consumption advisory based on the Virginia Department of Health, Division of Health Hazards Control standards.

USGS Bacteria Source Tracking – In 1998, a 4.5-mile segment of Accotink Creek from the confluence of Crook Branch and Accotink Creek to the start of Lake Accotink was placed on the Section 303(d) list of impaired waters due to elevated levels of fecal coliform bacteria. In order to develop a TMDL for this stream segment, a study was conducted by the United States Geological Survey (USGS) in cooperation with Virginia Department of Conservation and Recreation (DCR). This study was a bacteria source tracking (BST) study which would identify the sources of fecal coliform in the streams using genetic fingerprinting.

Waters that contain fecal coliform bacteria levels above the state water quality standard can pose an increased health risk for anyone coming into contact with that water. A study in the Accotink Creek watershed, with data collected between March 1999 and October 2000, used a type of BST called ribotyping to identify the most significant sources of fecal coliform bacteria as geese, humans, dogs, cats, sea gulls and raccoons. Source identification using ribotyping is precise enough as to be used in the development of a fecal coliform TMDL.

The results of the BST study were used in combination with the Hydrological Simulation Program – FORTAN (HSPF) watershed model to simulate streamflow and bacterial transport in the Accotink Creek watershed. According to the results of this second study, in order for the watershed to meet state water quality standards and the associated TMDL, an 89 percent reduction in fecal coliform bacteria load would need to occur.

1.6 Terrestrial Resources

1.6.1 Forests

Forests provide many benefits for aquatic systems. Vegetation and fallen leaves slow overland flow, reducing soil erosion. Nutrients are taken up by vegetation that might otherwise enter the stream system. Streamside forest canopy, or riparian buffers, provide shade and cool the water allowing for a higher dissolved oxygen concentration, which is needed by fish and aquatic macroinvertebrates. Additionally, aquatic habitat depends on the input of woody debris and stream bank root mats. Forest cover is also required for terrestrial fauna. However, various species require forest of a certain size and spatial distribution to provide adequate habitat. Today, open space occupies only 13 percent of the Accotink Creek watershed, primarily along stream corridors. Roadways and development have effectively fragmented much of the remaining forest, compromising its ability to provide viable habitat. Stream corridors and the associated Chesapeake Bay Resource Protection Areas (RPAs), a 100-foot forested riparian buffer around all perennial streams in the county, provide some connection between forest

cover and stream valleys, however upland forest cover does not have direct connectivity in most parts of the watershed.

1.7 Stormwater Management

1.7.1 History of Stormwater Management in Fairfax County

In the early 1900s, the population of Fairfax County was only slightly over 12,000 and development was basically unregulated. Stormwater controls consisted primarily of digging ditches or using pastures to prevent flooding.

By 1964, with the adoption of the first Policy and Guidelines Manual, the main goal of stormwater management was flood prevention. Stormwater management only consisted of maintaining adequate drainage through curb-and-gutter construction leading to concrete pipes or channels, which emptied into the nearest stream. Several large storms, including Hurricane Agnes, occurred during this time creating intense peak flows in receiving streams causing erosion and damage to homes built in the floodplain. Consequently, costly flood control structures were required which prompted the county to set strict limits on new construction within any 100-year floodplain.

During the 1970s, the population of Fairfax County grew to 900,000 residents. The associated development increased runoff and flooding potential downstream. During this time, stormwater detention, with the primary focus of controlling water quantity, began to be implemented to reduce peak flows downstream. In 1976, Fairfax County became one of the first jurisdictions in the U.S. to adopt stormwater management as a development requirement when it was required by the Army Corps of Engineers as part of their agreement for flood control improvements in the Four Mile Run watershed. The regulations were extended to manage stormwater quality in 1993. These “best management practices,” or BMPs, are used to reduce or even prevent the discharge of pollutants into waters downstream of the BMP. BMPs can be either structural (such as ponds, designed wetlands or bioretention facilities) or non-structural (such as public education, preserving open space and managing development). See Table 1-9 for BMP treatment types in the Accotink Creek watershed by WMA.

Table 1-9 - BMP Treatment Types by WMA

WMA	Current Treatment Types			
	Quantity (acres)	Quality (acres)	Quantity/Quality (acres)	None (acres)
Bear Branch	13	33	48	1,298
Crook Branch	38	18	25	1,017
Daniels Run	1	0	0	1,207
Hunters Branch	9	29	111	1,054
Long Branch Central	38	8	61	2,321
Long Branch North	5	70	106	1,306
Long Branch South	103	199	334	2,485
Mainstem 1	163	44	155	3,291
Mainstem 2	44	24	18	1,983
Mainstem 3	106	56	55	2,911
Mainstem 4	6	17	1	1,413
Mainstem 5	11	42	14	1,844
Mainstem 6	122	63	38	1,309
Mainstem 7	129	129	55	1,708
Mainstem 8	89	29	35	3,081
Potomac	0	0	0	479
WS Totals	878	763	1,056	28,707

Note: Ultimate condition values are estimates and will be revised when better data is available.

1.7.2 Chesapeake Bay Preservation Ordinance

In 1993, 100-foot buffers around perennial stream corridors were designated as Resource Protection Areas (RPAs) and the rest of the county was designed as a Resource Management Area (RMA). These designations governed the type and amount of new development and redevelopment that could occur in the environmentally sensitive areas of the county.

1.8 Flooding and Drainage Complaints

A total of 5,031 complaints were received throughout the Accotink Creek watershed. Five of these records had no associated complaint with them and were removed from the count, leaving a revised total of 5,026 complaints.

Complaints were organized into eight categories. Some of the comments that were received contained several different complaints, so it is possible for one comment to be placed into more than one category. The eight categories include: Erosion, House Flooding, Road Flooding, Yard Flooding, Miscellaneous Flooding, Blockage/Clog, Cave In/Sink Hole and Other. The 5,026 complaints are broken down and summarized in Table 1-10.

Table 1-10 - Summary of Drainage Complaints

Category	Number of Complaints	Percentage of Complaints
Erosion	443	8.8
House Flooding	184	3.7
Road Flooding	39	0.8
Yard Flooding	489	9.7
Miscellaneous Flooding	487	9.7
Blockage/Clog	1,206	24.0
Cave In/Sink Hole	578	11.5
Other	1,976	39.3

The Miscellaneous Flooding category includes those comments regarding standing water, overflows and flooding which were not designated as a specific type (i.e. house, road or yard). The Other category includes those complaints such as lost items in the storm drain, maintenance or repair needs or requests for more information.

As can be seen in Table 1-10, the majority of the complaints were regarding storm drains which were clogged up or blocked by debris. The second most common complaint was sink holes or caved-in areas throughout the watershed.

2 Watershed Management Area Characterization

All maps for Chapter 2 are attached as an Appendix to this document.

2.1 Introduction

Three levels of watershed management units have been used for this plan. The first is the watershed, a land area typically from 10 to 100 square miles. The watershed represented in this plan is the drainage area for all of Accotink Creek. Statewide water quality monitoring and management is focused at the watershed level.

The next smaller management unit for this plan is the Watershed Management Area (WMA). WMAs are areas of about one to 10 square miles, made up of one or more tributaries that drain parts of the watershed. Several of the larger tributaries have been defined as WMAs, including Daniels Run, Hunters Branch, Bear Branch, Long Branch North, Crook Branch, Long Branch Central and Long Branch South. Because Accotink Creek is a long, narrow watershed, most of the WMAs consist of direct drainage to the mainstem of the creek, along with some smaller tributaries.

Planning at the WMA level focuses on the condition of the tributary streams, including habitat for fish and other aquatic life. These management units are small enough that they are usually within one or two political jurisdictions so that regulatory authority to implement management measures is less complex. They also tend to be more uniform in relation to land use and pollutant sources, so that identification of problems and solutions is also less complex.

The most detailed level of management units for this plan are the subwatersheds, areas of 100 to 300 acres. They are the smallest drainage areas and are modeled to estimate flows and pollutant loads. Subwatershed analysis is used to pinpoint areas within a WMA where stormwater retrofits or other management measures should be investigated.

2.1.1 Field Reconnaissance

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

Prior to fieldwork, GIS analysis was used to identify neighborhoods representative of the watershed and hotspot sites. Approximately 25 neighborhoods and 30 hotspots were identified during the desktop analysis.

Neighborhood Source Assessment. The Neighborhood Source Assessment was conducted as part of the Unified Subwatershed and Site Reconnaissance (USSR), the purpose of which is to evaluate the pollution-producing behaviors in residential areas to help target education messages and voluntary stewardship programs. A subsample of neighborhoods within the watershed was assessed to provide representative coverage of existing residential areas. Field crews drove through each neighborhood to get a sense of its general characteristics, such as the location of downspout drainage, turf management status, curb and gutter condition and the amount of forest canopy. Where

needed, the pre-identified neighborhood was split into multiple neighborhoods when one portion of the neighborhood had significantly different characteristics (e.g., larger lawns, less forest canopy, etc.).

Hotspot Site Investigation. The Hotspot Site Investigation was conducted to evaluate the pollution-producing behaviors at commercial hotspots (e.g., gas stations, restaurants, industrial areas, etc.) to help target education messages and voluntary stewardship programs. The goal was to quickly identify areas where stormwater pollution is generated and identify ways to mitigate it. A subsample of potential hotspots within the watershed was assessed to provide representative coverage. At each hotspot, field crews evaluated various site activities, including vehicle operations, outdoor material storage, waste management, condition of the building, parking, and landscaped areas, and stormwater infrastructure. Due to the high number of sites visited, field crews completed the HSI form for only those sites that were found to have significant, solvable problems. Generally, recommendations for these sites fall into watershed-wide, non-structural recommendations such as better dumpster management and outdoor storage practices.

While assessing hotspots throughout the watershed, each field crew noted numerous opportunities for better dumpster and waste management at retail and restaurant establishments. Another frequent finding at hotspots was uncovered fuel areas. While retail gas stations generally had covered fuel pumps, a majority of on-site fueling pumps for fleet vehicles were found uncovered. In nearly each case, fueling areas sloped toward an adjacent storm drain with no containment or spill prevention materials visible. Dumpster and waste management education and spill prevention plans are an important recommendation in the heavily industrial/commercial areas of the watershed.

Another common observation in the industrial areas, especially in the southern part of the watershed, was excessive dumping, litter and trash – despite the presence of “No Dumping” signs. This excessive trash and litter is washed into storm drains. Providing bilingual public educational campaigns and materials and prohibiting sheet flow from industrial parking lots can help reduce this problem.

2.1.2 Existing Watershed Modeling

Storm events are classified by the amount of rainfall, in inches, that occurs over the duration of a storm. 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 two-year, 24-hour storm (having a 50 percent chance of happening in a given year) has less rainfall than a 10-year, 24-hour storm (having a 10 percent 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 ultimately is 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 the resulting pollution, such as nutrients (nitrogen and phosphorus) and sediment that are transported by the runoff.

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

Table 2-1 below shows three storm events and the rationale for modeling.

Table 2-1 - Storm Event Modeling Rationale

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

Hydrologic Modeling. Hydrologic modeling was performed using the EPA Storm Water Management Model, version 5. At the time of this writing, model results were preliminary and a final calibrated model had not been developed.

Water Quality Modeling. Water quality modeling consisted of estimating pollutant loads from each subwatershed with STEPL, a spreadsheet model. The model estimates loads for total nitrogen (TN), total phosphorus (TP), biological oxygen demand (BOD) and total suspended solids (TSS).

Results of the water quality modeling are shown in Maps 2-1, 2-2 and 2-3 and discussed at the subwatershed level in the following sections describing each WMA in more detail.

Hydraulic Modeling. Hydraulic modeling for the project was conducted using the HEC-RAS program developed by the Corps of Engineers. As of this writing, results of the modeling are preliminary.

2.1.3 WMA and Subwatershed Ranking

The purpose of the ranking approach is to provide a systematic means of compiling available water quality and natural resources information. Ranking WMAs and subwatersheds based on watershed characterization and modeling results provides a tool for planners and managers to use as they consider which areas should undergo further study and set priorities. The ranking will be updated based on issues and problem areas identified during the scoping forum and advisory group meetings. The resulting data will be utilized to identify key issues and proceed with projects that will achieve the county’s watershed management goals and objectives.

Three basic indicator categories are used to rank subwatershed conditions as shown in Table 2-2.

Table 2-2 - Indicator Categories used in Subwatershed Ranking

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 indicators are combined to generate composite scores which are used in the prioritization and subwatershed ranking process.

Results of the ranking at the subwatershed level are shown on Map 2-4.

2.2 Bear Branch

2.2.1 General Characteristics

Bear Branch flows for approximately six miles in a southerly direction from the Town of Vienna to its confluence with Accotink Creek just north of Barkley Drive. The Bear Branch WMA has a drainage area of 1,392 acres through both developed and undeveloped regions.

All of the assessed streams within the Bear Branch WMA are moderate to high gradient riffle/run streams categorized by active widening with bank erosion. The channel bed is primarily gravel.

2.2.2 Field Reconnaissance

In Bear Branch, the Carriage Lawn townhouse community was assessed. The community has virtually no forest canopy and approximately 90 percent impervious cover. The sidewalks and curb and gutter were found in good condition with a small amount of gravel and dirt. Storm drain inlets were clean and clear.

2.2.3 Land Use

The Bear Branch WMA is characterized by medium-density residential development which accounts for 41 percent of the area, as shown in Map 2-5, attached. Another 14 percent of the WMA is low-density residential development. Eight percent has been preserved for open space or parks. Future land use is projected to change primarily in the open space and estate residential land use categories. Losses in open space (-32 acres) and estate residential (-10 acres) will be met primarily with gains in the medium-density residential (39 acres) land use category. A summary of the land use within the WMA is shown in Table 2-3.

Table 2-3 - Bear Branch Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	115	8	83	6	-32	-28
Golf Course	0	0	0	0	0	0
Estate Residential	23	2	13	1	-10	-43
Low-Density Residential	191	14	192	14	1	1
Medium-Density Residential	576	41	615	44	39	7
High-Density Residential	130	9	131	9	1	1
Low-Intensity Commercial	17	1	17	1	0	0
High-Intensity Commercial	10	1	15	1	5	50
Industrial	4	<1	4	<1	0	0
Institutional	72	5	68	5	-4	-6
Transportation	246	18	246	18	0	0
Water	8	1	8	1	0	0
Total	1,392	100	1,392	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 397 acres, or 29 percent of the total WMA area of 1,392 acres.

2.2.4 Stormwater Infrastructure

Stormwater Management

County records show that there are 13 stormwater management facilities within the Bear Branch WMA. The facilities provide control for 98.8 acres, or approximately 8 percent of the WMA. About three-quarters of the area is treated for both quantity and quality, and the remaining area receives quantity control alone. All but one facility is located in the southern end of the WMA. Stormwater infrastructure is shown on Map 2-6, attached.

2.2.5 Stream Condition

Stream conditions for this WMA are shown on Map 2-7, attached.

Erosion

There was a total of 140 linear feet of erosion on the right stream bank (facing downstream) identified in the WMA at two specific erosion locations. (The first is located just south of Kingsley Road and the second is located south of Arlington Boulevard.) These erosion sites had moderate restoration potential.

Outfall Impacts

One 36-inch storm drainage pipe, located just south of Cottage Street, was identified as causing major erosion.

Stream Crossings

Thirty-four stream crossings were identified during the assessment. None of the crossings had significant impacts on stream condition or erosion.

Obstructions

There are 10 obstruction sites located in Bear Branch, all of which consist of trees and debris. Five of the obstruction sites are thought to be impacting fish movement within the stream (one obstruction site is located on the downstream end, two sites are located just north of Arlington Boulevard, and two sites are just south of Lee Highway/Route 237).

Stream Buffers

All of the stream buffer encroachments in the Bear Branch watershed are lawn. There were 16 deficient buffer points. None of these are severely impacting the stream.

Habitat

As part of the Stream Physical Assessment in 2003, the stream physical habitat was characterized along four of the five reaches in the Bear Branch WMA. The overall rating was poor for 100 percent of the assessed stream length.

In the entire WMA there were no assessed habitat parameters that fell within the optimal classification. Approximately 85 percent of the streams were classified as suboptimal for instream cover (fish habitat) and for frequency of riffles. All of the assessed streams were classified as poor for bank vegetative protection (left and right banks), bank stability (left and right banks) and vegetative buffer zone width (left bank).

2.2.6 WMA Modeling

As shown in Table 2-4, the subwatershed in the Bear Branch WMA with the highest modeled nutrient and sediment loading is AC-BB-0015, an area bisected by Interstate

66. AC-BB-0050, which contains the Vienna Technology Park, also shows some of the highest loadings in this WMA.

Table 2-4 - Bear Branch Water Quality Modeling Results

Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-BB-0000	6.33	1.03	0.15
AC-BB-0005	6.44	0.96	0.15
AC-BB-0010	6.40	0.96	0.19
AC-BB-0015	10.77	1.70	0.25
AC-BB-0020	7.82	1.17	0.17
AC-BB-0025	6.70	1.01	0.15
AC-BB-0030	7.93	1.22	0.18
AC-BB-0035	7.73	1.16	0.17
AC-BB-0040	6.50	1.00	0.15
AC-BB-0045	6.68	1.01	0.14
AC-BB-0050	8.01	1.18	0.17

2.3 Crook Branch

2.3.1 General Characteristics

Crook Branch flows for three miles in a southeasterly direction from its source near Pickett Road to Prince William Drive. The 1,099-acre drainage area includes a highly developed residential area.

All of the assessed streams within the Crook Branch WMA are characterized as moderate to high gradient riffle/run streams with active widening and bank erosion. The channel bed is primarily gravel.

2.3.2 Field Reconnaissance

Field crews visited four neighborhoods in Crook Branch to assess potential pollution runoff sources. Mantua is a single-family detached subdivision on Prince William Street with one-half-acre lots and some infill redevelopment. Lots are primarily grass (50 percent) with approximately 30 percent impervious cover and 10 percent tree cover. Sidewalks are present along one side of the street, and the open channel drainage includes storm drain inlets that were not stenciled but were free of obstructions. No stormwater management practices were observed.

Ridgelea Hills on Ridgelea Drive has single-family homes on one-quarter-acre lots with approximately 55 percent impervious cover, 25 percent grass and 10 percent each of landscaping and tree cover. Sidewalks are present and the curb and gutter were free of debris and water. Storm drain inlets were present but not stenciled.

Two single-family neighborhoods, Dunn Loring Woods and Stonewall Manor, lie along Stonewall Drive. These neighborhoods have one-quarter-acre lots with approximately 40 percent impervious cover, 50 percent grass cover and 10 percent tree canopy cover. Sidewalks are present throughout the neighborhoods along with unstenciled storm drains and curb and gutter with some leaf accumulation. No stormwater treatment was observed.

2.3.3 Land Use

The Crook Branch WMA is characterized by low-density residential development which accounts for 35 percent of the watershed area. Another 22 percent of the WMA is medium-density residential development. See Map 2-8, attached, for land use of this WMA.

Future land use is projected to change in the open space, estate residential, low-density residential and medium-density residential land use categories. Losses in open space (-15 acres) and estate residential (-15 acres) will be met primarily with gains in medium-density residential (19 acres) and low-density residential (11 acres) categories. A summary of the land use within the WMA is shown in Table 2-5.

Table 2-5 - Crook Branch Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	69	6	54	5	-15	-22
Golf Course	0	0	0	0	0	0
Estate Residential	40	4	25	2	-15	-38
Low-Density Residential	383	35	394	36	11	3
Medium-Density Residential	240	22	259	24	19	8
High-Density Residential	51	5	51	5	0	0
Low-Intensity Commercial	1	<1	0	0	-1	-100
High-Intensity Commercial	52	5	53	5	1	2
Industrial	41	4	41	4	0	0
Institutional	79	7	79	7	0	0
Transportation	136	12	136	12	0	0
Water	7	1	7	1	0	0
Total	1,099	100	1,099	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 274 acres, or 25 percent of the total WMA area of 1,099 acres.

2.3.4 Stormwater Infrastructure

Stormwater Management

County records indicate that there are 18 stormwater management facilities within the Crook Branch WMA. These facilities provide control for 7 percent of the WMA. There are no existing or planned regional ponds in the WMA. Five percent of the total area has quantity control only and the remaining 2 percent receives only quality control. Stormwater infrastructure is shown on Map 2-9, attached.

2.3.5 Stream Condition

Stream conditions for this WMA are shown on Map 2-10, attached.

Erosion

There was a total of 360 linear feet of erosion identified in the WMA at three specific erosion locations. (The first is located to the east of Pickett Road/Route 237, the second is located 1,390 feet downstream to the first and the third erosion site is located to the east of Prosperity Avenue/Route 699.)

Outfall Impacts

There were 21 outfall pipes located in the WMA. One 60-inch pipe, located at the headwaters east of Pickett Road/Route 237, was identified as causing major erosion.

Stream Crossings

Sixteen stream crossings were identified in the Crook Branch WMA. None of the crossings were having a significant impact on stream condition or causing erosion.

Obstructions

Six obstruction sites – all trees and debris – were located in the Crook Branch WMA. Four of the obstruction sites are thought to be impacting fish movement within the

stream. (The first obstruction is located to the west of Bentwood Court, the second is 864 feet downstream from the first, the third is located to the west of Prosperity Avenue/Route 699, and the fourth is located to the east of Prosperity Avenue/Route 699.) One utility line was also located within the stream banks of the WMA, but it is not a severe impact.

Stream Buffers

Most of the stream buffer encroachments in the Crook Branch WMA are lawns, although a few have pavement buffering the stream. There were 22 deficient buffer points. Seven percent of these buffer areas have a moderate potential for restoration.

Habitat

The 2003 countywide Stream Physical Assessment resulted in 31 percent of the assessed stream length in the Crook Branch WMA being classified as fair, 17 percent as poor and 52 percent as very poor.

There were no habitat parameters in the WMA that received an optimal rating. All of the assessed streams had marginal channel flow status and poor vegetative bank protection (left and right banks). Five of the six assessed reaches had poor vegetative buffer zones (left and right banks) and 69 percent of the streams had poor bank stability (left and right banks).

2.3.6 WMA Modeling

As shown in Table 2-6, the subwatersheds with the highest loads in this WMA are AC-CR-0010 and AC-CR-0020, both of which are crossed by US 50 and include institutional land uses and parking areas. AC-CR-0025 contains a significant amount of commercial and industrial area in the City of Fairfax. The highest quality area, AC-CR-0000, consists of wooded residential areas and forest.

Table 2-6 - Crook Branch Water Quality Modeling Results

Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-CR-0000	3.56	0.56	0.09
AC-CR-0005	5.38	0.81	0.15
AC-CR-0010	6.55	1.01	0.14
AC-CR-0015	5.86	0.90	0.13
AC-CR-0020	6.60	1.00	0.14
AC-CR-0025	7.69	0.98	0.17
AC-CR-0030	6.84	0.98	0.15

2.4 Daniels Run

2.4.1 General Characteristics

Daniels Run flows for four miles from a closed storm drainage system northeasterly through the City of Fairfax toward its confluence with Accotink Creek immediately south of Fairfax Circle. The drainage area of this tributary is 1,209 acres.

All of the assessed streams within the Daniels Run WMA are characterized as moderate to high gradient riffle/run streams with active widening and bank erosion. The channel bed is primarily gravel.

2.4.2 Field Reconnaissance

No specific sites were assessed in Daniel's Run. Neighborhood characteristics were similar to those in the adjacent WMAs (Crook Branch and Mainstem 2), and no commercial sites were assessed with a Hotspot Site Investigation.

2.4.3 Land Use

Most of the Daniels Run WMA is Fairfax City. Forty-four percent of the WMA is developed as either medium- or high-density residential and another 15 percent is golf course. Eight percent has been set aside as open space. See Map 2-11, attached, for details.

This WMA is fully developed. Only one acre of land currently in institutional use is expected to change to low-intensity commercial use. A summary of the land use within the WMA is shown in Table 2-7.

Table 2-7 - Daniels Run Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	100	8	100	8	0	0
Golf Course	176	15	176	15	0	0
Estate Residential	20	2	20	2	0	0
Low-Density Residential	94	8	94	8	0	0
Medium-Density Residential	375	31	375	31	0	0
High-Density Residential	156	13	156	13	0	0
Low-Intensity Commercial	53	4	54	4	1	2
High-Intensity Commercial	20	2	20	2	0	0
Industrial	63	5	63	5	0	0
Institutional	62	5	61	5	-1	-2
Transportation	81	7	81	7	0	0
Water	9	1	9	1	0	0
Total	1,209	100	1,209	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 260 acres, or 22 percent of the total WMA area of 1,209 acres.

2.4.4 Stormwater Infrastructure

Stormwater Management

County records indicate that there are seven stormwater management facilities within the Daniels Run WMA. These facilities provide control for less than 1 percent of the WMA. The total area receives quantity control only. Stormwater infrastructure is shown on Map 2-9, attached.

2.4.5 Stream Condition

Stream conditions for this WMA are shown on Map 2-10, attached.

Erosion

Two head cuts were identified in the WMA. One was 2 feet and the second was 1 foot in height.

Outfall Impacts

Fourteen outfall pipes were located within the Daniels Run WMA. The pipes ranged in size from 4 inches to 60 inches. None of the pipes were causing more than minor erosion.

Stream Crossings

Seventeen stream crossings were identified in the Daniels Run WMA. None of the identified stream crossings were having more than a moderate effect on stream condition.

Obstructions

There are two obstruction sites located in the Daniels Run WMA, one of which is trees and debris and the other concrete and metal. Neither of the obstruction sites was thought to be impacting fish movement within the stream. One sanitary utility line was also crossing the stream banks near base flow and negatively impacting the stream.

Stream Buffers

The majority of stream buffers in the Daniels Run WMA are lawns. There were 13 deficient buffer points. None of the buffer encroachments were rated as severe.

Habitat

A habitat assessment was conducted in 2003 as part of the countywide Stream Physical Assessment. Within the Daniels Run WMA, five stream reaches were characterized throughout the watershed with 50 percent of the assessed length being classified as fair, 7 percent as poor and 43 percent as very poor.

None of the habitat parameters assessed for the Daniels Run WMA were classified as optimal. All of the streams were classified as marginal for embeddedness and channel flow status (for both normal flow and drought conditions). All of the streams had poor vegetative bank protection (left and right banks).

2.4.6 WMA Modeling

Modeled pollutant loads for all the subwatersheds in Daniels Run were better than the median for the Accotink watershed, due in large part to the amount of open space, low-density residential development, and stormwater treatment. As shown in Table 2-8, the

highest loads were found in AC-DR-0020, which contains several commercial and institutional parcels.

Table 2-8 - Daniels Run Water Quality Modeling Results

Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-DR-0000	2.56	0.48	0.10
AC-DR-0005	5.16	0.65	0.19
AC-DR-0010	3.79	0.60	0.11
AC-DR-0015	5.54	0.78	0.11
AC-DR-0020	6.36	0.92	0.13
AC-DR-0025	4.45	0.50	0.04

2.5 Hunters Branch

2.5.1 General Characteristics

Hunters Branch, which flows in a southerly direction for approximately three miles, is located in the north-central portion of the watershed. This tributary has a drainage area of 1,202 acres and joins with Accotink Creek just south of Arlington Boulevard.

All of the assessed streams within the Hunters Branch WMA are characterized as moderate to high gradient riffle/run streams with active widening and bank erosion. The channel bed is primarily gravel.

2.5.2 Field Reconnaissance

No specific sites were assessed in Hunter's Branch and no commercial sites were assessed with a Hot Spot Investigation. Similar areas were assessed in the Bear Branch and Mainstem 2 WMAs.

2.5.3 Land Use

The Hunters Branch WMA is characterized by medium-density residential development with 24 percent of the watershed area developed as such. Another 18 percent of the WMA is high-density residential development. Sixteen percent has been preserved for open space or parks. See Map 2-12, attached, for details.

Future land use is projected to change in the open space, estate residential, medium-density residential, high-density residential, low-intensity commercial and high-intensity commercial land use categories. Losses in the open space (-53 acres), low-intensity commercial (-24 acres), estate residential (-12 acres), low-density residential (-6 acres) and Institutional (-3 acres) categories will be met with gains in high-intensity commercial (46 acres), high-density residential (30 acres) and medium-density residential (22 acres) categories. A summary of the land use within the WMA is shown in Table 2-9.

Table 2-9 - Hunters Branch Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	193	16	140	12	-53	-27
Golf Course	0	0	0	0	0	0
Estate Residential	17	1	5	0	-12	-71
Low-Density Residential	109	9	103	9	-6	-6
Medium-Density Residential	287	24	309	26	22	8
High-Density Residential	216	18	246	19	30	14
Low-Intensity Commercial	47	4	23	2	-24	-51
High-Intensity Commercial	11	1	57	5	46	418
Industrial	32	3	32	3	0	0
Institutional	54	4	51	4	-3	-6
Transportation	229	19	229	19	0	0
Water	7	1	7	1	0	0
Total	1,202	100	1,202	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 444 acres, or 37 percent of the total WMA area of 1,202 acres.

2.5.4 Stormwater Infrastructure

Stormwater Management

County records indicate that there are 21 stormwater management facilities within the Hunters Branch WMA. These facilities provide control for 14 percent of the WMA. Thirteen percent of the total area has quantity control only, one percent receives only quality control and the remaining portion has both quantity and quality control. Stormwater infrastructure is shown on Map 2-6, attached.

2.5.5 Stream Condition

Stream conditions for this WMA are shown on Map 2-7, attached.

Erosion

There was a total of 80 linear feet of erosion identified in the WMA at two specific erosion locations. Of this, 50 linear feet was identified on the left stream bank (facing downstream) and 30 linear feet on the right. Both of the erosion sites had low restoration potential.

Outfall Impacts

Eight outfall pipes were located within the Hunters Branch WMA, ranging in size from 12 inches to 72 inches. None of the pipes were causing erosion.

Stream Crossings

Fourteen stream crossings were identified in the Hunters Branch WMA. None of the crossings were having a significant impact on stream condition or causing erosion.

Obstructions

There is one obstruction site, a beaver dam, located in the Hunters Branch WMA. The obstruction site is not thought to be impacting fish movement within the stream.

Stream Buffers

The areas of deficient stream buffer in the Hunters Branch WMA are a mix of lawn and pavement. There were 11 deficient buffer points. None of the buffer encroachments were rated as severe.

Habitat

As part of the Stream Physical Assessment in 2003, the stream physical habitat was characterized along five of the seven reaches in the Hunters Branch WMA. Of these assessed reaches, 50 percent of the length was classified as fair, 42 percent as poor and 8 percent as very poor.

None of the habitat parameters assessed for the Hunters Branch WMA were classified as optimal. All of the streams were classified as marginal for embeddedness and channel flow status (drought and normal flow). All of the streams were classified as poor for bank vegetative protection (left and right banks) and bank stability (left and right banks).

2.5.6 WMA Modeling

The highest modeled pollutant loads in Hunters Branch are found in AC-HB-0010 and AC-HB-0015, which drain the interchange of I-66 and Nutley Street (see Table 2-10). These areas also contain industrial, commercial and high-density residential land uses. The best quality area is AC-HB-0025, the location of Northway Park.

Table 2-10 - Hunters Branch Water Quality Modeling Results

Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-HB-0000	6.24	0.99	0.18
AC-HB-0005	5.70	0.84	0.19
AC-HB-0010	9.21	1.42	0.23
AC-HB-0015	8.50	1.27	0.21
AC-HB-0020	7.40	1.11	0.16
AC-HB-0025	4.20	0.67	0.13
AC-HB-0030	8.26	1.24	0.18
AC-HB-0035	6.94	1.02	0.15

2.6 Long Branch Central

2.6.1 General Characteristics

Long Branch Central flows in a southeasterly direction for approximately nine miles, where it joins with Accotink Creek south of Braddock Road. This tributary has a drainage area of 2,429 acres.

All of the assessed streams within the Long Branch Central WMA are characterized as moderate to high gradient riffle/run streams with active widening and bank erosion. The channel bed is primarily gravel.

2.6.2 Field Reconnaissance

Field staff conducted an assessment of potential runoff pollution in the Long Branch Central WMA. There was one hot spot identified, Kings Park Shopping Center, which forms a triangle bounded by Rolling Road on the west, Burke Lake Road on the east and Braddock Road to the north. Loading operations were present but were not draining toward a storm drain. Solid materials were stored uncovered and outside on a paved area and garbage dumpsters without lids were overflowing. These dumpsters were not located near a storm drain. The building's downspouts drained to impervious cover but not directly to a storm drain. Storm drains were located, but no stormwater treatment was evident.

All other assessments were in residential neighborhoods. Along Maple Avenue, Holly Park lies adjacent to the Calvary Memorial Gardens. Holly Park is a neighborhood with primarily single-family homes on one-quarter-acre lots with an average of 65 percent impervious, 25 percent grass, 10 percent landscaping and 20 percent tree canopy. Sidewalks run along both sides of the street and the curbs and gutters were clean and dry. Storm drain inlets were present and clean. The small amount of open space appeared to be in good condition with no encroachment into the buffer.

Somerset and Old Creek Estates adjacent to Old Creek Elementary and the Long Branch Stream Valley Park is a neighborhood of one-quarter-acre lots with 65 percent impervious cover, 25 percent grass, 10 percent landscaping and 25 percent tree canopy. Sidewalks were present with clean and dry curbs and gutters. Storm drains were marked with "no-dumping" markers. Encroachment into the stream buffer was evident. No stormwater treatment was provided.

Built on top of an old golf course, the Starlit Ponds single-family development has approximately 70 percent impervious cover, 20 percent grass, and 10 percent each of landscaping and tree canopy. The curb and gutter system was clean and dry, and there were no sidewalks. One wet pond, converted from an old golf course pond, was treating stormwater at the site.

Haywood, a single-family development with one-quarter acre lots, lies at the intersection of Tartan View Drive and Olley Lane. In this neighborhood there is approximately 60 percent impervious, 25 percent grass, 15 percent landscaping and 20 percent tree canopy. Some roads had sidewalks with clean curbs and gutters. Storm drains were not stenciled, and stormwater treatment was not observed.

The Hunts Village and Rutherford neighborhoods, along Braeburn and Ashmeade Drives, is comprised of one-quarter-acre single-family lots with approximately 65 percent impervious cover, 20 percent grass, 15 percent landscaping and 20 percent tree canopy. Sidewalks and clean curb and gutter were present, and storm drains were stenciled.

Along Colbert Court lies a small neighborhood of 20 single-family homes built in 1999, each on a one-quarter-acre lot with no tree canopy cover, approximately 65 percent impervious, 25 percent grass and 10 percent landscaping. There are sidewalks along one side of the street with clean curbs and gutters. Stormwater treatment was not provided for this small subdivision.

Old Forge, at Picket Road and Jomar Drive, is a single-family detached subdivision with one-quarter-acre lots. On average, there was approximately 65 percent impervious cover, 30 percent grass and five percent landscaping. Tree canopy covered approximately 20 percent of the lots, and some illegal dumping was observed in the open space park area. Sidewalks were present with clean and dry curbs and gutters. Stormwater drains were not stenciled but were also clean and free of obstructions. This neighborhood is not receiving any stormwater treatment.

Somerset South is a neighborhood of small lots of less than one-quarter acre. Each lot is mostly impervious (approximately 70 percent), 20 percent grass and 15 percent tree canopy. Sidewalks, curbs and gutters and storm drain inlets were present, and all appeared clean and dry. One dry pond was noted. There was no illegal dumping or trash observed in yards.

Near King David Boulevard and Windflower Lane is the Long Branch/Bradfield subdivision with smaller than one-quarter-acre lots. These lots are mostly impervious (70 percent) with 20 percent grass cover and 20 percent tree canopy. There was no dumping or trash present, and the sidewalks and curbs and gutters were clean. Some of the storm drain inlets were stenciled, but there was no treatment.

Willow Woods is a neighborhood with one-quarter-acre lots and single-family detached housing. It is adjacent to the Willow Woods Park and showed some evidence of infill, redevelopment and remodeling. Lots had approximately 60 percent impervious cover, 25 percent grass and 20 percent tree canopy. All roads, except Starr Jordan Road, had sidewalks, curbs and gutters, and unstenciled storm drain inlets. The neighborhood did not receive any stormwater treatment, and the only community open space was the park.

Near the intersection of Braddock Road and Woodland Way are the Woodland Forest and Stonehaven neighborhoods. The one-quarter-acre lots in these neighborhoods had approximately 60 percent impervious cover, 25 percent grass, and 20 percent tree canopy. Sidewalks, curbs and gutters and storm drains were present. Some storm drains were stenciled and all were clear of obstruction. The neighborhood had no stormwater treatment or open space.

Canterbury Woods, a neighborhood of detached single-family residences, is situated near Chanticleer Avenue and Queen Elizabeth Boulevard. The one-quarter-acre lots were approximately 55 percent impervious, 30 percent grass cover and 20 percent tree canopy. Yards were free of debris, and illegal dumping was not apparent. Sidewalks and

clean, dry curbs and gutters were present. Some of the storm drains were stenciled or marked. No dedicated stormwater treatment was found.

Kings Park is a neighborhood of one-quarter-acre lots bounded to the north by Braddock Road and to the west by Rolling Road. Lots were approximately 60 percent impervious cover, 30 percent grass and 15 percent tree canopy. Sidewalks and curbs and gutters were present and clean. Storm drain inlets were marked with Chesapeake Bay drainage stencils. No stormwater treatment or open space was present, though there was a neighborhood park near Trafalgar Way.

2.6.3 Land Use

The Long Branch Central WMA is characterized by medium-density residential development with 48 percent of the watershed area developed as such. Another 15 percent of the WMA has been preserved for open space or parks. See Map 2-13, attached, for details.

Future land use is projected to change in the open space, estate residential, low-density residential and medium-density residential land use categories. Losses in the open space (-27 acres) and estate residential (-29 acres) uses will be met with gains in low-density residential (29 acres) and medium-density residential (27 acres) categories. A summary of the land use within the WMA is shown in Table 2-11.

Table 2-11 - Long Branch Central Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	362	15	335	14	-27	-7
Golf Course	0	0	0	0	0	0
Estate Residential	53	2	24	1	-29	-55
Low-Density Residential	223	9	252	10	29	13
Medium-Density Residential	1,155	48	1,182	49	27	2
High-Density Residential	37	2	37	2	0	0
Low-Intensity Commercial	23	1	13	<1	-10	-43
High-Intensity Commercial	9	0	19	1	10	111
Industrial	0	0	0	0	0	0
Institutional	162	7	162	7	0	0
Transportation	389	16	389	16	0	0
Water	16	<1	16	<1	0	0
Total	2,429	100	2,429	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 640 acres, or 26 percent of the total WMA area of 2,429 acres.

2.6.4 Stormwater Infrastructure

Stormwater Management

County records indicate that there are 24 stormwater management facilities within the Long Branch Central WMA. These facilities provide control for 3 percent of the WMA. Three percent of the total area has quantity control only and the remaining portion has only quality control. The Olley Lane regional pond is located East of Surrey Square Park. Stormwater infrastructure is shown on Map 2-14, attached.

2.6.5 Stream Condition

Stream conditions for this WMA are shown on Map 2-15, attached.

Erosion

There was a total of 25 linear feet of erosion identified on the outer bends of the stream bank in the WMA at one specific erosion location. This erosion site had moderate restoration potential. One 10-foot high head cut was identified in the WMA located north of Colt Lane.

Outfall Impacts

Twenty outfall pipes were located within the Long Branch Central WMA. All of the pipes were within 100 feet of the stream channel and ranged in size from 12 inches to 60 inches. One 12-inch pipe was identified as causing major erosion. This pipe is located east of Guinea Road within Rutherford Park.

Stream Crossings

Sixteen stream crossings were identified in the Long Branch Central WMA. None of the crossings were having a significant impact on stream condition or causing erosion.

Obstructions

There are five obstruction sites located in the Long Branch Central WMA, four of which are trees and debris. The fifth obstruction site is a beaver dam. None of the obstruction sites are thought to be impacting fish movement within the stream. Two sanitary utility lines were also located within the stream banks of the WMA.

Stream Buffers

There were 19 deficient buffer points with severe impact totaling approximately 400 linear feet. All of this has low potential for restoration.

Habitat

As part of the Stream Physical Assessment in 2003, the stream physical habitat was characterized along the stream reaches in the Long Branch Central WMA. This assessment resulted in a fair classification for 74 percent of the assessed length and a poor classification for 26 percent.

None of the habitat parameters assessed for the Long Branch Central WMA were classified as optimal. Almost all of the streams were classified as poor for bank vegetative protection (left and right banks) and bank stability (left and right banks).

2.6.6 WMA Modeling

The highest modeled pollutant loads in this WMA are on the south side along Braddock Road, in subwatersheds AC-LB-0000, AC-LB-0005, AC-LB-0015, AC-LB-0020 and AC-

LB-0025, which also contain a significant amount of medium density residential development. See Table 2-12 for results. The northern subwatersheds show loads below the median for Accotink Creek, based on open space along the stream valley and residential development.

Table 2-12 - Long Branch Central Water Quality Modeling Results

Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-LB-0000	8.34	1.33	0.22
AC-LB-0005	8.03	1.24	0.20
AC-LB-0010	7.00	1.05	0.18
AC-LB-0015	8.04	1.21	0.27
AC-LB-0020	7.80	1.16	0.17
AC-LB-0025	8.24	1.25	0.18
AC-LB-0030	7.14	1.08	0.16
AC-LB-0035	7.19	1.08	0.15
AC-LB-0040	6.45	0.95	0.13
AC-LB-0045	5.97	0.91	0.14
AC-LB-0050	6.27	0.96	0.16
AC-LB-0055	5.10	0.79	0.13
AC-LB-0060	6.25	0.95	0.14
AC-LB-0065	5.67	0.89	0.13
AC-LB-0070	5.31	0.84	0.13
AC-LB-0075	4.63	0.71	0.11

2.7 Long Branch North

2.7.1 General Characteristics

Long Branch North flows for approximately four miles in a southerly direction from the northernmost reaches of the watershed to its confluence with Accotink Creek, west of Prosperity Avenue. The drainage area of this tributary is 1,487 acres.

All of the assessed streams within the Long Branch North WMA are characterized as moderate to high gradient riffle/run streams with active widening and bank erosion. The channel bed is primarily sand and gravel.

2.7.2 Field Reconnaissance

Neighborhood assessments were not conducted in this WMA. Similar neighborhoods were assessed in the Mainstem 2 and Bear Branch WMAs. A number of Hotspot Site Investigations were conducted, however. A summary of the results is discussed below.

Lancaster Landscape on Lee Highway between Cedar Lane and Hilltop Road is an industrial site with approximately 20 vehicles that appeared to be fueled, stored, and repaired outdoors with no source control. Spills and/or leaks were present. Mulch and dirt were stored in a grassy area without cover or secondary containment. Other storage areas had containers that were in poor condition. This site was identified as a confirmed hotspot.

Virginia Outdoor Power Equipment had topsoil and sand storage areas that were uncovered and connected to a storm drain via the concrete pad where they were stored and with staining visible around this area. The parking lot was dirty and pieces of asphalt were breaking up and exposing additional dirt to precipitation. No stormwater treatment was present. This site was classified as a potential hotspot.

Rosslyn Tire Company is a facility where vehicles are repaired and stored. Used oil and tires were being stored and discoloration was noted near the storage area. There was no cover or secondary containment to contain potential oil spills. The paved parking lot was stained from oil and downspouts discharged onto the impervious area. There was no apparent stormwater treatment. This site was classified as a confirmed hotspot.

The Citgo and Sunoco gas stations, on Lee Highway near Hilltop and Gallows Road, respectively, were assessed together as their characteristics were quite similar. Cars were repaired and fueled outside with no cover or runoff diversion methods to keep spills out of the adjacent, downgradient storm drains. The garbage dumpster appeared to be in poor condition and was not covered. The paved parking lot was stained, and no stormwater treatment was present. These gas stations were classified as potential hotspots.

Merrifield Plaza on Lee Highway near Gallows Road was also assessed. Unloading operations were present at this location; they were not covered, and they drained toward a storm drain with some staining visible. Garbage dumpsters were located near a storm drain without runoff diversion or secondary containment. Downspouts drain to the paved parking lot, which was clean at the time of inspection. The small amount of landscaping

that was present did not drain toward a storm drain. This shopping plaza was classified as a potential hotspot.

Fairfax Plaza, a shopping center near Gallows Road and Strawberry Lane, had covered outdoor loading operations present that were not situated near storm drains. Storage areas included overflowing grease traps without cover or secondary containment. It was raining at the time of assessment, and this lack of containment was apparent. The area was covered with grease, oil and solids from the grease traps. No stormwater treatment was present, and this site was classified as a confirmed hotspot.

Gatehouse Plaza at Gallows Road and Arlington Boulevard was identified as a potential hotspot with overflowing garbage dumpsters located near storm drains. There were no runoff diversion methods apparent. Downspouts drained to a clean paved parking lot. Approximately 15 percent of the site had some sort of maintained vegetation and drained toward a storm drain. No stormwater treatment was present.

2.7.3 Land Use

The Long Branch North WMA is characterized by medium-density residential development with 24 percent of the watershed area developed as such. Another 14 percent of the WMA is low-density residential development. Eight percent has been preserved for open space or parks. See Map 2-16, attached, for details.

Future land use is projected to change in the open space, low-density residential, low-intensity commercial, high-intensity commercial, industrial and institutional land use categories. Losses in the industrial (-66 acres), low-intensity commercial (-63 acres), institutional (-45 acres) and open space (-39 acres) categories will be met with gains in high-intensity commercial (178 acres), medium-density residential (31 acres), high-density residential (9 acres) and estate residential (2 acres) categories. A summary of the land use within the WMA is shown in Table 2-13.

Table 2-13 - Long Branch North Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	113	8	74	5	-39	-35
Golf Course	0	0	0	0	0	0
Estate Residential	17	1	19	1	2	12
Low-Density Residential	204	14	197	13	-7	-3
Medium-Density Residential	351	24	382	26	31	9
High-Density Residential	76	5	85	6	9	12
Low-Intensity Commercial	108	7	45	3	-63	-58
High-Intensity Commercial	97	6	275	18	178	184
Industrial	170	11	104	7	-66	-39
Institutional	78	5	33	2	-45	-58
Transportation	264	18	264	18	0	0
Water	9	1	9	1	0	0
Total	1,487	100	1,487	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 610 acres, or 41 percent of the total WMA area of 1,487 acres.

2.7.4 Stormwater Infrastructure

Stormwater Management

County records indicate that there are 67 stormwater management facilities within the Long Branch North WMA. These facilities provide control for 19 percent of the WMA. Sixteen percent of the total area has quantity control only, 2 percent receives only quality control and the remaining 1 percent has both quantity and quality control. Stormwater infrastructure is shown on Map 2-6, attached.

2.7.5 Stream Condition

Stream conditions for this WMA are shown on Map 2-7, attached.

Erosion

There was a total of 475 linear feet of erosion identified in the WMA at three specific erosion locations. (The first is located at Dogwood Lane, the second is located just south of Route 66, and the third is located north of Route 66.) All of the erosion sites had moderate restoration potential. Two head cuts were identified in the WMA. One was 1.5 feet and the other was 1 foot in height.

Outfall Impacts

Twenty outfall pipes were located within the Long Branch North WMA. All of the pipes were within 130 feet of the stream channel and ranged in size from 4 inches to 60 inches. None of the pipes were causing more than minor erosion.

Stream Crossings

Fifteen stream crossings were identified in the Long Branch North WMA. None of the crossings were having a significant impact on stream condition or causing notable erosion.

Obstructions

There are 11 obstruction sites located in the Long Branch North WMA, all of which are trees and debris. Seven of the obstruction sites are thought to be impacting fish movement within the stream (four of the obstructions are located within Eakin Community Park, the fifth is located north of Arlington Boulevard, the sixth is located north of Lee Highway/Route 237 and the seventh obstruction is located 300 feet upstream of the sixth). Six utility lines were also located within the WMA. Four of the utility lines were partially buried crossing the stream, one crossed above base flow and one was within the stream banks.

There were four dump sites found in the WMA. None of the dump sites appeared to contain toxic material.

Stream Buffers

The stream buffers in the Long Branch North WMA are a mix of lawns and pavement. There were 19 deficient buffer points. Approximately 16,050 linear feet, or 56 percent, of the streams had a severe buffer encroachment. Of this, 6 percent had a moderate restoration potential, 49 percent was low and 45 percent had no potential for restoration.

Habitat

The 2003 habitat assessment of Long Branch North resulted in a poor classification for 87 percent of the assessed length and a very poor classification for 13 percent.

None of the habitat parameters assessed for the Long Branch North WMA were classified as optimal. Eighty-seven percent of the streams were classified as suboptimal for instream cover (fish). All of the streams were classified as marginal for channel flow status (normal and drought flow). All of the streams were classified as poor for bank vegetative protection (left and right banks) and bank stability (left and right banks). Almost all of the streams were classified as poor for vegetative buffer zone (left and right banks).

2.7.6 WMA Modeling

Three subwatersheds on the east side of the WMA (AC-LC-0005, AC-LC-0010, and AC-LC-0025) show the highest modeled pollutant loads, based primarily on intensive commercial and industrial development. The best quality subwatersheds (AC-LC-0000 and AC-LC-0015) are at the mouth of the WMA, containing forested land and low-density residential development. See Table 2-14 for results.

Table 2-14 - Long Branch North Water Quality Modeling Results

Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-LC-0000	5.96	0.93	0.14
AC-LC-0005	8.37	1.16	0.21
AC-LC-0010	8.43	1.10	0.22
AC-LC-0015	5.96	0.87	0.14
AC-LC-0020	7.37	1.03	0.17
AC-LC-0025	9.84	1.44	0.25
AC-LC-0030	7.73	1.16	0.16
AC-LC-0035	7.40	1.12	0.16

2.8 Long Branch South

2.8.1 General Characteristics

Long Branch South flows in a southwesterly direction for approximately six miles from Franconia Road to its confluence with Accotink Creek. The Richmond, Fredericksburg, and Potomac Railroad crosses this stream four times. The stream parallels the railroad for most of its run through a relatively undeveloped area, discharging into Accotink Creek. The drainage area of Long Branch South is 3,121 acres.

All of the assessed streams within the Long Branch South WMA are characterized as low to moderate gradient glide/pool streams with active widening and bank erosion. The channel bed is primarily cobble and gravel.

2.8.2 Field Reconnaissance

Several neighborhoods and a number of Hotspot Site Investigations were conducted in the Long Branch South WMA. A summary of the results is discussed below.

Loisdale Estates is a single-family subdivision located along the east side of Loisdale Road and south of the Franconia-Springfield Parkway. This neighborhood has one-quarter-acre lots with approximately 45 percent impervious cover, 50 percent grass cover and 15 percent tree canopy. Sidewalks were present with organic matter and lawn clippings present in the curbs and gutters. Storm drain inlets were also present but were not stenciled. There was no stormwater treatment.

Hunter Estates and Newberry Station on Accotink Drive and Telegraph Road are single-family subdivisions with one-half-acre lots made up of approximately 25 percent impervious cover, 65 percent grass and 30 percent tree cover. There is an open drainage system with no storm drain inlets or curb and gutter. One wet pond serves the neighborhood. Open space was present without dumping or encroachment into the buffer.

Windsor Park and Springfield Forest sit east and south east of Springfield Mall, respectively. The two areas are separated by Franconia Road. The one-half-acre lots in these subdivisions have approximately 30 percent impervious cover, 50 percent grass cover and 40 percent cover from mature tree canopy. A few of the driveways were constructed with permeable or semi-permeable materials. There was no sidewalk, curbs or gutters, storm drain inlets or stormwater treatment.

National Capital Industries is a construction equipment company on Backlick Road. Drums and buckets with unknown and unlabeled contents were stored outside on a grass and dirt area without cover or secondary storage. These containers were in poor condition. This was identified as a potential hotspot.

Sunbelt is an equipment rental company on Kincannon Place in Lorton. There were approximately 100 pieces of equipment that are fueled and stored uncovered outside with no runoff diversion methods. It was unclear whether these areas drained toward storm drains. This area was classified as a potential hotspot.

Washington Lamb on Conell Court off Cinder Bed Road in Lorton is a meat processing and distribution plant. Loading operations were present, and drums with liquids were stored on impervious areas. This storage area had no cover or secondary containment, and the drums were either not labeled or in poor condition. No stormwater treatment was provided for the private storm drains. This area was identified as a confirmed hotspot.

The Fairfax Connection Bus Depot off Cinder Bed Road is a county-owned bus servicing company. There were more than 100 buses that are maintained, fueled, repaired and/or stored on site. Storage and repair appeared to be conducted at least partially outdoors in an area with no cover or runoff diversion methods. However, all areas did not drain toward the storm drain. Uncovered outdoor fueling areas were also present. While no stormwater treatment practice was visible, storm drains were protected by oil booms.

The Newington Industrial Park on Newington Road had garbage dumpsters overflowing with carpeting and construction waste. These dumpsters were located near storm drains, and the carpeting was blocking a storm drain inlet. Sediment was observed around the inlet. There was no obvious stormwater treatment. This site was not classified as a hotspot.

An illegal dumping site was found at the cul-de-sac at the northern end of Terminal Road. Various potentially hazardous items were noted, including car batteries, drums, tires, and a water heater. This area was identified as a confirmed hotspot.

Springfield Mall was also assessed. Garbage dumpsters were leaking and had either no cover or an open lid. These areas were draining to a storm drain inlet with staining present around the inlet. This site was not an identified hotspot.

Fleet Industrial Park on Fleet Drive in Lorton had five fleet vehicles (at the time of inspection) that were fueled, washed and stored outdoors in an uncovered area discharging to the storm drain. Construction materials and garbage were also stored poorly with no cover on the dumpster that was located near a storm drain. There were no runoff diversion methods. Additionally, field crews observed a van being washed with the runoff flowing directly into a storm drain. Field crews also inspected the outfall into Long Branch and observed an oily sheen coating the water surface. This was identified as a confirmed hotspot.

2.8.3 Land Use

The Long Branch South WMA is characterized by low-density, medium-density, and high-density residential development with 11 percent, 10 percent and 14 percent, respectively, of the watershed area developed as such. Another 11 percent of the WMA has been preserved for open space or parks. See Map 2-17, attached, for details.

Future land use is projected to change in the open space, estate residential, low-intensity commercial and institutional land use categories. Losses in open space (-231 acres) will be met primarily with gains in high-intensity commercial (99 acres), industrial (90 acres), medium-density residential (48 acres), low-density residential (22 acres) and high-density residential (10 acres) categories. A summary of the land use within the WMA is shown in Table 2-15.

Table 2-15 - Long Branch South Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	583	19	352	11	-231	-40
Golf Course	0	0	0	0	0	0
Estate Residential	34	1	21	1	-13	-38
Low-Density Residential	332	11	354	11	22	7
Medium-Density Residential	319	10	367	12	48	15
High-Density Residential	453	14	463	15	10	2
Low-Intensity Commercial	116	4	100	3	-16	-14
High-Intensity Commercial	141	4	240	8	99	70
Industrial	450	14	540	17	90	20
Institutional	85	3	76	2	-9	-11
Transportation	592	19	592	19	0	0
Water	16	<1	16	1	0	0
Total	3,121	100	3,121	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 1,025 acres, or 33 percent of the total WMA area of 3,121 acres.

2.8.4 Stormwater Infrastructure

Stormwater Management

County records indicate that there are 136 stormwater management facilities within the Long Branch South WMA. These facilities provide control for 21 percent of the WMA. Eighteen percent of the total area has quantity control only, 2 percent receives both quantity and quality control and the remaining 1 percent has only quality control. There are two constructed ponds in this WMA. The first, Pond L-05, is located at the headwaters south of Franconia-Springfield Parkway and the second, Pond L-10, is located southeast of the first, just west of the railroad. There are also plans to construct two additional ponds within the Long Branch South WMA. The first is planned to be constructed south of Springfield Center Drive and the second is planned to be constructed south of Rolling Creek Way. Stormwater infrastructure is shown on Map 2-18, attached.

2.8.5 Stream Condition

Stream conditions for this WMA are shown on Map 2-19, attached.

Erosion

There were no erosion or headcut sites located in the Long Branch South WMA.

Outfall Impacts

Twenty-one outfall pipes were located within the WMA. The pipes ranged in size from 12 inches to 72 inches. None of the pipes were causing significant erosion.

Stream Crossings

Twenty-three stream crossings were identified in the Long Branch South WMA. No stream crossing was having more than a moderate impact on stream conditions.

Obstructions

There are two obstruction sites located in the Long Branch South WMA, one of which is trees and debris and the other a beaver dam. The trees and debris obstruction site, located southeast of Springfield Center Drive, is thought to be impacting fish movement within the stream.

There was one dump site found instream and on the left bank and floodplain of the WMA. The dump material was identified as appliances, trash, tires and lawn waste (grass and leaves). The site did not appear to contain toxic material.

Stream Buffers

The stream buffers in the Long Branch South WMA are a mix of lawns and pavement. There were 17 deficient buffer points. Approximately 4,000 linear feet of streams, or 33 percent, had severe encroachment within the stream buffer.

Habitat

For the habitat assessment conducted in 2003 on Long Branch South 19 percent of the stream length was classified as excellent, 30 percent as good, 29 percent as fair and 23 percent as poor.

Approximately 64 percent of the streams were classified as optimal for bottom substrate/available cover and about 24 percent for pool variability and channel alteration.

2.8.6 WMA Modeling

Pollutant loads are high in the north and south areas of the watershed, as shown in Table 2-16, with high concentrations of commercial, industrial and high density residential land uses. The central area (AC-LC-0025, AC-LC-0030 and AC-LC-0045) consists of low-density residential and wooded areas and consequently shows lower loading. Even though low for this WMA, however, they are still at or just under the median for the entire watershed.

Table 2-16 - Long Branch South Water Quality Modeling Results

Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-LA-0000	4.80	0.80	0.13
AC-LA-0003	9.09	1.36	0.26
AC-LA-0005	10.30	1.43	0.28
AC-LA-0010	7.55	1.07	0.20
AC-LA-0015	8.96	1.19	0.33
AC-LA-0020	9.45	1.24	0.28
AC-LA-0025	6.38	0.94	0.16
AC-LA-0030	5.93	0.85	0.14
AC-LA-0035	7.19	1.08	0.21
AC-LA-0040	6.59	1.04	0.18
AC-LA-0045	5.40	0.83	0.15
AC-LA-0050	9.47	1.45	0.22
AC-LA-0055	5.88	0.90	0.13
AC-LA-0060	9.83	1.45	0.25
AC-LA-0065	7.12	0.97	0.20
AC-LA-0070	8.40	1.21	0.20
AC-LA-0075	10.13	1.41	0.24
AC-LA-0080	7.47	1.12	0.19
AC-LA-0085	8.39	1.22	0.22
AC-LA-0090	6.09	0.88	0.14

2.9 Mainstem 1

2.9.1 General Characteristics

Mainstem 1 flows for approximately 13 miles in a southeasterly direction from the northernmost reaches of the watershed. The drainage area of this tributary is 3,653 acres.

All of the assessed streams within the Mainstem 1 WMA are characterized as moderate to high gradient riffle/run streams with active widening and bank erosion. The channel bed is primarily gravel.

2.9.2 Field Reconnaissance

Neighborhood assessments were not conducted in this WMA. Similar neighborhoods were assessed in the Crook Branch WMA. One Hotspot Site Investigation was conducted, however. A summary of the results is discussed below.

The Bob Evans restaurant on White Granite Drive in Oakton had the materials storage area behind the restaurant fenced off. There were some storage containers visible through the fence that were missing labels. The dumpster was in poor condition and lacked a cover but was not situated near a storm drain. This site was classified as a potential hotspot.

2.9.3 Land Use

The Mainstem 1 WMA contains portions of Fairfax City. Land use in the WMA is primarily residential, with 24 percent developed as medium-density residential, another 16 percent developed as high-density residential, and 12 percent low-density residential. Seven percent of the WMA has been set aside as open space. See Map 2-20, attached, for details.

Future land use is projected to change in the open space, estate residential, low-density residential low-intensity commercial and institutional land use categories. Losses in the institutional (-44 acres) and open space (-32 acres) uses will be met primarily with gains in high-intensity commercial (49 acres) and medium-density residential (39 acres) categories. A summary of the land use within the WMA is shown in Table 2-17.

Table 2-17 - Mainstem 1 Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	256	7	224	6	-32	-13
Golf Course	27	1	27	1	0	0
Estate Residential	49	1	37	1	-12	-24
Low-Density Residential	420	12	415	11	-5	-1
Medium-Density Residential	885	24	924	25	39	4
High-Density Residential	589	16	597	16	8	1
Low-Intensity Commercial	303	8	300	8	-3	-1
High-Intensity Commercial	203	6	252	7	49	24
Industrial	67	2	67	2	0	0
Institutional	259	7	215	6	-44	-17
Transportation	580	16	580	16	0	0
Water	15	<1	15	<1	0	0
Total	3,653	100	3,653	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 1,421 acres, or 39 percent of the total WMA area of 3,653 acres.

2.9.4 Stormwater Infrastructure

Stormwater Management

County records indicate that there are 76 stormwater management facilities within the Mainstem 1 WMA. These facilities provide control for 10 percent of the WMA. Seven percent of the total area has quantity control only, 2 percent receives both quantity and quality control and the remaining 1 percent has only quality control. Stormwater infrastructure is shown on Map 2-21, attached.

2.9.5 Stream Condition

Stream conditions for this WMA are shown on Map 2-22, attached.

Erosion

A total of 70 linear feet of erosion was identified in the WMA at two specific erosion locations. (The first is located toward the headwater end of the WMA, north of Main Street/Route 236 and the second site is located north of Lee Highway.) Of this, 50 linear feet was identified on the right stream bank (facing downstream) and 20 linear feet on the left. Both of the erosion sites had high restoration potential. Two head cuts were identified in the WMA. One was 1.5 feet and the other was 2 feet in height.

Outfall Impacts

Seventy-three outfall pipes were located within the Mainstem 1 WMA. All of the pipes were within 100 feet of the stream channel and ranged in size from 12 inches to 72 inches. One 12-inch pipe, located within Keith Avenue Park, was identified as causing major erosion.

Stream Crossings

Sixty stream crossings were identified in the Mainstem 1 WMA. None of the crossings were having a significant impact on stream condition or causing any type of erosion.

Obstructions

There is one obstruction site located in the Mainstem 1 WMA, which is trees and debris. The obstruction site is not thought to be impacting fish movement within the stream. Two sanitary utility lines and one cable line was also located in the WMA. The sanitary lines were partially buried crossing the stream and the cable line crossed above the base flow.

There was one dump site found on the left bank of the WMA. The dump material was identified as trash and lawn waste (grass and leaves) and it did not appear to contain toxic material.

Stream Buffers

The stream buffers in the Mainstem 1 watershed are a mix of lawns and pavement. There were 51 deficient buffer points. Severe encroachment has not occurred in any of these stream buffers.

Habitat

As part of the Stream Physical Assessment in 2003, the stream physical habitat was characterized along the stream reaches in the Mainstem 1 WMA resulting in 90 percent of the stream length classified as poor and 10 percent as very poor.

No habitat parameters assessed in Mainstem 1 were classified as optimal. All of the streams were classified as poor for bank vegetative protection.

2.9.6 WMA Modeling

The highest loadings for this WMA are for AC-AC-500 and AC-AC-505, which drain the cloverleaf intersection of I-66 and Chain Bridge Road. AC-AC-460, which is also high, drains a heavily commercial area at the intersection of Lee Highway, Fairfax Boulevard, and Main Street. See Table 2-18 for results.

Table 2-18 - Mainstem 1 Water Quality Modeling Results

Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-AC-0400	6.35	0.91	0.17
AC-AC-0405	7.18	1.09	0.19
AC-AC-0410	6.62	0.99	0.17
AC-AC-0415	6.73	1.06	0.16
AC-AC-0420	8.27	1.14	0.34
AC-AC-0425	5.42	0.82	0.12
AC-AC-0430	7.44	1.12	0.16
AC-AC-0435	4.02	0.59	0.13
AC-AC-0440	6.98	1.01	0.14
AC-AC-0445	6.60	0.96	0.13
AC-AC-0450	6.67	0.99	0.14
AC-AC-0455	6.69	0.97	0.14
AC-AC-0460	9.12	1.22	0.19
AC-AC-0465	8.02	1.23	0.18
AC-AC-0470	8.05	1.20	0.17
AC-AC-0475	6.88	0.99	0.15
AC-AC-0480	4.91	0.75	0.13
AC-AC-0485	7.18	1.00	0.15
AC-AC-0490	4.54	0.67	0.09
AC-AC-0495	6.45	0.89	0.13
AC-AC-0500	12.61	1.99	0.29
AC-AC-0505	19.28	3.20	0.48
AC-AC-0510	8.70	1.33	0.20

2.10 Mainstem 2

2.10.1 General Characteristics

Mainstem 2 flows in a southeasterly direction for approximately eight miles starting east of Pickett Road to Little River Turnpike. This tributary has a drainage area of 2,069 acres.

All of the assessed streams within the Mainstem 2 WMA are characterized as moderate to high gradient riffle/run streams with active widening and bank erosion. The channel bed is primarily sand and gravel.

2.10.2 Field Reconnaissance

Several neighborhoods were assessed and one Hot Spot Investigation was conducted in the Mainstem 2 WMA. A summary of the results is discussed below.

Woodburn Village is a condominium community at Tobin Road and Woodburn Village Drive. The area has approximately 70 percent impervious cover, 20 percent grass cover and 5 percent tree cover. Sidewalks were present with curbs and gutters. There was long-term car parking and some overhead tree canopy. Storm drain inlets were not stenciled, and there was no apparent stormwater treatment.

Prosperity Heights, at Monarch Lane and Broken Arrow Court, is a detached single-family detached subdivision with one-quarter-acre lots. Average lot conditions included 35 percent impervious cover, 50 percent grass cover, and 10 percent each of landscaping and mature tree canopy. Sidewalks and curbs and gutters were present with some overhead tree canopy. The storm drains were not stenciled. Stormwater treatment was provided by a dry pond. There was also some open space with no encroachment or dumping evident.

Woodlawn Village is a townhome community along Beverly Drive west and southwest of Inova Fairfax Hospital. These lots are approximately one-eighth acre with 70 percent impervious cover, 20 percent grass cover and five percent each of landscaping and tree canopy. No trash or illegal dumping was located. Sidewalks and curbs and gutters were present, and there was some evidence of long-term car parking and oil leaks. Storm drain inlets were not stenciled but were free of obstructions. Field crews noted that this subdivision was a minor source of oil and grease.

The parcel for Hawthorne Condos on Kingsbridge Drive was approximately 60 percent impervious, 25 percent grass cover and five percent landscaping. There was no bare soil or tree cover. Sidewalks and curbs and gutters were clean. Unstenciled storm drain inlets were located and were free of obstruction.

Camelot Elementary School on Guinevere Drive in Annandale had approximately 60 school buses parked on the site. The garbage dumpster was in poor condition, lacked a cover and was located by a storm drain. The downspouts were not visible. The site had approximately 30 percent grass cover with medium management. This school was classified as a potential hotspot.

2.10.3 Land Use

The Mainstem 2 WMA is characterized by medium-density and low-density residential development with 24 percent and 22 percent, respectively, of the watershed area developed as such. Another 22 percent of the WMA has been preserved for open space or parks. See Map 2-23, attached, for details.

Future land use is projected to change primarily in the open space, estate residential, low-density residential, high-density residential and low-intensity commercial land use categories. Losses in open space (-53 acres), low-intensity commercial (-49 acres) and estate residential (-24 acres) categories will be met primarily with gains in high-intensity commercial (52 acres), low-density residential (44 acres) and medium-density residential (28 acres) categories. A summary of the land use within the WMA is shown in Table 2-19.

Table 2-19 - Mainstem 2 Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	445	22	392	19	-53	-12
Golf Course	0	0	0	0	0	0
Estate Residential	41	2	17	1	-24	-59
Low-Density Residential	447	22	490	24	43	10
Medium-Density Residential	492	24	520	25	28	6
High-Density Residential	119	6	114	5	-5	-4
Low-Intensity Commercial	56	3	7	0	-49	-88
High-Intensity Commercial	1	0	53	3	52	5,200
Industrial	5	0	5	0	0	0
Institutional	164	8	164	8	0	0
Transportation	276	13	284	14	8	3
Water	23	1	23	1	0	0
Total	2,069	100	2,069	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 434 acres, or 21 percent of the total WMA area of 2,069 acres.

2.10.4 Stormwater Infrastructure

Stormwater Management

County records indicate that there are 29 stormwater management facilities within the Mainstem 2 WMA. These facilities provide control for 4 percent of the WMA. Two percent of the total area has quantity control only, 1 percent receives both quantity and quality control and the remaining 1 percent has only quality control. Stormwater infrastructure is shown on Map 2-9, attached.

2.10.5 Stream Condition

Stream conditions for this WMA are shown on Map 2-10, attached.

Erosion

There was a total of 300 linear feet of erosion identified on the right stream bank in the WMA at three specific erosion locations. (The first is located east of Highland Lane, the

second is located east of Prosperity Avenue and the third is located south of Guinevere Drive.) Each of these erosion sites had moderate restoration potential.

Outfall Impacts

Eleven outfall pipes were located within the Mainstem 2 WMA. All of the pipes were within 100 feet of the stream channel and ranged in size from 4 inches to 60 inches. One 60-inch pipe, located south of Pine Ridge Park, was identified as causing major erosion.

Stream Crossings

Twenty-one stream crossings were identified in the Mainstem 2 WMA. None of the crossings were having a significant impact on stream condition or causing any type of erosion.

Obstructions

There are 22 obstruction sites located in the Mainstem 2 WMA, all of which are trees and debris. Eight of the obstruction sites are thought to be impacting fish movement within the stream (all are located within Eakin Community Park). Two utility lines also crossed the stream, one partially buried and one above base flow.

There were two dump sites found in the WMA. The first dump site on the left stream bank contained lawn waste (grass and leaves) and it did not appear to contain toxic material. The second site on the right bank included motors, iron pipes, 55 gallon drums and construction material.

Stream Buffers

The stream buffers in the Mainstem 2 WMA were mostly lawns with a few buildings. There were 28 deficient buffer points. Approximately 4,525 linear feet, or 39 percent, of the streams have severe encroachment within the buffers. Of this, 3 percent had high restoration potential.

Habitat

The Stream Physical Assessment in 2003 along the streams in the Mainstem 2 WMA resulted in 15 percent of the assessed length classified as good, 19 percent as fair, 57 percent as poor and 10 percent as very poor

A total of 19 stream reaches were characterized through the watershed. Of all the streams, 3 percent were characterized as optimal for instream cover (fish) and epifaunal substrate (benthic).

2.10.6 WMA Modeling

AC-AC-335 shows the highest modeled TP loads in this WMA, based on drainage from I-695, which is adjacent on the west. The two subwatersheds, AC-AC-375 and AC-AC-380, in the northeast area also among the highest, based on commercial and high-density land uses. The subwatersheds surrounding Accotink Creek (AC-AC-355, AC-AC-365, AC-AC-385, and AC-AC-390) had the lowest loadings in this WMA. See Table 2-20 for results.

Table 2-20 - Mainstem 2 Water Quality Modeling Results

Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-AC-0330	6.06	1.02	0.19
AC-AC-0335	8.36	1.32	0.20
AC-AC-0340	6.49	1.00	0.15
AC-AC-0345	5.63	0.88	0.28
AC-AC-0350	6.48	0.99	0.14
AC-AC-0355	4.50	0.71	0.12
AC-AC-0360	6.17	0.96	0.15
AC-AC-0365	2.52	0.43	0.10
AC-AC-0370	5.22	0.81	0.11
AC-AC-0375	7.39	1.05	0.16
AC-AC-0380	8.45	1.09	0.19
AC-AC-0385	4.54	0.71	0.11
AC-AC-0390	5.12	0.80	0.13
AC-AC-0395	5.76	0.88	0.14

2.11 Mainstem 3

2.11.1 General Characteristics

Mainstem 3 flows in a southwesterly direction for approximately 11 miles starting east of Pickett Road to Little River Turnpike. This tributary has a drainage area of 3,267 acres.

All of the assessed streams within the Mainstem 3 WMA are characterized as moderate to high gradient riffle/run streams with active widening and bank erosion. The channel bed is primarily sand.

2.11.2 Field Reconnaissance

Many neighborhoods were assessed and multiple Hotspot Site Investigations were conducted in the Mainstem 3 WMA. A summary of the results is discussed below.

Chapel Square and Camelot Greens are detached single-family neighborhoods with one-quarter-acre lots. Average lot conditions included approximately 60 percent impervious cover, 25 percent grass cover and 20 percent tree canopy. Sidewalks were present on most streets and curbs and gutters were clean. Storm drain inlets were not stenciled and no stormwater treatment was apparent. There was some encroachment into the buffer and floodplain area.

Wakefield/Chapel Woods lies east of Wakefield Forest Elementary. This neighborhood is made up of detached single-family homes on one-quarter-acre lots. Each lot was approximately 55 percent impervious, 25 percent tree canopy and 10 percent each of grass cover and landscaping. There was some evidence of infill/remodeling but no illegal dumping or trash was observed. A portion of the neighborhood was open section without sidewalks, while other areas had both sidewalks and curb and gutter with organic matter present in the gutter. Storm drains were present but not stenciled. No dedicated stormwater treatment was evident.

Oakhill, a subdivision south of Wakefield Forest Elementary has detached single-family homes on one-quarter-acre lots. Lots were approximately 55 percent impervious, 25 percent tree canopy and 10 percent each of grass cover and landscaping. There was no evidence of infill development or illegal dumping. Roads had sidewalks along both sides with organic matter accumulating in the curb and gutter. Storm drains were present but not stenciled. No dedicated stormwater treatment was apparent, and there was some encroachment into the forested buffer and floodplain area adjacent to the stream.

The neighborhoods of Camelot and Mill Creek are situated south and west of Camelot Elementary along King Arthur Road. These subdivisions have one-quarter acre lots with approximately 40 percent impervious cover, 35 percent grass, 15 percent landscaping and 10 percent tree canopy. There are sidewalks along both sides of the street, and the curb and gutter area was clean and dry. Storm drain inlets were not stenciled and no on-site stormwater treatment was apparent. Some of the downspouts were piped underground and did not resurface at the front of the house or to the road through weep holes, indicating that they may be connected directly into the storm or sanitary sewer system.

Holmes Run Heights, southeast of the Gallows Road exit of the Capital Beltway, is a subdivision that is experiencing infill development with large homes. Approximately 30 percent of the neighborhood consists of newer large houses that use a greater percentage of the available area than nearby older homes. The entire neighborhood was open section with no storm drains or dedicated stormwater treatment. A stream flowed through the front or side yards of several properties, and severe buffer encroachment was evident. The following land cover descriptions summarize the differences between the newer and older parcel development:

- On average, the newer parcels are approximately 60 percent impervious cover, 12 percent grass cover, 3 percent bare soil (for unseeded lawns), 25 percent landscaping and 10 percent tree canopy cover
- Older parcels are approximately 35 percent impervious, 50 percent grass cover, 30 percent tree canopy and 15 percent landscaping.

Fairfax Hills is a subdivision with one-acre lots and some residential infill development located southwest of the Little River Turnpike exit off the Capital Beltway. On average, lots were approximately 20 percent impervious, with 60 percent grass cover, 20 percent landscaping and 50 percent mature tree canopy coverage. Approximately 80 percent of the driveways were impervious. There were no storm drains, stormwater treatment, or curb and gutter present.

Park Glen Heights is a multi-family development on Glen Park Road at Wakefield Chapel Road. Each townhome lot had approximately 60 percent impervious cover, 30 percent grass cover and 5 percent landscaping. Approximately 5 percent of each lot had mature tree canopy. Sidewalks and curb and gutter were present and clean. Unstenciled storm drain inlets were located, but stormwater treatment was not apparent.

Bristow Village, along Schuyler Drive northeast of the Braddock Road exit of the Capital Beltway, is a townhome community with approximately 75 percent impervious cover, 5 percent grass cover, 5 percent landscaping and 15 percent tree canopy. Unstenciled, clean storm drains were present along the curbs and gutters. Open space was present with no illegal dumping. No stormwater treatment was provided in the neighborhood.

Avant Apartment Homes are located on Americana Drive at Patriot Drive. This community has approximately 75 percent impervious cover, 15 percent grass, 5 percent landscaping and 5 percent tree canopy cover. No illegal dumping or trash was found throughout the complex or in the open space area. Sidewalks and curbs and gutters were present and clean. Storm drains were not stenciled and there was no apparent stormwater treatment on site.

The Bristow/Ravensworth/Cedar Crest area, south of Annandale High School, has one-quarter-acre lots with approximately 50 percent impervious cover, 20 percent grass cover, 5 percent landscaping and 15 percent tree cover. Sidewalks and curb and gutter were present. Storm drain inlets were not stenciled. No stormwater treatment was apparent.

The Heritage Court condominiums are situated between Americana and Patriot Drives. The community is approximately 75 percent impervious, 15 percent grass cover, 5 percent landscaping and 5 percent tree cover. Sidewalks and curbs and gutters were present. Storm drain inlets on the site were present and clear of obstruction but were not stenciled. No stormwater treatment was provided for the development.

Tall Tree Gardens is a multi-family development with approximately 60 percent impervious cover, 20 percent grass cover, 10 percent landscaping and 10 percent tree cover. Sidewalks, storm drain inlets, and curbs and gutters were present and clean. No stormwater treatment was provided exclusively for the development.

Chicken Pollo is a restaurant on the northeast corner of the Little River Turnpike and Markham Street intersection. The grease trap was on a raised, vegetated area, but with no cover or secondary containment. Staining on the pavement nearby was found. No storm drain facilities were located, and no stormwater treatment was apparent. This site was determined to be a potential hotspot.

The Shell gas station on Little River Turnpike near Prosperity Avenue has a repair facility where vehicles seem to be handled well. There was no evidence of any spills or leaks, and the covered fuel islands don't drain toward the storm drain. There were no storm drains and no apparent stormwater treatment. This site was not classified as a hotspot.

Citgo gas and auto repair located on Heritage Road had uncovered fueling areas that did not appear to drain to a storm drain. Materials were stored outside without cover or secondary containment and were indirectly connected to a storm drain. There was no obvious on-site stormwater treatment. This site was classified as a potential hotspot.

2.11.3 Land Use

The Mainstem 3 WMA is characterized by medium-density residential development with 27 percent of the watershed area developed as such. Another 16 percent of the WMA is low-density residential development and 12 percent is high-density residential development. Seventeen percent has been preserved for open space or parks. See Map 2-24, attached, for details.

Future land use is projected to change primarily in the open space, low-density residential and low-intensity commercial land use categories. Losses in open space (-84 acres), low-density residential (-41 acres) and low-intensity commercial (-29 acres) uses will be met primarily with gains in medium-density residential (91 acres), high-intensity commercial (39 acres) and estate residential (27 acres) categories. A summary of the land use within the WMA is shown in Table 2-21.

Table 2-21 - Mainstem 3 Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	565	17	481	15	-84	-15
Golf Course	0	0	0	0	0	0
Estate Residential	33	1	60	2	27	82
Low-Density Residential	519	16	478	15	-41	-8
Medium-Density Residential	890	27	981	30	91	10
High-Density Residential	384	12	386	12	2	1
Low-Intensity Commercial	43	1	14	<1	-29	-67
High-Intensity Commercial	64	2	103	3	39	61
Industrial	7	<1	5	<1	-2	-29
Institutional	174	5	171	5	-3	-2
Transportation	556	17	556	17	0	0
Water	32	1	32	1	0	0
Total	3,267	100	3,267	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 841 acres, or 26 percent of the total WMA area of 3,267 acres.

2.11.4 Stormwater Infrastructure

Stormwater Management

County records indicate that there are 38 stormwater management facilities within the Mainstem 3 WMA. These facilities provide control for 7 percent of the WMA. Five percent of the total area has quantity control only, one percent receives only quality control and the remaining portion has both quantity and quality control. Stormwater infrastructure is shown on Map 2-14, attached.

2.11.5 Stream Condition

Stream conditions for this WMA are shown on Map 2-15, attached.

Erosion

There was a total of 1,780 linear feet of erosion identified in the WMA at 12 specific erosion locations. Of this, 190 linear feet had low to moderate restoration potential. Another 890 linear feet of erosion along the left bank had moderate restoration potential. Additionally, field crews located one three-foot head cut.

Outfall Impacts

Forty-one outfall pipes were located within the Mainstem 3 WMA. All of the pipes were within 100 feet of the stream channel and ranged in size from 4 inches to 60 inches. Two pipes, a 15-inch and 12-inch, were identified as causing major erosion. (The first is located east of Americana Drive and the second is located east of John Hancock Drive.)

Stream Crossings

Seventy-three stream crossings were identified in the Mainstem 3 WMA. One box culvert crossing, located east of Wakefield Park, was having a severe effect on stream conditions.

Obstructions

There are 36 obstruction sites located in the Mainstem 3 WMA, most of which are trees and debris. Twelve of the obstruction sites are thought to be impacting fish movement within the stream. Five utility lines also crossed the stream, two partially buried, and three above base flow.

There were two dump sites found instream and on both banks of the WMA. Neither site appeared to contain toxic material.

Stream Buffers

The stream buffers in the Mainstem 3 WMA were a mix of lawns, buildings, easements and pavement. There were 65 deficient buffer points. Approximately 10,900 linear feet, or 21 percent of the streams had severe encroachment within the buffers. Of this only 25 percent had low restoration potential, while the other 75 percent has no potential for restoration. Approximately 8,300 linear feet, or 16 percent, of the stream had extreme encroachment in the buffer. None of this area had potential for restoration.

Habitat

As part of the countywide Stream Physical Assessment a habitat assessment was conducted in 2003 on the streams throughout the Mainstem 3 WMA. This assessment resulted in 16 percent of the assessed length classified as good, 25 percent as fair, 32 percent as poor and 27 percent as very poor.

A total of 20 stream reaches were characterized through the watershed. Of all the reaches, only 7 percent were characterized as optimal for instream cover (fish) and 4 percent for epifaunal substrate (benthic). Almost all of the streams were classified as poor for bank vegetative protection (left and right banks).

2.11.6 WMA Modeling

Pollutant loading is relatively high across this WMA, based on significant percentages of medium and high-density residential development and runoff from I-695 and US-50 (see Table 2-22). The lowest pollutant loading is from the subwatersheds adjacent to Accotink Creek, AC-AC-280, AC-AC-285, and AC-AC-305, which consist of woods and open space. AC-CO-0015, in Coon Branch, also showed low loadings, based on low-density development and open space.

Table 2-22 - Mainstem 3 Water Quality Modeling Results

Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-AC-0280	4.73	0.75	0.14
AC-AC-0285	5.09	0.82	0.16
AC-AC-0290	10.02	1.57	0.23
AC-AC-0295	7.95	1.20	0.37
AC-AC-0300	7.38	1.08	0.16
AC-AC-0305	4.96	0.85	0.17
AC-AC-0310	6.77	1.04	0.14
AC-AC-0315	7.79	1.16	0.17
AC-AC-0320	6.12	0.97	0.13
AC-AC-0325	7.72	1.20	0.17
AC-CO-0000	7.13	1.14	0.19
AC-CO-0005	6.43	0.94	0.14
AC-CO-0010	7.97	1.17	0.17
AC-CO-0015	4.88	0.75	0.11
AC-CO-0020	6.56	1.00	0.14
AC-TR-0000	6.36	0.95	0.14
AC-TR-0005	7.27	1.10	0.16
AC-TR-0010	6.45	0.98	0.14

2.12 Mainstem 4

2.12.1 General Characteristics

Mainstem 4 flows in a southeasterly direction for approximately five miles starting just south of Braddock Road/Route 620 to the railroad crossing at Lake Accotink Park. A portion of Mainstem 4 flows through Lake Accotink. This tributary has a drainage area of 1,673 acres.

All of the assessed streams within the Mainstem 4 WMA are characterized as moderate to high gradient riffle/run streams with active widening and bank erosion. The channel bed is primarily sand.

2.12.2 Field Reconnaissance

Three neighborhoods were assessed and four Hotspot Site Investigations were conducted in the Mainstem 4 WMA. A summary of the results is discussed below.

Kings Park is a detached single-family detached subdivision with one-half-acre lots located at Braddock and Rolling Roads. The lots were approximately 40 percent impervious cover, 50 percent grass cover, 10 percent landscaping and 35 percent tree cover. Sidewalks were present, as well as curb and gutter with accumulated organic matter. Storm drain inlets were stenciled and free of obstruction. There was open space but no dumping was observed.

Ravensworth and Springfield are communities located near the Capital Beltway and Accotink Park Road in both the Mainstem 4 and Mainstem 5 WMAs. The single-family lots here ranged in size from one-quarter to one-half acre and were approximately 40 percent impervious cover, 50 percent grass cover, 10 percent landscaping, and 40 percent tree cover. Sidewalks were present and adjacent curbs and gutters were clean and dry. Storm drain inlets were stenciled and clear of debris. There was open space with intact stream buffers within the floodplain and no encroachment was evident.

Interstate Van Lines is a relocation service company located on Morrisette Drive. Approximately 50 fleet vehicles are fueled, stored, and repaired outside, with no runoff diversion methods present. Inspectors did not identify evidence of spills or leaks from the vehicles and were unsure whether vehicles were washed outside. Uncovered outdoor fueling areas were directly connected to storm drains. The site was determined to be a potential hotspot, and should be included in future education efforts.

FedEx is located on Morrisette Drive. Approximately five fleet vehicles are fueled onsite, with the fueling areas directly connected to storm drains. Loading operations were present and storage containers in poor condition. Gravel and sand covering the parking lot ran into storm drain inlet. This site was also classified as a potential hotspot.

Hatchik Supply Company is an industrial site with approximately 10 fleet vehicles stored onsite. Loading operations were occurring at the time of inspection and garbage was present. Liquid materials and construction materials were stored outside on concrete without covers or containment. The building is approximately 30 years old. The adjacent paved parking lot is approximately 15 years old, stained, and cracked. The site was

classified as a potential hotspot and should be scheduled for a review of a storm water pollution prevention plan.

AG&E Landscape Services is an industrial site located on Woodcuff Court. There are approximately 10 trailers maintained and stored outside. Loading operations were present. Large mounds of soil and gravel are stored on concrete without cover. This site was determined to be a potential hotspot.

2.12.3 Land Use

The Mainstem 4 WMA is characterized by medium-density residential development with 37 percent of the watershed area developed as such. Another 11 percent of the WMA is high-density residential development. Twenty-one percent has been preserved for open space or parks. See Map 2-25, attached, for details.

Future land use is projected to change in the high-intensity commercial (4 acres) and industrial (-4 acres) land use categories. A summary of the land use within the WMA is shown in Table 2-23.

Table 2-23 - Mainstem 4 Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	360	21	360	21	0	0
Golf Course	0	0	0	0	0	0
Estate Residential	0	0	0	0	0	0
Low-Density Residential	19	1	19	1	0	0
Medium-Density Residential	613	37	613	37	0	0
High-Density Residential	186	11	186	11	0	0
Low-Intensity Commercial	10	1	10	1	0	0
High-Intensity Commercial	0	0	4	<1	4	<1
Industrial	170	10	166	10	-4	-2
Institutional	33	2	33	2	0	0
Transportation	205	12	205	12	0	0
Water	77	5	77	5	0	0
Total	1,673	100	1,673	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 582 acres, or 35 percent of the total WMA area of 1,673 acres.

2.12.4 Stormwater Infrastructure

Stormwater Management

County records indicate that there are 11 stormwater management facilities within the Mainstem 4 WMA. These facilities provide control for 1 percent of the WMA. One percent of the total area receives quantity control only and the remaining portion has only quality control. There is one constructed pond, Lake Accotink, located in the southern end of this WMA. Stormwater infrastructure is shown on Map 2-26, attached.

2.12.5 Stream Condition

Stream conditions for this WMA are shown on Map 2-27, attached.

Erosion

There was a total of 110 linear feet of erosion identified in the WMA at three specific erosion locations (all located within Lake Accotink Park). Of this, 40 linear feet was identified along the right stream bank with high restoration potential. Seventy linear feet was identified on the outer bends of the stream banks which had moderate restoration potential. Two head cuts, each 2 feet in height, were identified in the WMA.

Outfall Impacts

Twenty-five outfall pipes were located within the Mainstem 4 WMA. All of the pipes were within 150 feet of the stream channel and ranged in size from 12 inches to 72 inches. One 12-inch pipe, located east of Mitcham Court, was identified as causing major erosion.

Stream Crossings

Twelve stream crossings were identified in the Mainstem 4 WMA. None of the crossings were having a significant impact on stream condition or causing any type of erosion.

Obstructions

There are ten obstruction sites located in the Mainstem 4 WMA, most of which are trees and debris. Three of the obstruction sites are thought to be impacting fish movement within the stream. (One site is located north of Kirkham Court and two sites are located within Lake Accotink Park east of Lonsdale Drive.) Two sanitary utility lines also crossed the stream, one within the banks and one above high water.

Stream Buffers

The majority of the Mainstem 4 stream buffers were lawn with some buildings and pavement. There were 15 deficient buffer points. Severe encroachment was not present in any of the stream buffers.

Habitat

A habitat assessment conducted on the streams throughout the Mainstem 4 WMA in 2003 as part of the countywide Stream Physical Assessment resulted in a good classification for 29 percent of the assessed length, 64 percent as fair, 3 percent as poor and 4 percent as very poor.

A total of 11 reaches were characterized through the watershed. Approximately 68 percent of the streams were characterized as optimal for instream cover (fish) and 35 percent for epifaunal substrate (benthic).

2.12.6 WMA Modeling

Accotink Mainstem 4 shows moderate and high modeled pollutant loads across the watershed, based on significant percentages of medium and high-density residential development. The lowest loads are from the wooded subwatersheds adjacent to Lake Accotink and Accotink Creek, AC-AC-235, AC-AC-245, AC-AC-250 and AC-AC-255. See Table 2-24 for results.

Table 2-24 - Mainstem 4 Water Quality Modeling Results

Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-AC-0235	3.31	0.50	0.09
AC-AC-0240	8.12	1.15	0.20
AC-AC-0245	2.46	0.36	0.16
AC-AC-0248	4.98	0.70	0.13
AC-AC-0250	5.37	0.83	0.14
AC-AC-0255	5.60	0.85	0.14
AC-AC-0260	7.70	1.07	0.19
AC-AC-0265	6.80	1.05	0.17
AC-AC-0270	7.48	1.13	0.16
AC-AC-0275	8.33	1.25	0.18
AC-FR-0000	7.44	1.07	0.19
AC-FR-0005	8.78	1.34	0.19

2.13 Mainstem 5

2.13.1 General Characteristics

Mainstem 5 flows in a southeasterly direction approximately nine miles, from the southern tip of Lake Accotink to the confluence of Calamo Branch and Accotink Creek. This tributary has a drainage area of 2,445 acres.

All of the assessed streams within the Mainstem 5 WMA are characterized as moderate to high gradient riffle/run streams with active widening and bank erosion. The channel bed is primarily cobble and gravel.

2.13.2 Field Reconnaissance

One neighborhood was assessed and four Hotspot Site Investigations were conducted in the Mainstem 5 WMA. A summary of the results is discussed below.

Keene Mill Manor is a single-family development located at Old Keene Mill and Greeley Boulevard in West Springfield. This area lies across the Mainstem 5 and Mainstem 6 WMA boundary. The one-quarter-acre lots had 40 percent impervious cover, 50 percent grass cover, 10 percent landscaping, and 35 percent tree cover. Sidewalks were present, and curbs and gutters were clean and dry. Some of the storm drain inlets were stenciled, and all were clean.

At Cox Communications, about 100 fleet vehicles were fueled and stored outside with fueling areas directly connected to storm drains. Private storm drains and a wet pond were present, but cable spools were found in the pond. This site was determined to be a potential hotspot, and should be scheduled for a review of a storm water pollution prevention plan.

TW Perry Decking and Lumber is an industrial site located on Southern Drive in Springfield. Oil tanks were stored on an uncovered, outdoor concrete area indirectly connected to a storm drain. Garbage, construction materials and hazardous materials were found on site. This site was identified as a potential hotspot and a follow-up on-site inspection should be conducted.

At Curtis Lumber and Plywood loading operations were present. Tar cans, trash, equipment and roofing materials were stored outside on uncovered concrete. Liquid materials were stored without secondary containment, and storage containers were in poor condition. The building and parking lot were stained. This site was determined to be a potential hotspot and should be scheduled for a review of a storm water pollution prevention plan.

Uncovered loading operations were present at the Springfield Plaza Shopping Center, with drainage toward a storm drain. Uncovered grease barrels in poor condition were stored outside on concrete without secondary containment. The stained storage area was connected to a storm drain. Garbage was also lying on the ground outside of overflowing dumpsters. This site was determined to be a potential hotspot and should be scheduled for a review of a storm water pollution prevention plan.

2.13.3 Land Use

The Mainstem 5 WMA is characterized by medium-density residential development with 38 percent of the watershed area developed as such. Another 8 percent of the WMA is low-density residential development and 6 percent is high-density residential development. Eighteen percent has been preserved for open space or parks. See Map 2-28, attached, for details.

Future land use is projected to change in the open space, low-density residential, low-intensity commercial, industrial and institutional land use categories. The most significant changes are losses in open space (-37 acres) and low-density residential (-15 acres) uses, which will be met primarily with gains in medium-density residential (41 acres) and high-intensity commercial (20 acres) categories. A summary of the land use within the WMA is shown in Table 2-25.

Table 2-25 - Mainstem 5 Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	447	18	410	17	-37	-8
Golf Course	0	0	0	0	0	0
Estate Residential	8	0	8	0	0	0
Low-Density Residential	205	8	190	8	-15	-7
Medium-Density Residential	928	38	969	40	41	5
High-Density Residential	145	6	155	6	10	7
Low-Intensity Commercial	22	1	14	1	-8	-38
High-Intensity Commercial	80	3	100	4	20	23
Industrial	95	4	90	4	-5	-5
Institutional	99	4	93	4	-6	-6
Transportation	393	16	393	16	<1	0
Water	23	1	23	1	<1	0
Total	2,445	100	2,445	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 694 acres, or 28 percent of the total WMA area of 2,445 acres.

2.13.4 Stormwater Infrastructure

Stormwater Management

County records indicate that there are 45 stormwater management facilities within the Mainstem 5 WMA. These facilities provide control for 5 percent of the WMA. Three percent of the total area has quantity control only and the remaining 2 percent has only quality control. Stormwater infrastructure is shown on Map 2-26, attached.

2.13.5 Stream Condition

Stream conditions for this WMA are shown on Map 2-27, attached.

Erosion

There were no erosion or headcut sites located in the Mainstem 5 WMA.

Outfall Impacts

Thirty-nine outfall pipes were located within the Mainstem 5 WMA. All of the pipes were within 100 feet of the stream channel and ranged in size from 6 inches to 60 inches. One 18-inch pipe, located within Brookfield Park and north of Nancemond Street, was identified as causing moderate erosion.

Stream Crossings

Nineteen stream crossings were identified in the Mainstem 5 WMA. None of the crossings were having a significant impact on stream condition or causing any type of erosion.

Obstructions

Five sanitary utility lines and one water line were identified crossing the streams. The water line and two of the sanitary utility lines crossed the stream above base flow. One of the sanitary lines was partially buried and one crossed above the high water.

Stream Buffers

The majority of stream buffers in the Mainstem 5 WMA are lawns with some pavement and construction. There were 20 deficient buffer points. Approximately 450 linear feet, or two percent, of the stream buffer had severe encroachment. All of this had low restoration potential.

Habitat

As part of the Stream Physical Assessment in 2003, the stream physical habitat was characterized along the streams in the Mainstem 5 WMA. This characterization resulted in 6 percent of the assessed length characterized as excellent, 54 percent as good, 24 percent as fair and 15 percent as poor.

A total of 17 stream reaches were characterized through the watershed. Sixty-one percent of the streams were classified as optimal for bottom substrate/available cover and 41 percent for pool substrate characterization.

2.13.6 WMA Modeling

The commercial areas near Springfield Plaza drive the pollutant loads from AC-CA-0010 and AC-CA-0005. Other relatively high loading is associated with the medium density residential development throughout the watershed. See Table 2-26 for results.

Table 2-26 - Mainstem 5 Water Quality Modeling Results

Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-AC-0185	6.63	1.02	0.18
AC-AC-0190	6.61	0.99	0.15
AC-AC-0195	6.61	0.99	0.15
AC-AC-0200	7.70	1.16	0.17
AC-AC-0205	4.36	0.68	0.12
AC-AC-0210	8.13	1.24	0.18
AC-AC-0215	8.09	1.18	0.19
AC-AC-0220	9.10	1.38	0.21
AC-AC-0225	9.10	1.38	0.21
AC-AC-0230	3.16	0.44	0.11
AC-CA-0000	5.45	0.83	0.12
AC-CA-0005	7.87	1.15	0.17
AC-CA-0010	9.09	1.31	0.20

2.14 Mainstem 6

2.14.1 General Characteristics

Mainstem 6 flows in a southeasterly direction approximately six miles starting at the confluence of Calamo Branch and Accotink Creek to the north side of Fort Belvoir Proving Ground. A portion of Mainstem 6 flows through Springfield Golf and Country Club. This tributary has a drainage area of 1,532 acres.

All of the assessed streams within the Mainstem 6 WMA are characterized as moderate to low gradient glide/pool streams with active widening and bank erosion. The channel bed is primarily gravel and cobble.

2.14.2 Field Reconnaissance

Neighborhood assessments were not conducted in this WMA. Similar neighborhoods were assessed in the Mainstem 5 WMA. A number of Hotspot Site Investigations were conducted, however. A summary of the results is discussed below.

At the Old Keene Mill Shopping Center, behind Blockbuster, grease was found in an uncovered outdoor storage area connected to a storm drain. The concrete in this area was also stained. The grease was stored without secondary containment. This site was identified as a potential hotspot.

At the Quarles-Newington Commerce Center, approximately 50 fleet vehicles were fueled and stored in an uncovered outdoor area lacking diversion methods. The fueling areas were directly connected to storm drains. Fuel tanks were also stored outside without cover. The approximately 40-year old building was clean, but the parking lot was stained. Downspouts discharged to impervious surfaces. Storm water treatment practices were not present. Private storm drains were located at the facility. This site was identified as a potential hotspot and a follow-up on-site inspection should be conducted. Also, a review of the stormwater pollution prevention plan should be scheduled.

2.14.3 Land Use

The Mainstem 6 WMA is characterized by medium-density residential development with 27 percent of the watershed area developed as such. Another 15 percent of the WMA is high-density residential development. Twenty percent has been preserved for open space or parks. See Map 2-29, attached, for details.

Future land use is projected to change in the open space, estate residential, and low-intensity commercial land use categories. The most significant changes are losses in open space (-32 acres) and estate residential (-10 acres) uses, which will be met primarily with gains in low-density residential (25 acres) and medium-density residential (18 acres) categories. A summary of the land use within the WMA is shown in Table 2-27.

Table 2-27 - Mainstem 6 Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	311	20	279	18	-32	-10
Golf Course	146	10	146	10	0	0
Estate Residential	24	2	14	1	-10	-42
Low-Density Residential	86	6	111	7	25	29
Medium-Density Residential	409	27	427	28	18	4
High-Density Residential	225	15	225	15	0	0
Low-Intensity Commercial	5	<1	0	0	-5	-100
High-Intensity Commercial	30	2	34	2	4	13
Industrial	0	0	0	0	0	0
Institutional	45	3	45	3	0	0
Transportation	228	15	228	15	0	0
Water	23	1	23	1	0	0
Total	1,532	100	1,532	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 378 acres, or 25 percent of the total WMA area of 1,532 acres.

2.14.4 Stormwater Infrastructure

Stormwater Management

County records indicate that there are 28 stormwater management facilities within the Mainstem 6 WMA. These facilities provide control for 10 percent of the WMA. Five percent of the total area has quantity control only, 4 percent receives only quality control and the remaining 1 percent has both quantity and quality control. There is one constructed pond, Rolling Valley, located in the northwestern end of the WMA, east of Millwood Court. Stormwater infrastructure is shown on Map 2-26, attached.

2.14.5 Stream Condition

Stream conditions for this WMA are shown on Map 2-27, attached.

Erosion

There were no erosion or headcut sites located in the Mainstem 6 WMA.

Outfall Impacts

Twenty-nine outfall pipes were located within the Mainstem 6 WMA. All of the pipes were within 100 feet of the stream channel and ranged in size from 12 inches to 60 inches. Only one of the pipes was causing minor erosion.

Stream Crossings

Seventeen stream crossings were identified in the Mainstem 6 WMA. None of the crossings were having a significant impact on stream condition or causing any type of erosion.

Obstructions

There are two obstruction sites, consisting of trees, debris and sediment, located in the Mainstem 6 WMA. One of the obstruction sites also has a utility line. This obstruction

site is thought to be impacting fish movement within the stream and is located at the southern end of Springfield Golf and Country Club.

Stream Buffers

All of the stream buffers within the Mainstem 6 WMA are lawns and pavement. There were 16 deficient buffer points. Severe encroachment is not present at any of these locations.

Habitat

As part of the Stream Physical Assessment in 2003, the stream physical habitat was characterized along the streams in the Mainstem 6 WMA. This resulted in 67 percent of the assessed stream length characterized as good and 33 percent as fair.

Approximately 77 percent of the streams were characterized as optimal for bottom substrate/available cover. All of the streams were classified as suboptimal for channel alteration and channel flow status.

2.14.6 WMA Modeling

The area of highest loading found in this watershed is AC-AC-145, located at the headwaters and draining the intersection of Fairfax County Parkway and Rolling Road. AC-AC-0170 and AC-AC-0175 which contain the commercial areas at Keene Mill Road and Rolling Road also had high loadings. See Table 2-28 for results.

Table 2-28 - Mainstem 6 Water Quality Modeling Results

Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-AC-0135	6.26	0.97	0.13
AC-AC-0140	4.29	0.65	0.10
AC-AC-0145	8.96	1.43	0.29
AC-AC-0150	6.44	0.97	0.15
AC-AC-0155	4.11	0.66	0.13
AC-AC-0160	6.24	0.97	0.15
AC-AC-0165	4.56	0.77	0.13
AC-AC-0170	7.36	1.13	0.18
AC-AC-0175	8.66	1.15	0.18
AC-AC-0180	7.05	1.07	0.16

2.15 Mainstem 7

2.15.1 General Characteristics

Mainstem 7 flows in a southeasterly direction approximately five miles, from the north side of Fort Belvoir Proving Ground to Telegraph Road/Route 611. This tributary has a drainage area of 2,391 acres.

The majority of the assessed streams within the Mainstem 7 WMA are characterized as moderate to low gradient glide/pool streams with active widening and bank erosion. The channel bed is primarily cobble.

2.15.2 Field Reconnaissance

In the Mainstem 7 WMA field crews assessed two neighborhoods and conducted four Hotspot Site Investigations. The results of these assessments are discussed below.

The Fairfax Assisted Living is a multifamily development. The area is 50 percent impervious cover, 40 percent grass cover, ten percent landscaping, and ten percent tree cover. Sidewalks were present with clean and dry curbs and gutters. Storm drain inlets were not stenciled, but were free of obstruction. There was open space with stream buffers in the floodplain with no encroachment evident.

Southgate Woods is a multifamily development located at Telegraph Road and Whernside Street. Lots had approximately 50 percent impervious cover, 45 percent grass cover, 5 percent landscaping, and 5 percent tree cover. Tires were found dumped in a dry stormwater management pond. Sidewalks were present with clean and dry curbs and gutters. Storm drain inlets were not stenciled, but were free of obstruction.

At the Virginia 95 Interstate Park and Fullerton Industrial Park vehicles were stored outdoors without diversion runoff. Leaks were evident. At Enterprise, vehicles were washed outdoors in an area that discharged directly to the storm drain. Garbage dumpsters were not covered. This location was identified as a potential hotspot.

At U-Haul on Terminal Road, approximately 30 fleet vehicles were stored outside without runoff diversion. Leaks were evident. Vehicles were washed in a garage, but wash water went directly into a storm drain inlet and a concrete channel. There was visible staining around an outdoor storage area connected to the storm drain system. The approximately 10-year-old building appeared clean, but the paved parking lot was stained. This site was identified as a confirmed hotspot.

Deen Park is a fueling station where fleet vehicles were fueled and stored uncovered outside. Leaks and spills were evident. There was a swale draining the parking lot which led to a stream channel. There were no private storm drains observed. This site was identified as a potential hotspot.

At D&K Heavy Truck Repair, approximately 30 large trucks were stored, repaired, and fueled in uncovered outdoor areas. This site was not identified as a hotspot.

2.15.3 Land Use

The Mainstem 7 WMA is characterized by a large amount of open space, parks and recreation areas with 41 percent of the watershed area set aside for these uses. Another 23 percent of the WMA is industrial development. See Map 2-30, attached, for details.

Future land use is projected to change in the open space, estate residential and low-intensity commercial land use categories. The most significant change is a loss in open space (-120 acres) which will primarily be met with gains in low-density residential (64 acres), industrial (30 acres), medium-density residential (20 acres) and high-intensity commercial (14 acres) categories. A summary of the land use within the WMA is shown in Table 2-29

Table 2-29 - Mainstem 7 Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	986	41	865	36	-121	-12
Golf Course	0	0	0	0	0	0
Estate Residential	5	0	0	0	-5	-100
Low-Density Residential	56	2	119	5	63	113
Medium-Density Residential	166	7	186	8	20	12
High-Density Residential	114	5	114	5	0	0
Low-Intensity Commercial	54	2	52	2	-2	-4
High-Intensity Commercial	51	2	66	3	15	29
Industrial	540	23	571	24	31	6
Institutional	22	1	21	1	-1	-5
Transportation	358	15	358	15	0	0
Water	39	2	39	2	0	0
Total	2,391	100	2,391	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 651 acres, or 27 percent of the total WMA area of 2,391 acres.

2.15.4 Stormwater Infrastructure

Stormwater Management

County records indicate that there are 61 stormwater management facilities within the Mainstem 7 WMA. These facilities provide control for 17 percent of the WMA. Thirteen percent of the total area has quantity control only, 3 percent receives both quantity and quality control and the remaining 1 percent has only quality control. Stormwater infrastructure is shown on Map 2-18, attached.

2.15.5 Stream Condition

Stream conditions for this WMA are shown on Map 2-19, attached.

Erosion

There was a total of 50 linear feet of erosion identified on the right stream bank in the WMA at one specific erosion location south of Boston Boulevard. This erosion site has moderate restoration potential.

Outfall Impacts

There are fifteen outfall pipes located within the Mainstem 7 WMA. All of the pipes were within 100 feet of the stream channel and ranged in size from 12 inches to 84 inches. None of the pipes were causing erosion.

Stream Crossings

Seven stream crossings were identified in the Mainstem 7 WMA. None of the crossings were having a significant impact on stream condition or causing any type of erosion.

Obstructions

There are two obstruction sites located in the Mainstem 7 WMA, one which is trees and the other a beaver dam. The obstruction site with the trees, located west of Telegraph Road, is thought to be impacting fish movement within the stream.

Stream Buffers

All of the stream buffers within the Mainstem 7 WMA are lawns and pavement. There were eight deficient buffer points. Severe encroachment is not present in any of these stream buffers.

Habitat

As part of the Stream Physical Assessment in 2003, the stream physical habitat was characterized along the streams in the Mainstem 7 WMA. Of the assessed reaches, 92 percent of the length was classified as good, 7 percent as fair and 1 percent as poor.

Approximately 67 percent of the glide/pool streams were characterized as optimal for bottom substrate/available cover and 56 percent for pool substrate characterization. Almost all of the streams were classified as suboptimal for channel flow status (normal flow).

2.15.6 WMA Modeling

The highest loadings in this WMA are from the subwatersheds containing industrial land uses adjacent to the Capitol Beltway: AC-AC-0090, AC-AC-0095, AC-AC-0105 and AC-FL-0000. See results in Table 2-30. The headwater area of Fieldlark Branch (AC-FL-0010) also shows high loadings from the intersection of the Beltway and Franconia-Springfield Parkway.

Table 2-30 - Mainstem 7 Water Quality Modeling Results

Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-AC-0070	7.20	0.93	0.25
AC-AC-0075	2.96	0.43	0.34
AC-AC-0080	7.09	1.12	0.55
AC-AC-0085	9.08	1.16	0.26
AC-AC-0090	9.55	1.49	0.23
AC-AC-0095	9.33	1.30	0.25
AC-AC-0100	9.02	1.18	0.22
AC-AC-0105	10.79	1.51	0.28
AC-AC-0110	8.02	1.05	0.20
AC-AC-0115	4.99	0.83	0.09
AC-AC-0120	4.84	0.81	0.09
AC-AC-0125	6.60	1.09	0.13
AC-AC-0130	6.38	1.03	0.12
AC-FL-0000	10.66	1.49	0.26
AC-FL-0005	7.07	1.07	0.16
AC-FL-0010	11.74	1.91	0.28

2.16 Mainstem 8

2.16.1 General Characteristics

Mainstem 8 flows in a southeasterly direction starting at the north side of Fort Belvoir U.S. Army Reservation. This tributary has a drainage area of 3,233 acres.

2.16.2 Field Reconnaissance

There were four neighborhoods assessed by field crews in the Mainstem 8 WMA. No Hotspot Site Investigations were conducted. The results of the neighborhood assessments are discussed in more detail below.

Inlet Cove is a community of attached single-family homes on one-eighth-acre lots. Lawns had approximately 80 percent impervious cover, due in part to permeable pavers on some sidewalks and driveways. Grass cover was approximately 15 percent, 5 percent landscaping and 2 percent tree cover. Sidewalks were present with clean and dry curbs and gutters. Storm drain inlets were not stenciled, but were free of obstruction.

Terra Estates is made up of detached single-family homes. The one-quarter-acre lawns are approximately 40 percent impervious cover, 45 percent grass cover, 15 percent landscaping and 35 percent tree cover. Sidewalks were present with clean and dry curbs and gutters. Storm drain inlets were not stenciled but were free of obstruction.

Springfield Oaks is a multifamily development. Lawn areas were approximately 65 percent impervious cover, 30 percent grass cover, 5 percent landscaping and 10 percent tree cover. Sidewalks were present with clean and dry curbs and gutters. Storm drain inlets were not stenciled but were free of obstruction.

Pohick Estates is a single-family detached neighborhood located at Pohick Road and Cullum Street. Lawns were approximately 40 percent impervious, 50 percent grass cover, 5 percent landscaping, and 35 percent tree cover. Sidewalks were present with organic matter accumulating in the curbs and gutters. Storm drain inlets were stenciled and clean.

2.16.3 Land Use

The Mainstem 8 WMA is characterized primarily by open space, parks and recreational areas with 47 percent of the WMA area developed as such. Another 13 percent of the WMA consists of golf course, and 12 percent is in institutional use. See Map 2-31, attached, for details.

Future land use is projected to change in the open space, estate residential, low-density residential and medium-density residential land use categories. Losses in the open space (-44 acres) and estate residential (-21 acres) land uses will be met primarily with gains in low-density residential (40 acres) and medium-density residential (13 acres) categories. A summary of the land use within the WMA is shown in Table 2-31.

Table 2-31 - Mainstem 8 Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	1,516	47	1,473	46	-43	-3
Golf Course	407	13	407	13	0	0
Estate Residential	23	1	2	0	-21	-91
Low-Density Residential	49	2	89	3	40	82
Medium-Density Residential	73	2	86	3	13	18
High-Density Residential	193	6	201	6	8	4
Low-Intensity Commercial	2	<1	2	<1	0	0
High-Intensity Commercial	3	<1	6	<1	3	100
Industrial	310	10	310	10	0	0
Institutional	396	12	396	12	0	0
Transportation	205	6	205	6	0	0
Water	56	2	56	2	0	0
Total	3,233	100	3,233	100	0	0

Due to rounding error, total percentages may be slightly greater or lesser than 100.

Total impervious area for the WMA is approximately 304 acres, or 9 percent of the total WMA area of 3,233 acres.

2.16.4 Stormwater Infrastructure

Stormwater Management

County records indicate that there are 30 stormwater management facilities within the Mainstem 8 WMA. These facilities provide control for 5 percent of the WMA. Four percent of the total area has quantity control only, 1 percent receives only quality control and the remaining portion has both quantity and quality control. Stormwater infrastructure is shown on Map 2-32, attached.

2.16.5 Stream Condition

The stream reaches in Mainstem 8 are all within the property of Fort Belvoir and were not assessed as part of this project.

2.16.6 WMA Modeling

Fort Belvoir makes up almost all of this WMA. See Table 2-32 for results.

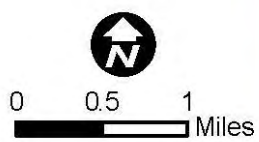
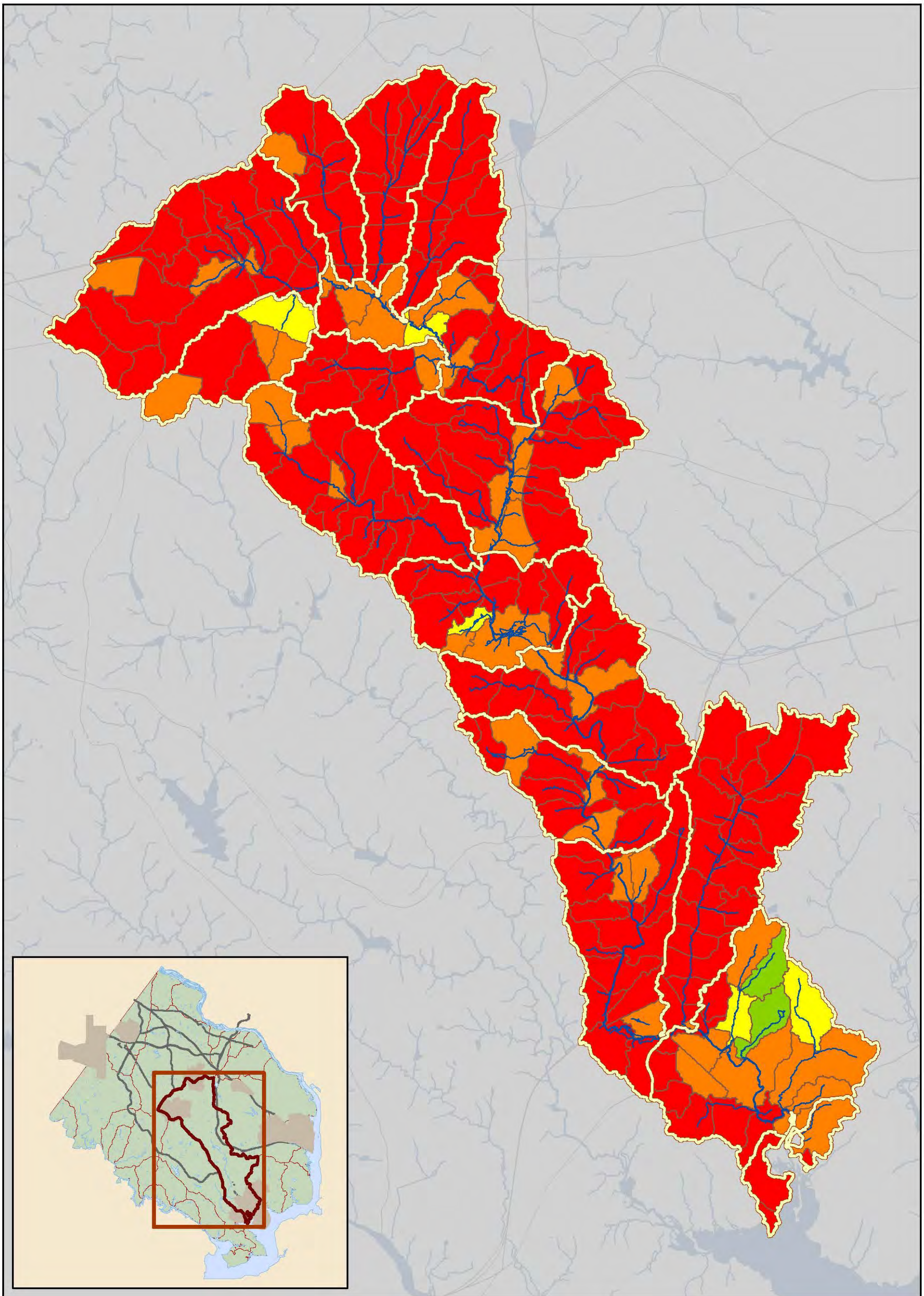
Table 2-32 - Mainstem 8 Water Quality Modeling Results





Subwatershed	Pollutant Loading		
	TN lb/ac/yr	TP lb/ac/yr	TSS t/ac/yr
AC-AC-0000	4.39	0.73	0.10
AC-AC-0005	5.02	0.84	0.09
AC-AC-0010	5.23	0.86	0.42
AC-AC-0015	6.08	1.01	0.18
AC-AC-0020	6.20	1.03	1.32
AC-AC-0025	6.64	1.08	0.13
AC-AC-0030	4.85	0.81	0.09
AC-AC-0035	1.29	0.36	0.09
AC-AC-0040	4.98	0.83	0.09
AC-AC-0045	7.47	1.14	0.16
AC-AC-0050	7.74	1.02	0.21
AC-AC-0055	4.94	0.82	0.09
AC-AC-0060	5.59	0.87	0.12
AC-AC-0065	9.01	1.34	0.19
AC-KR-0000	2.11	0.46	0.10
AC-KR-0005	4.61	0.75	0.12
AC-KR-0010	0.71	0.28	0.09
AC-MR-0000	5.11	0.85	0.10
AC-MR-0005	2.27	0.47	0.08






2.17 Potomac

This WMA is entirely within the boundaries of Fort Belvoir and was not assessed as part of this project.

APPENDIX

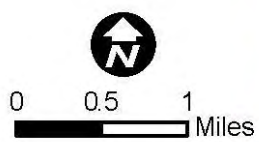
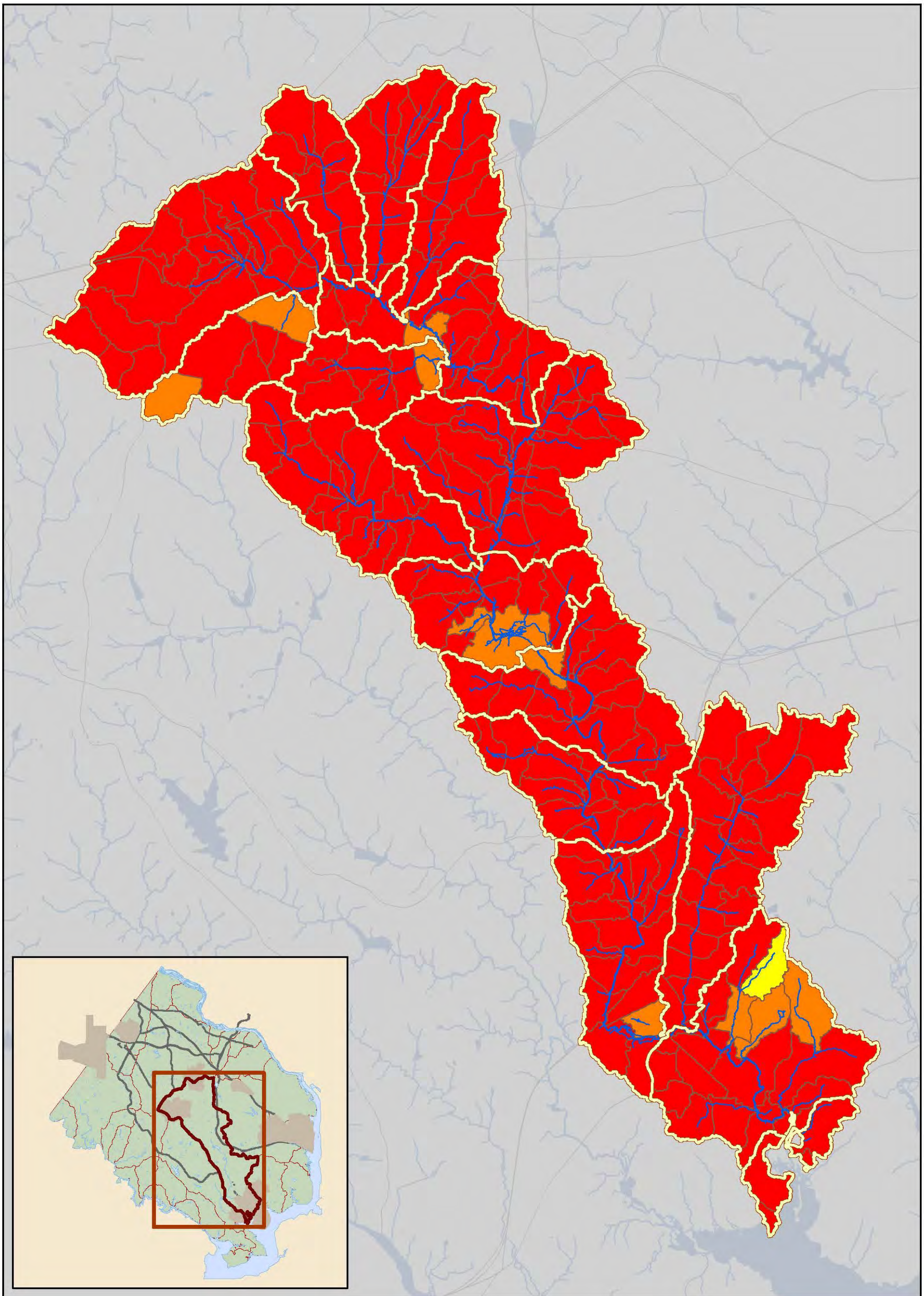






-  Watershed Boundary
-  Subwatershed Boundary
-  Lakes and Ponds
-  Streams

- Existing Total Nitrogen Load**
-  No Data
 -  Low
 -  Moderate
 -  High
 -  Very High

Map 2-1

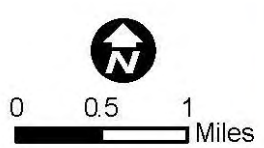
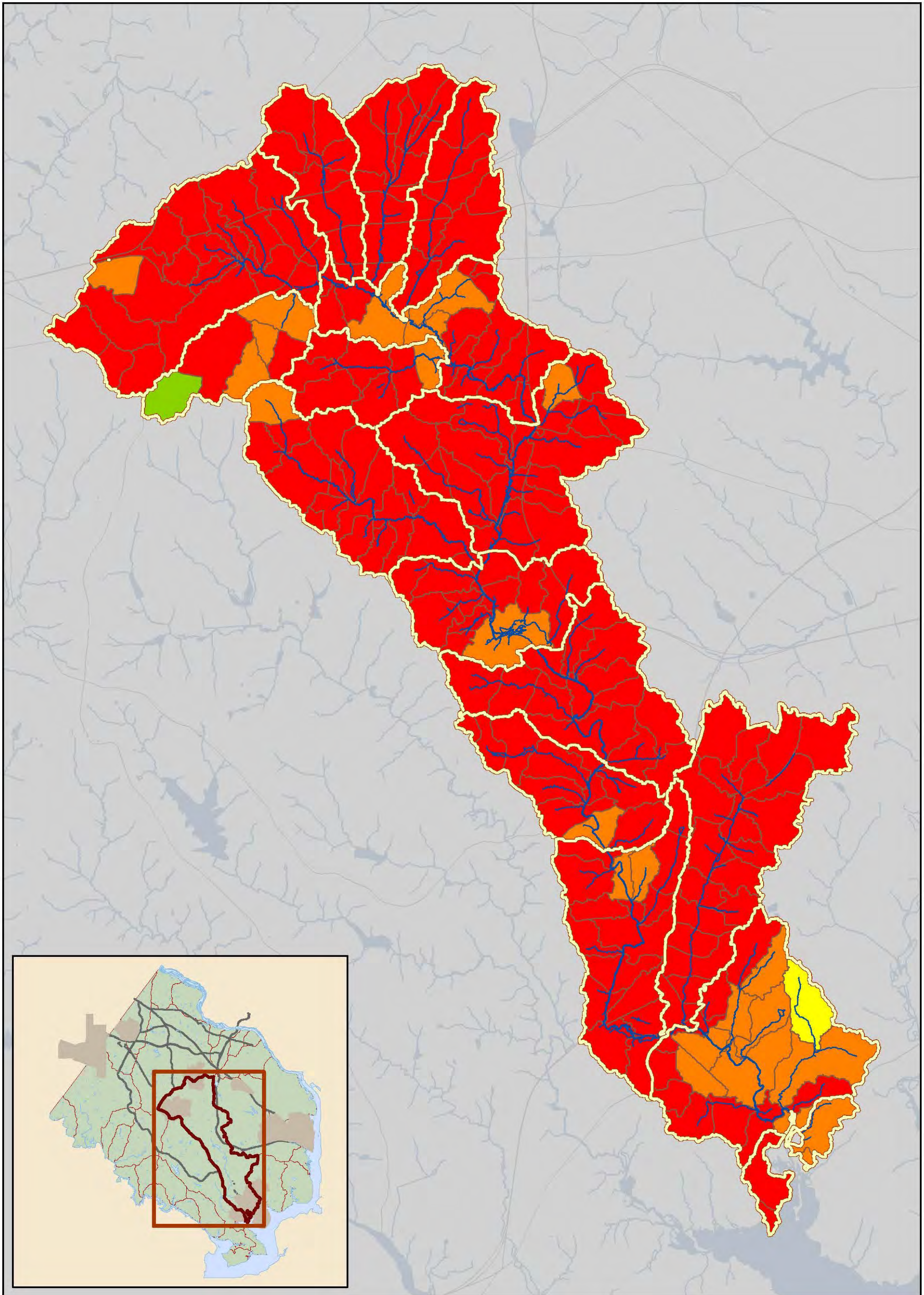
TN Loading Map
Accotink Creek Watershed












-  Watershed Boundary
-  Subwatershed Boundary
-  Lakes and Ponds
-  Streams

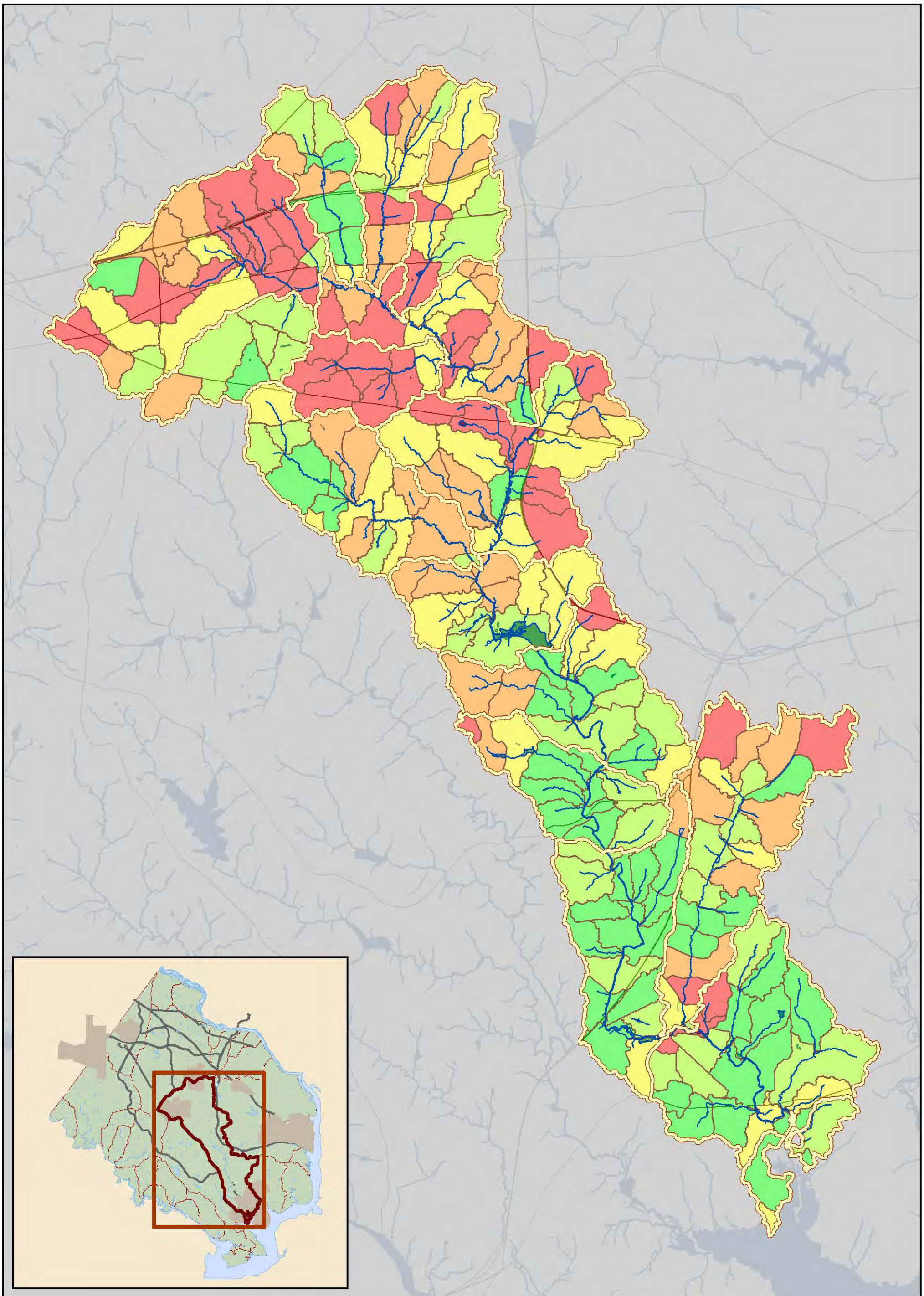
Existing Total Phosphorus Load

-  No Data
-  High
-  Low
-  Very High
-  Moderate



-  Watershed Boundary
-  Subwatershed Boundary
-  Lakes and Ponds
-  Streams

- Existing Total Suspended Solids Load**
-  No Data
 -  Low
 -  Moderate
 -  High
 -  Very High



Rank (from 1 to 205)

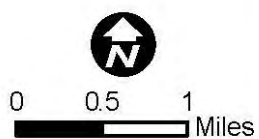
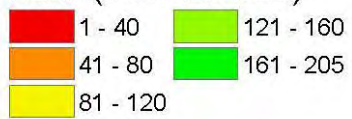
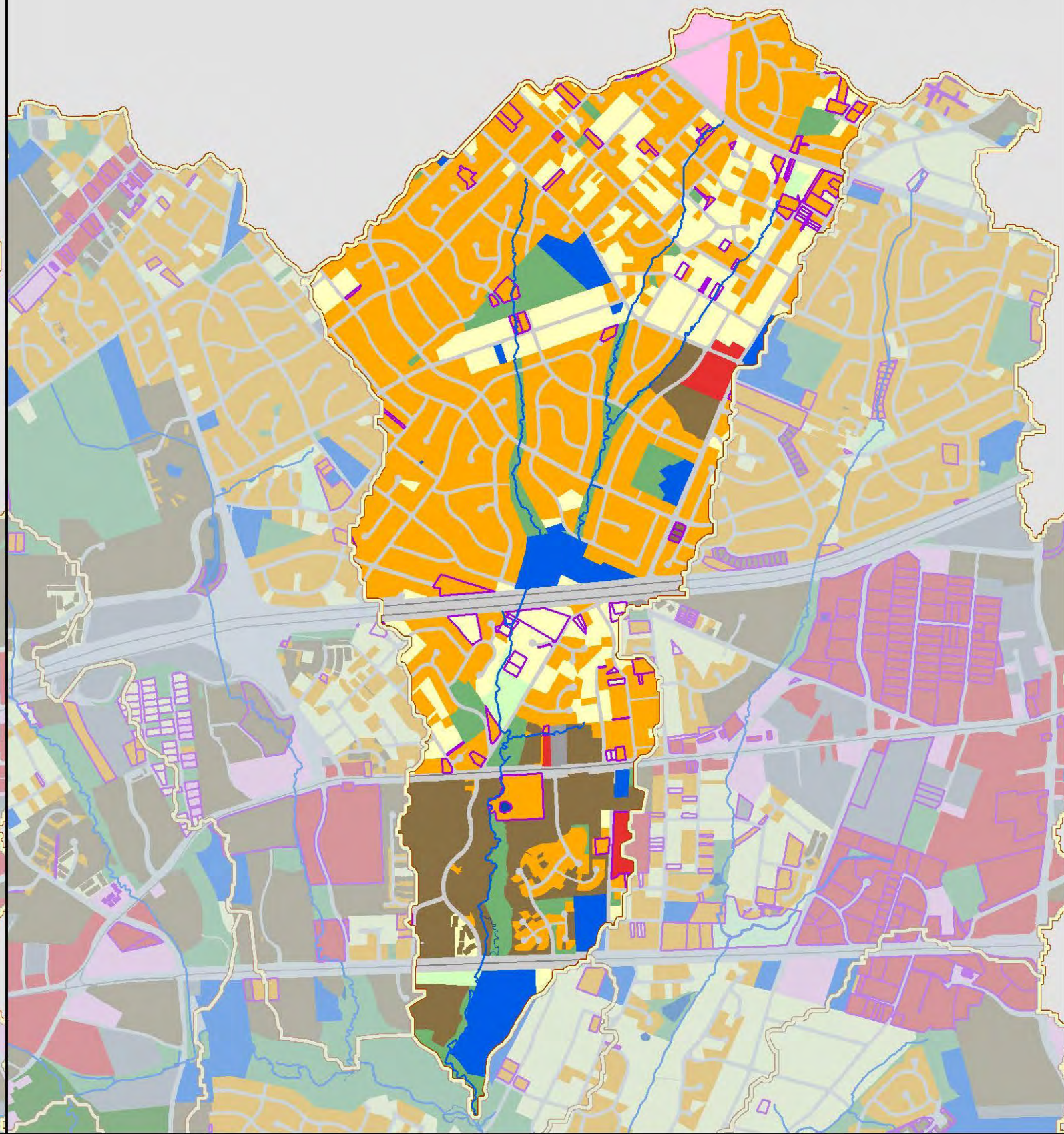
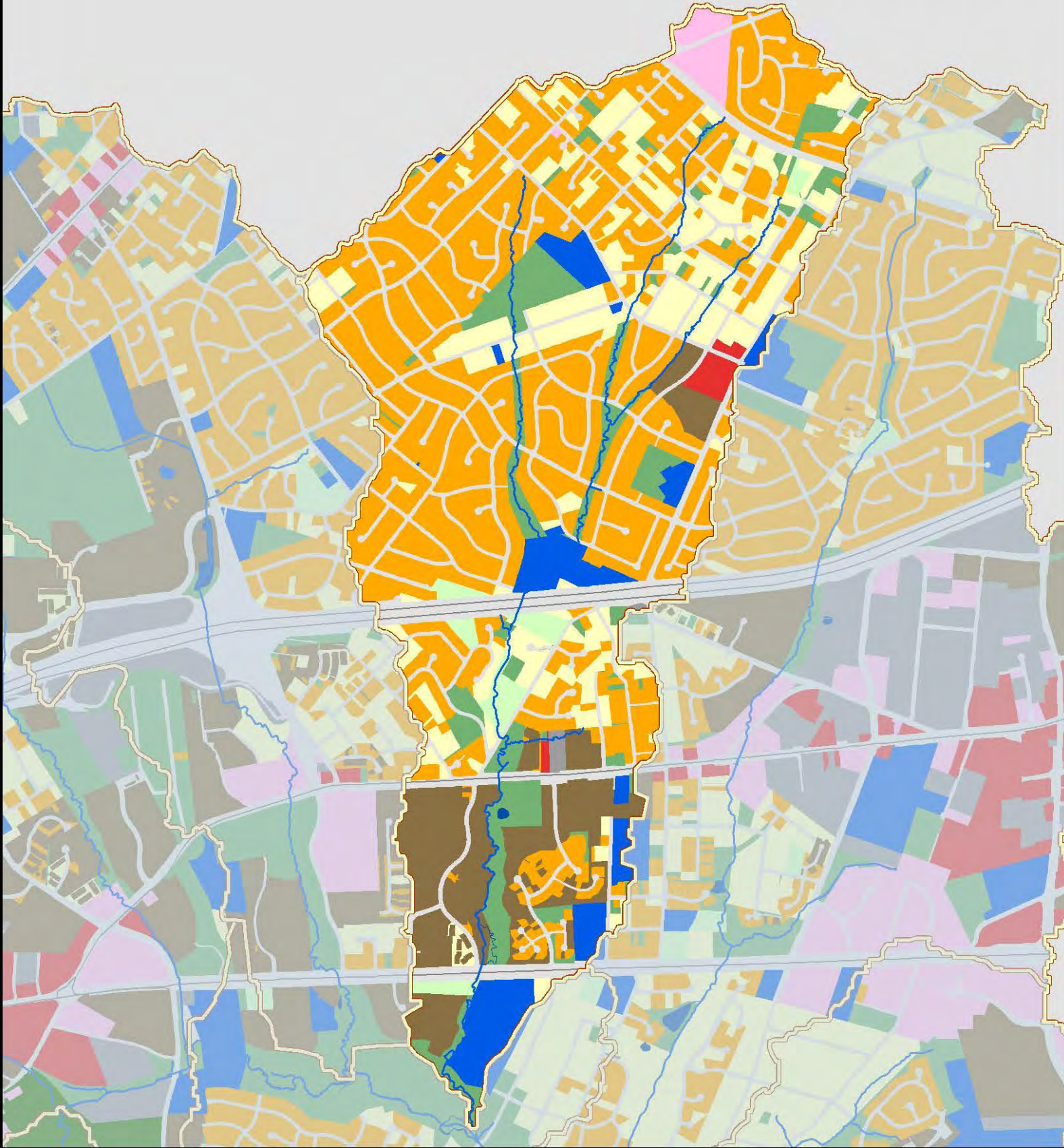


Figure 2-4
Subwatershed Ranking
 Accotink Creek Watershed

Existing Land Use

Future Land Use

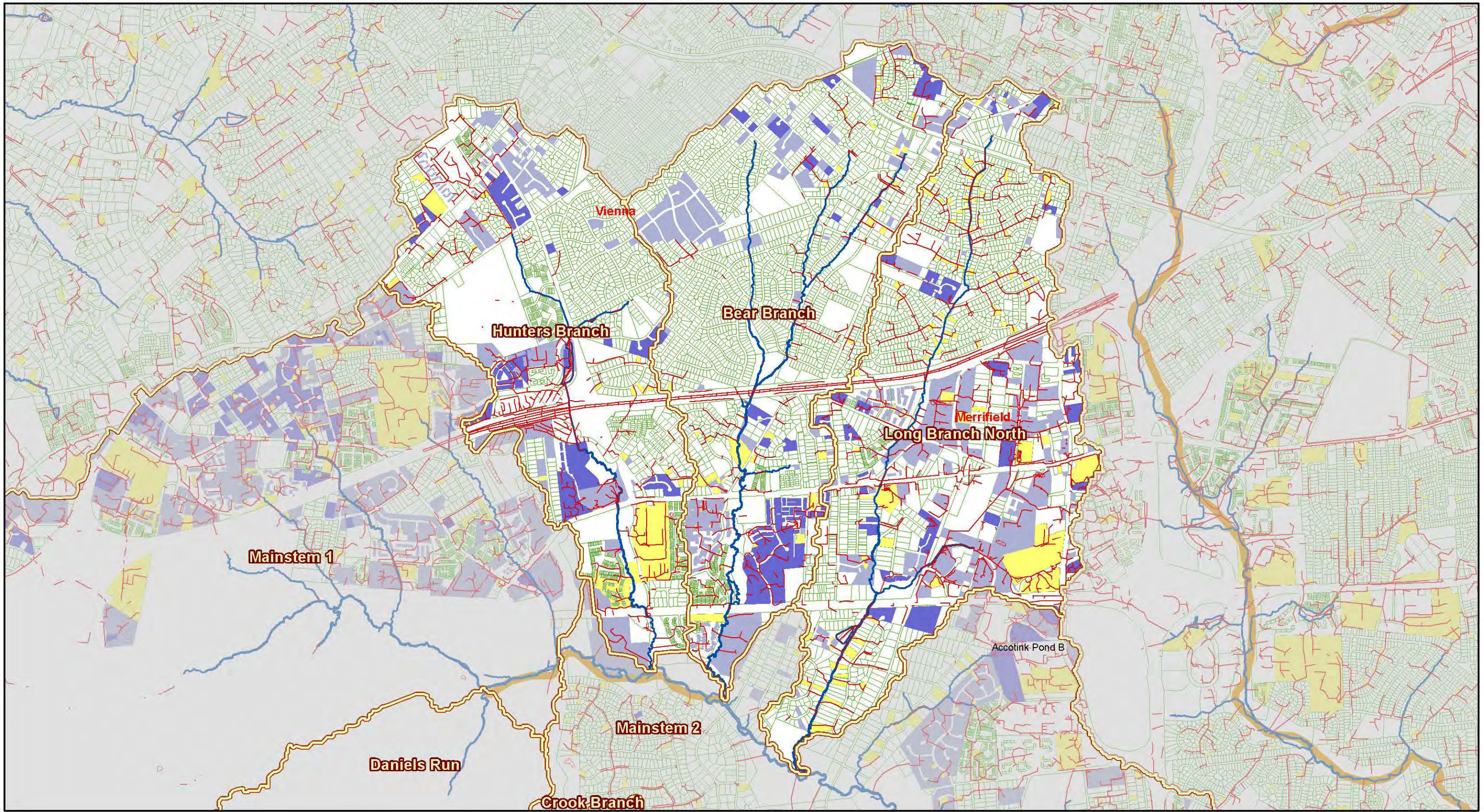


Land Use

- | | | | |
|--------------------------|---------------------------|----------------------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space |
| Golf Course | Industrial | Low Intensity Commercial | Transportation |
| High Density Residential | Institutional | Medium Density Residential | Water |
| | | | WMA Boundary |
| | | | Change in Land Use |

Map 2-5

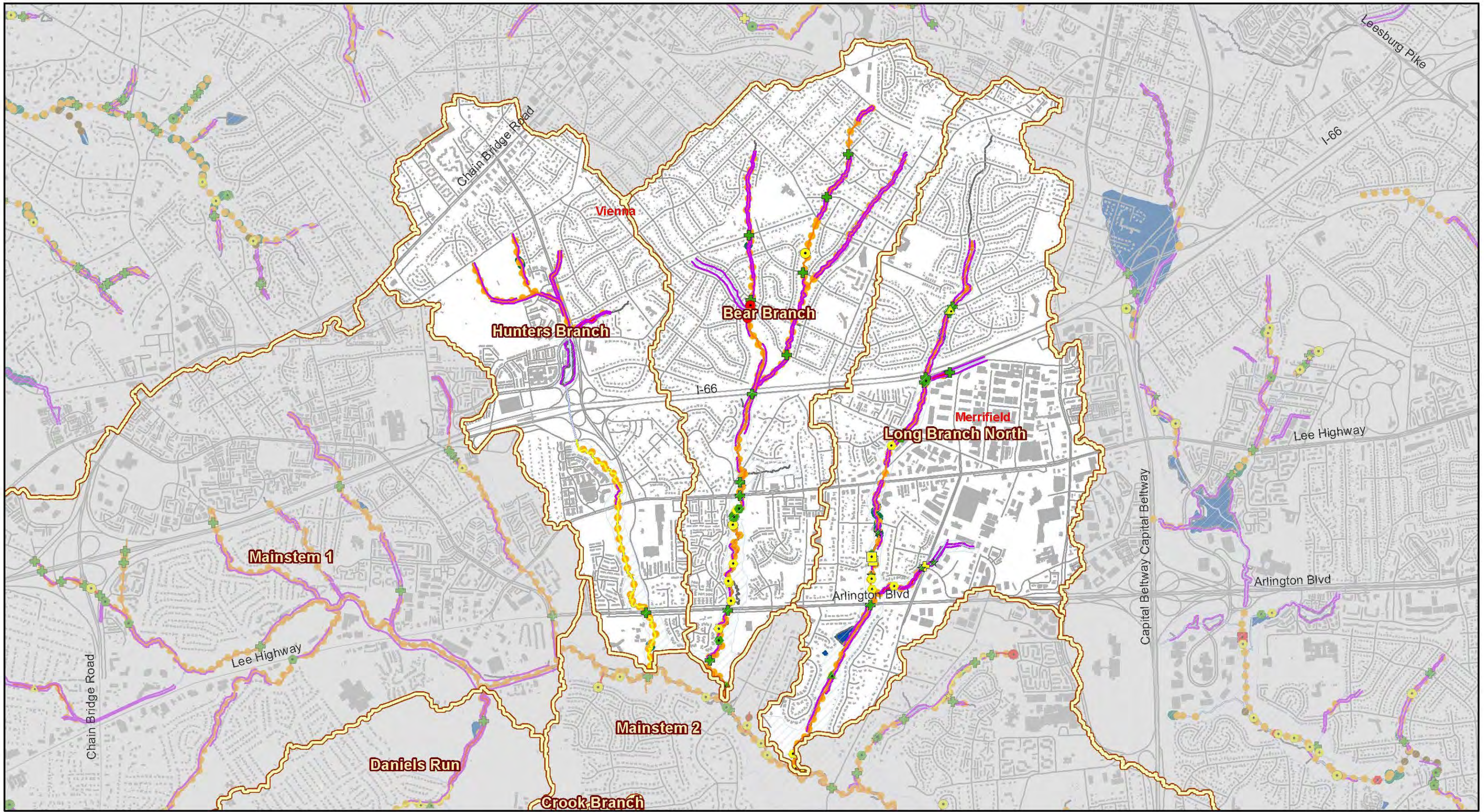
Land Use Map
Bear Branch



0 0.25 0.5 Miles

- | | | | |
|---------------------|-----------------------|----------------------|---|
| WMA Boundary | Regional Ponds | Subarea | MSMD Flooding/Drainage Complaints |
| 303d Listed Streams | Constructed | Quantity and Quality | STMDRN; SWM/BMP |
| Stormnet Facilities | Planned | Quantity | Public Identified Problem Areas 2003 - 2006 |
| Stormnet Arcs | | | |
| Parcels | | | |

Map 2-6
Stormwater Infrastructure Map
 Hunters Branch
 Bear Branch
 Long Branch North



0 0.25 0.5 Miles

Obstruction Impact	Dump Site Impact	Pipe Impact	Ditch Impact	Utility Impact	Crossing Impact	Head Cut Height
● Minor to Moderate	★ Minor to Moderate	● Minor to Moderate	■ Minor to Moderate	● Minor to Moderate	✚ Minor to Moderate	▲ 0.5' - 1.0'
● Moderate to Severe	★ Moderate to Severe	● Moderate to Severe	■ Moderate to Severe	● Moderate to Severe	✚ Moderate to Severe	▲ 1' - 2'
● Severe to Extreme	★ Severe to Extreme	● Severe to Extreme	■ Severe to Extreme	● Severe to Extreme	✚ Severe to Extreme	▲ >2'
Habitat Rating	CEM Category		Resource Protection Area (RPA)		Lakes and Ponds	Deficient Buffer
— Excellent	● CEM 2 - Incising	▨ RPA	■ Lakes and Ponds	— Deficient Buffer		
— Fair	● CEM 3 - Widening	▨ WMA Boundary	■ Erosion			
— Very Poor						
— Good						
— Poor						
— Unassessed						

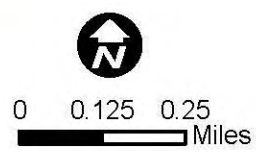
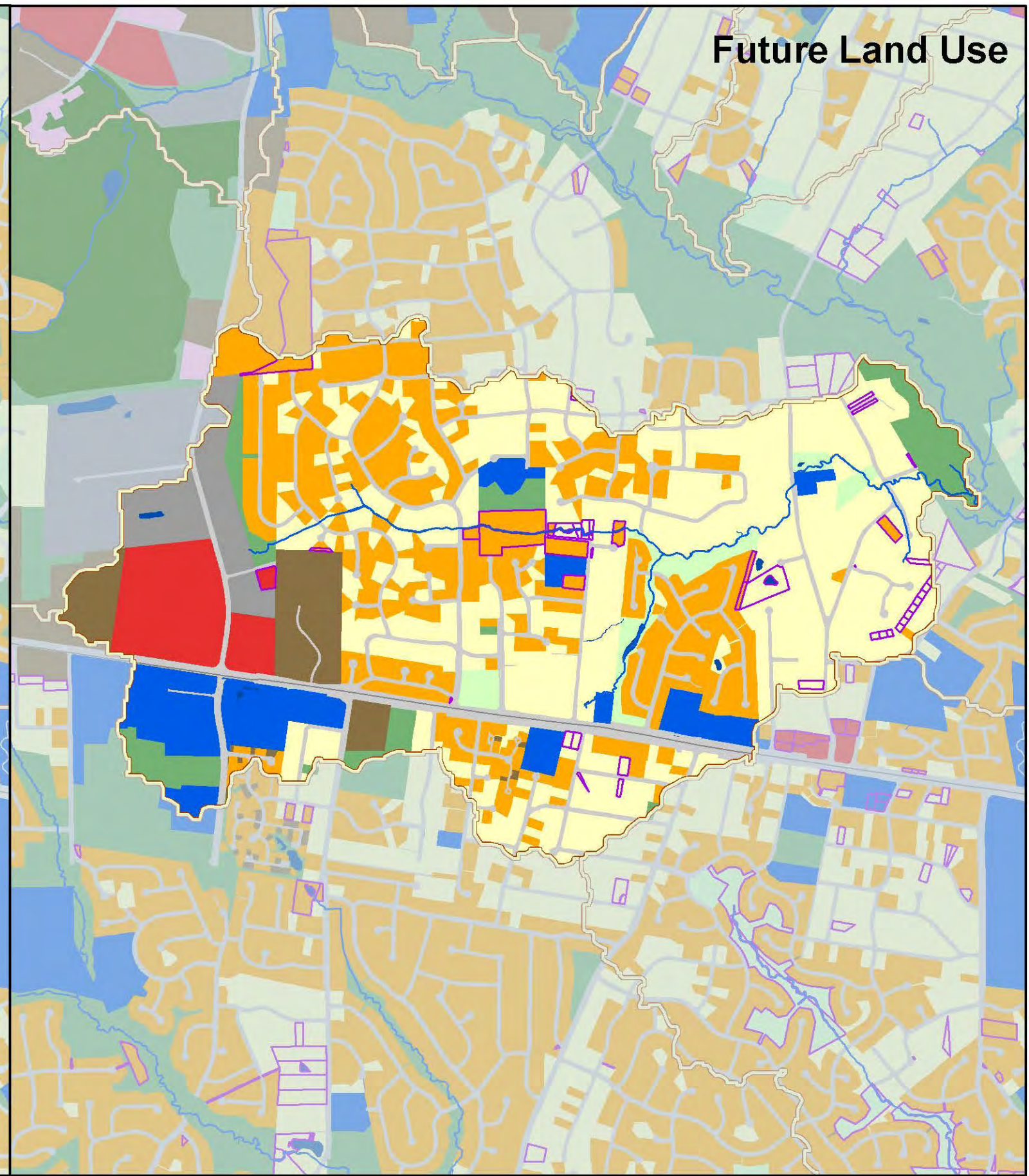
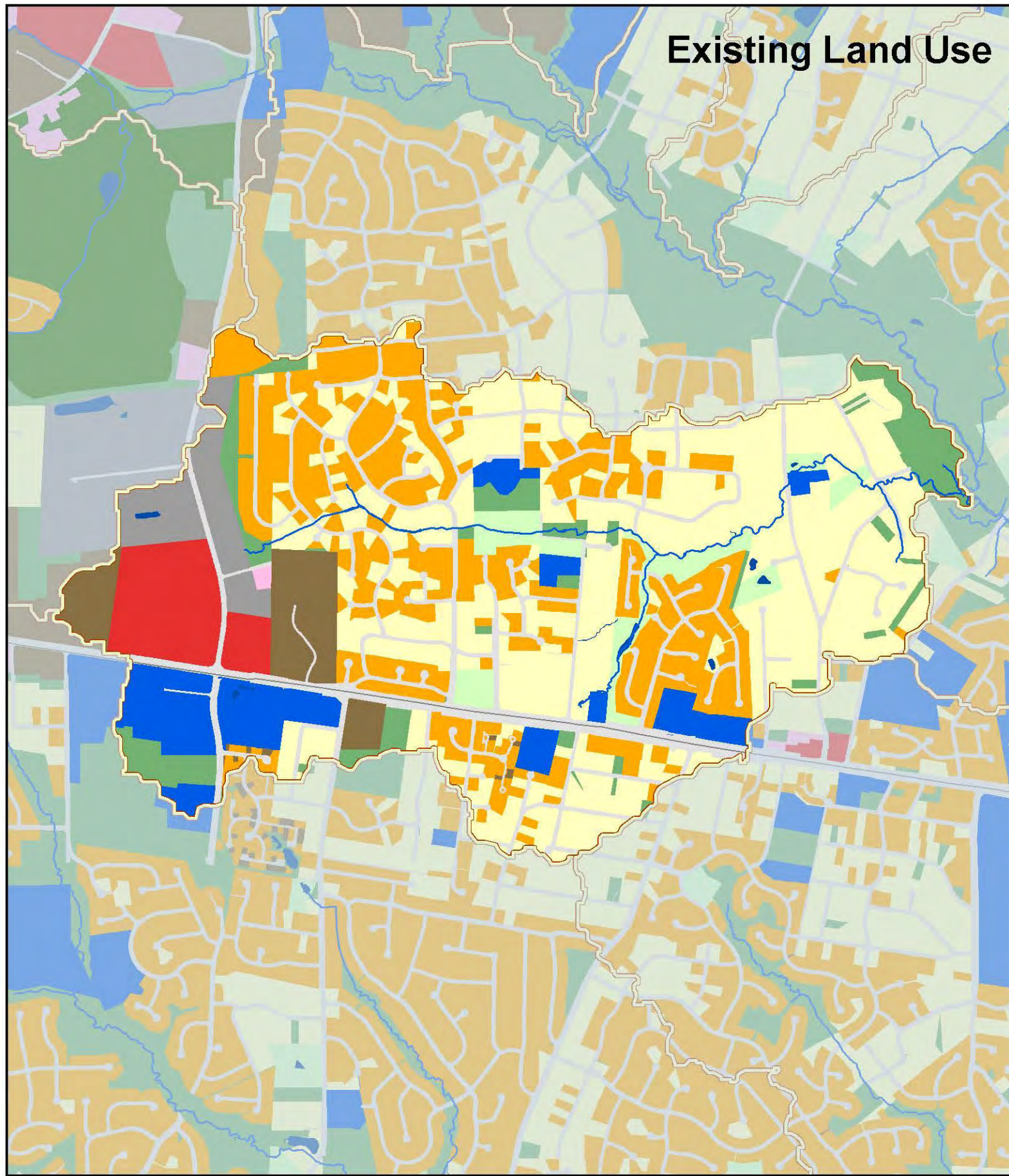
Map 2-7

Stream Condition Map

Hunters Branch
Bear Branch
Long Branch North

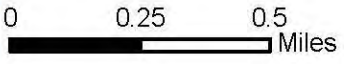
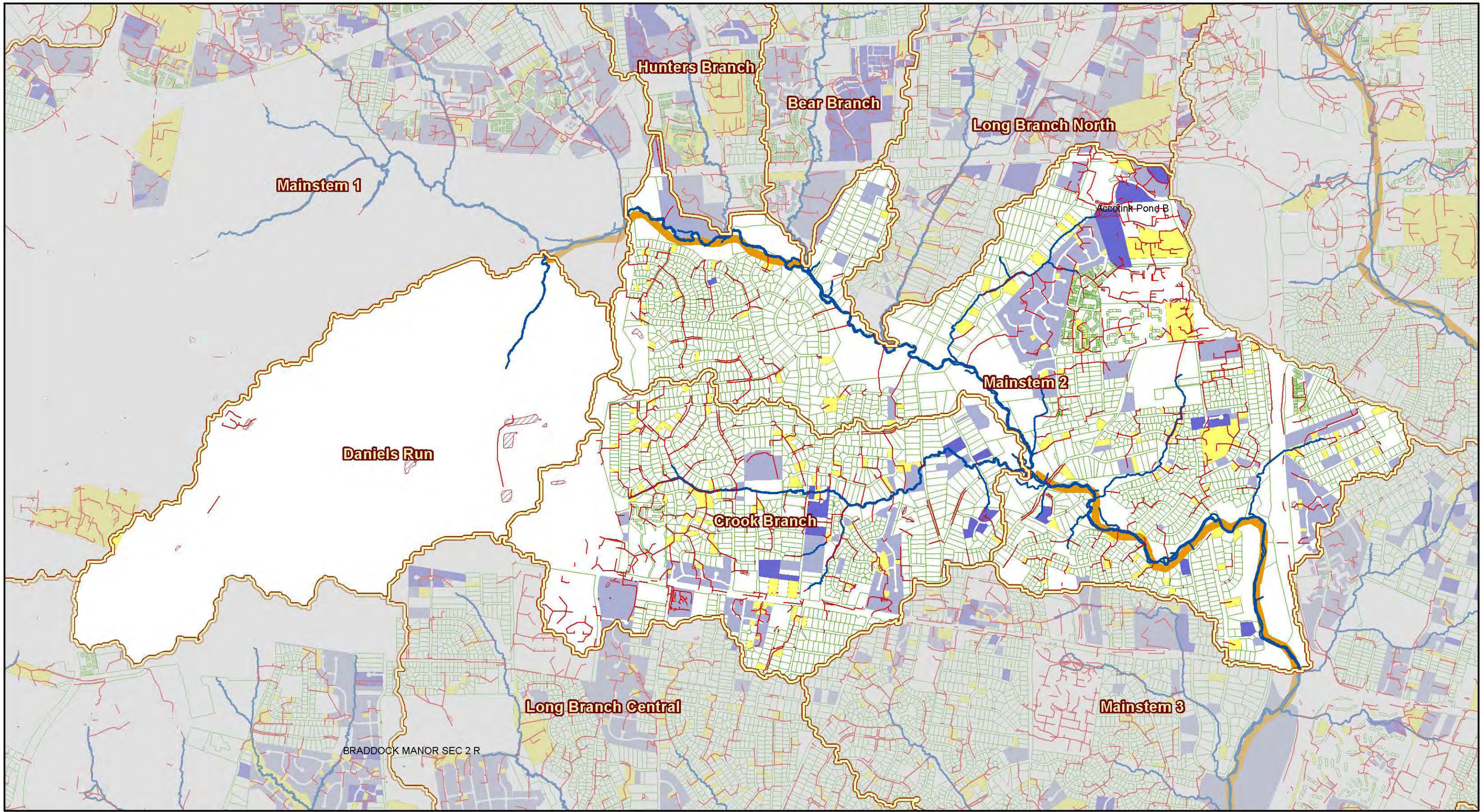
Existing Land Use

Future Land Use



Land Use

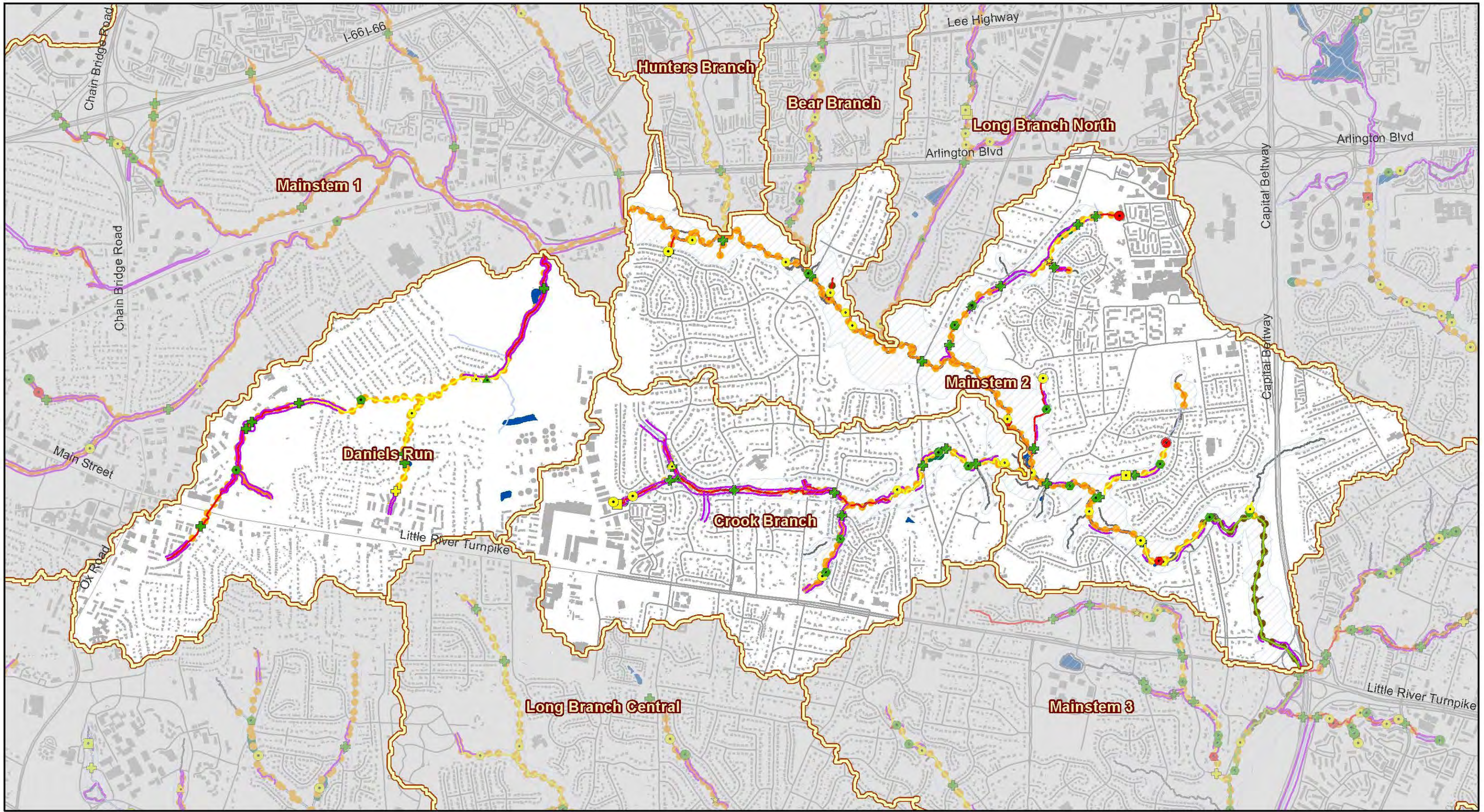

- | | | | |
|--------------------------|---------------------------|----------------------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space |
| Golf Course | Industrial | Low Intensity Commercial | Transportation |
| High Density Residential | Institutional | Medium Density Residential | Water |
| | | | WMA Boundary |
| | | | Change in Land Use |




- | | | | |
|---------------------|-----------------------|----------------------|---|
| WMA Boundary | Regional Ponds | Subarea | MSMD Flooding/Drainage Complaints |
| 303d Listed Streams | Constructed | Quantity and Quality | STMDRN; SWM/BMP |
| Stormnet Facilities | Planned | Quantity | Public Identified Problem Areas 2003 - 2006 |
| Stormnet Arcs | | | |
| Parcels | | | |

Map 2-9
Stormwater Infrastructure Map

Daniels Run
 Crook Branch
 Mainstem 2

0 0.25 0.5 Miles

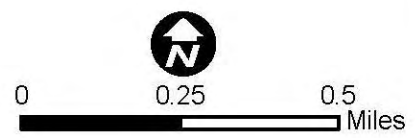
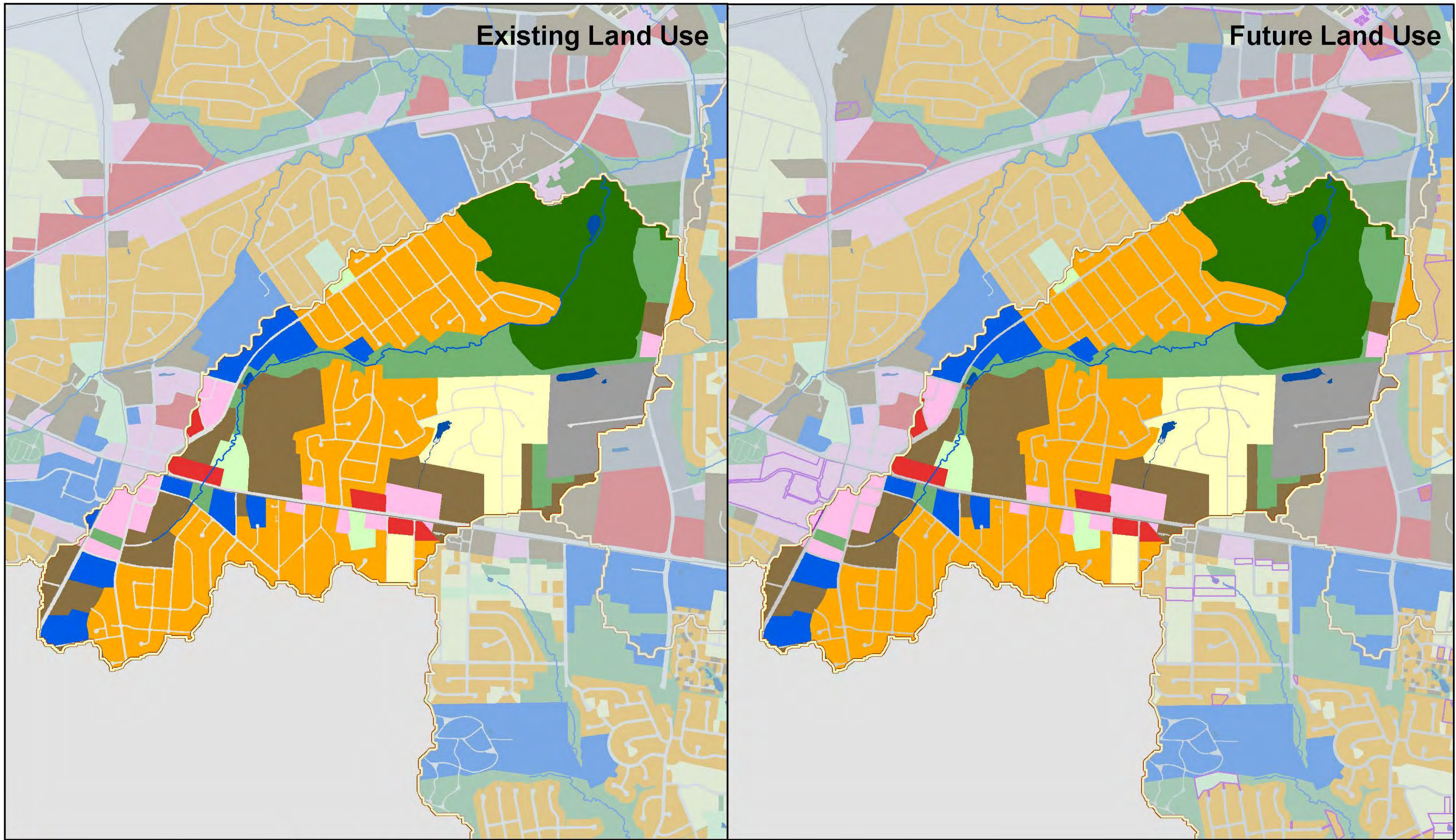


<p>Obstruction Impact</p> <ul style="list-style-type: none"> Minor to Moderate Moderate to Severe Severe to Extreme 	<p>Dump Site Impact</p> <ul style="list-style-type: none"> Minor to Moderate Moderate to Severe Severe to Extreme 	<p>Pipe Impact</p> <ul style="list-style-type: none"> Minor to Moderate Moderate to Severe Severe to Extreme 	<p>Ditch Impact</p> <ul style="list-style-type: none"> Minor to Moderate Moderate to Severe Severe to Extreme 	<p>Utility Impact</p> <ul style="list-style-type: none"> Minor to Moderate Moderate to Severe Severe to Extreme 	<p>Crossing Impact</p> <ul style="list-style-type: none"> Minor to Moderate Moderate to Severe Severe to Extreme 	<p>Head Cut Height</p> <ul style="list-style-type: none"> 0.5' - 1.0' 1' - 2' >2'
<p>Habitat Rating</p> <ul style="list-style-type: none"> Excellent Fair Very Poor Good Poor Unassessed 		<p>CEM Category</p> <ul style="list-style-type: none"> CEM 2 - Incising CEM 3 - Widening 		<p> Resource Protection Area (RPA)</p> <p> WMA Boundary</p>	<p> Lakes and Ponds</p> <p> Erosion</p>	<p> Deficient Buffer</p>

Map 2-10
Stream Condition Map
 Daniels Run
 Crook Branch
 Mainstem 2

Existing Land Use

Future Land Use



Land Use

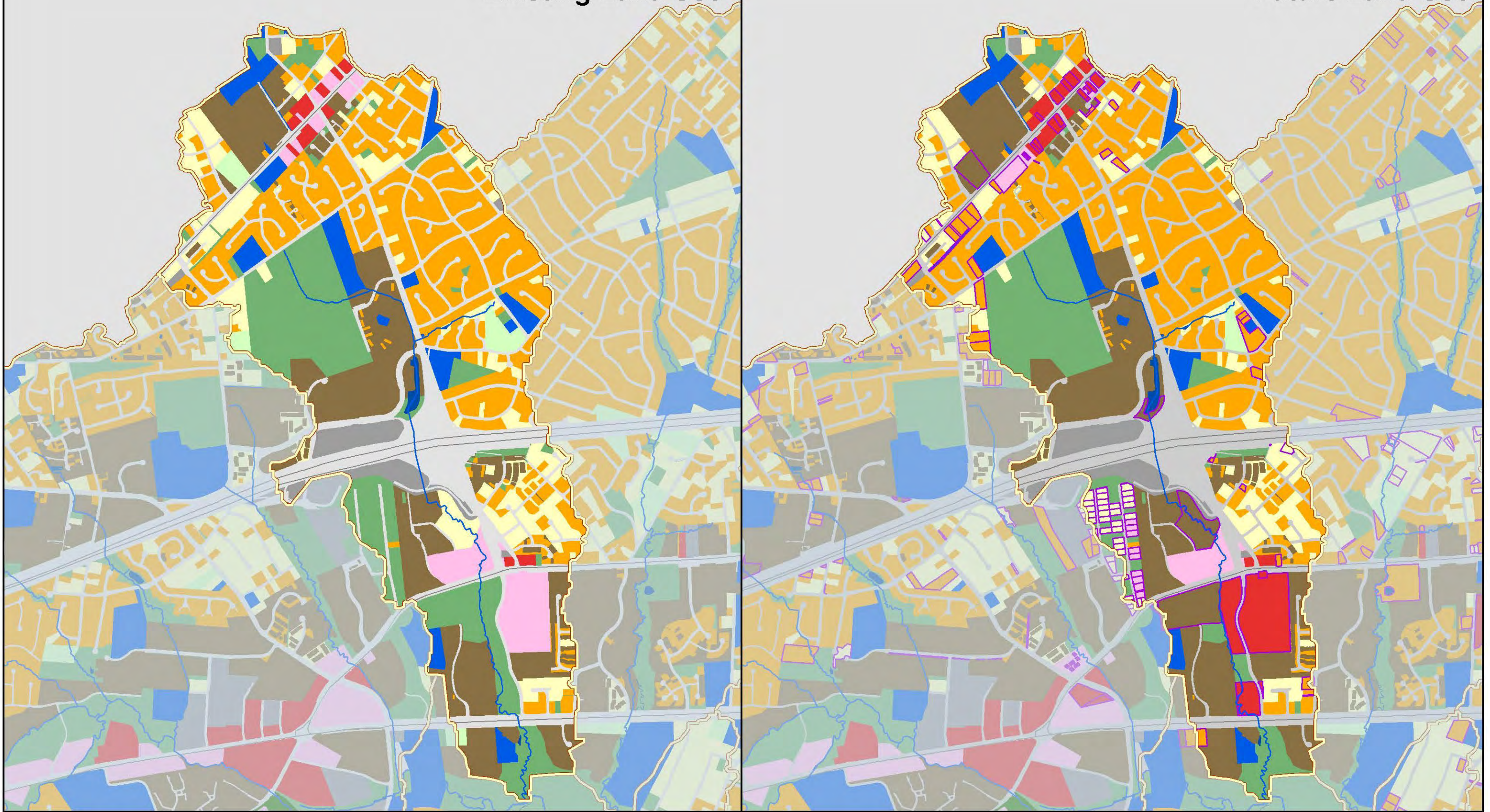
- | | | | |
|--------------------------|---------------------------|----------------------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space |
| Golf Course | Industrial | Low Intensity Commercial | Transportation |
| High Density Residential | Institutional | Medium Density Residential | Water |
| | | WMA Boundary | Change in Land Use |

Map 2-11

Land Use Map
Daniels Run

Existing Land Use

Future Land Use



Land Use

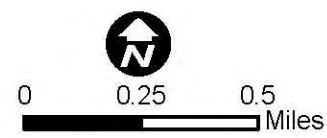
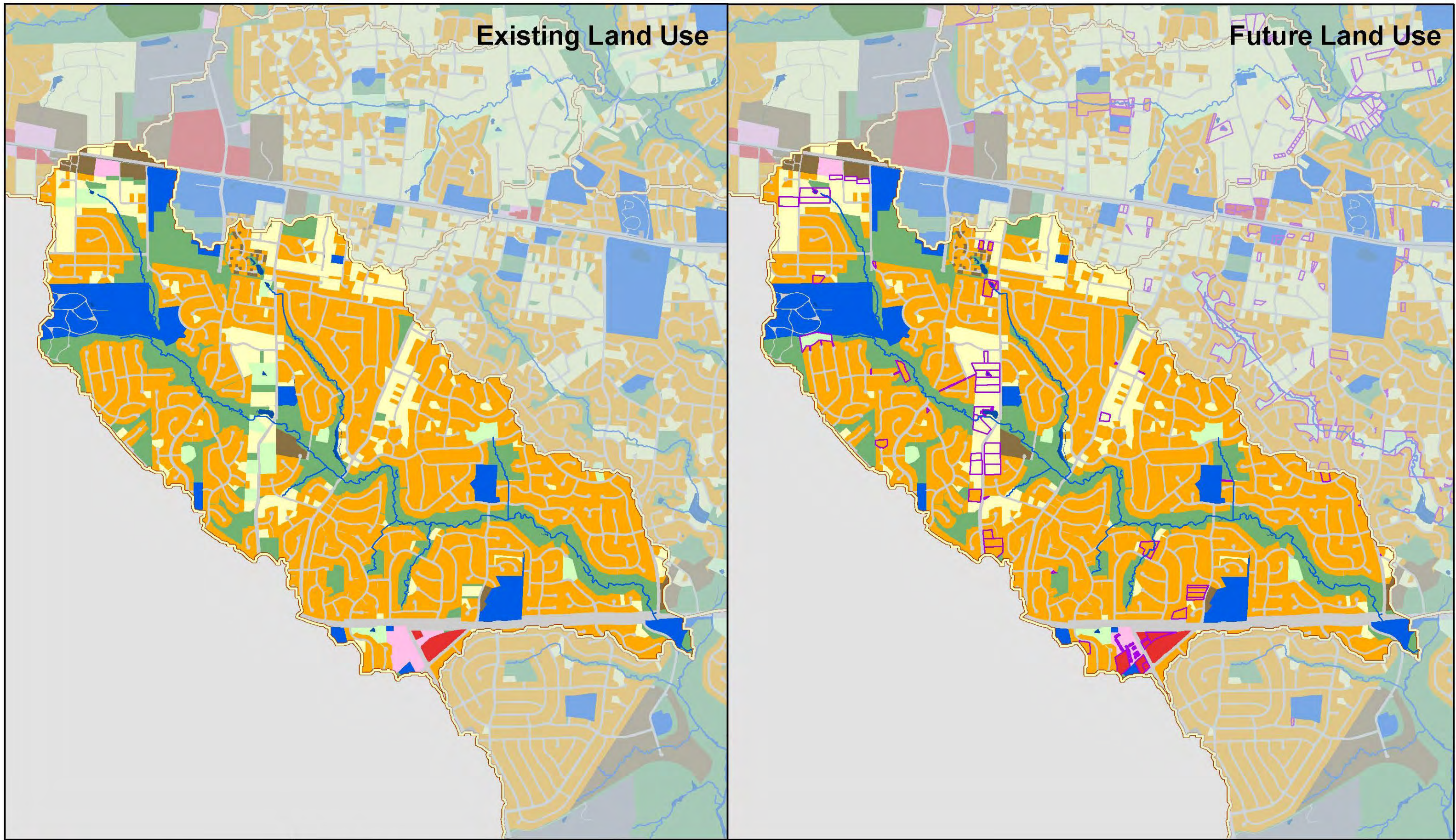
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|--------------------------|---------------------------|----------------------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space |
| Golf Course | Industrial | Low Intensity Commercial | Transportation |
| High Density Residential | Institutional | Medium Density Residential | Water |
| | | | WMA Boundary |
| | | | Change in Land Use |

Map 2-12

Land Use Map
Hunters Branch

Existing Land Use

Future Land Use

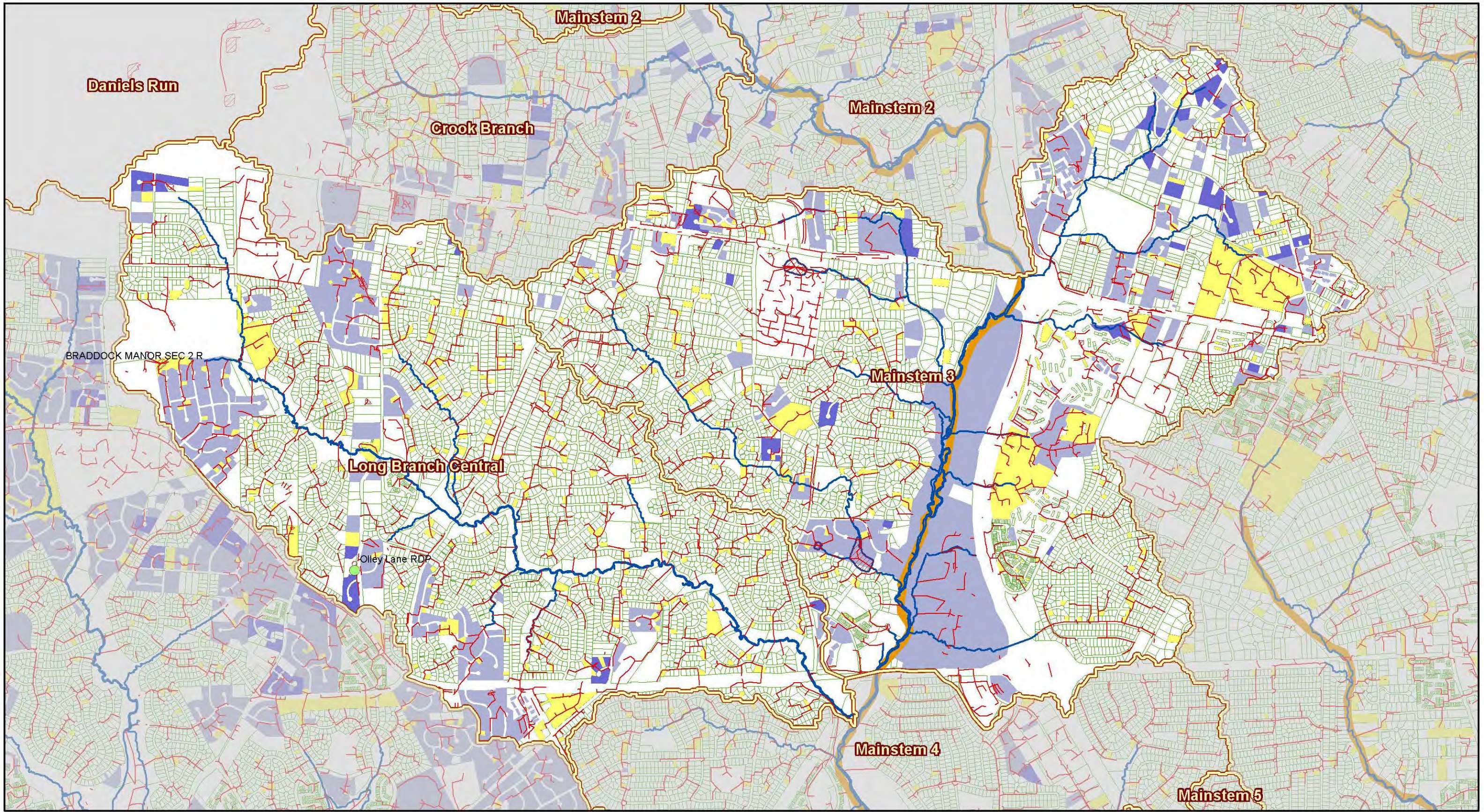


Land Use

- | | | | | |
|--------------------------|---------------------------|----------------------------|----------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space | WMA Boundary |
| Golf Course | Industrial | Low Intensity Commercial | Transportation | Change in Land Use |
| High Density Residential | Institutional | Medium Density Residential | Water | |

Map 2-13

Land Use Map
Long Branch Central



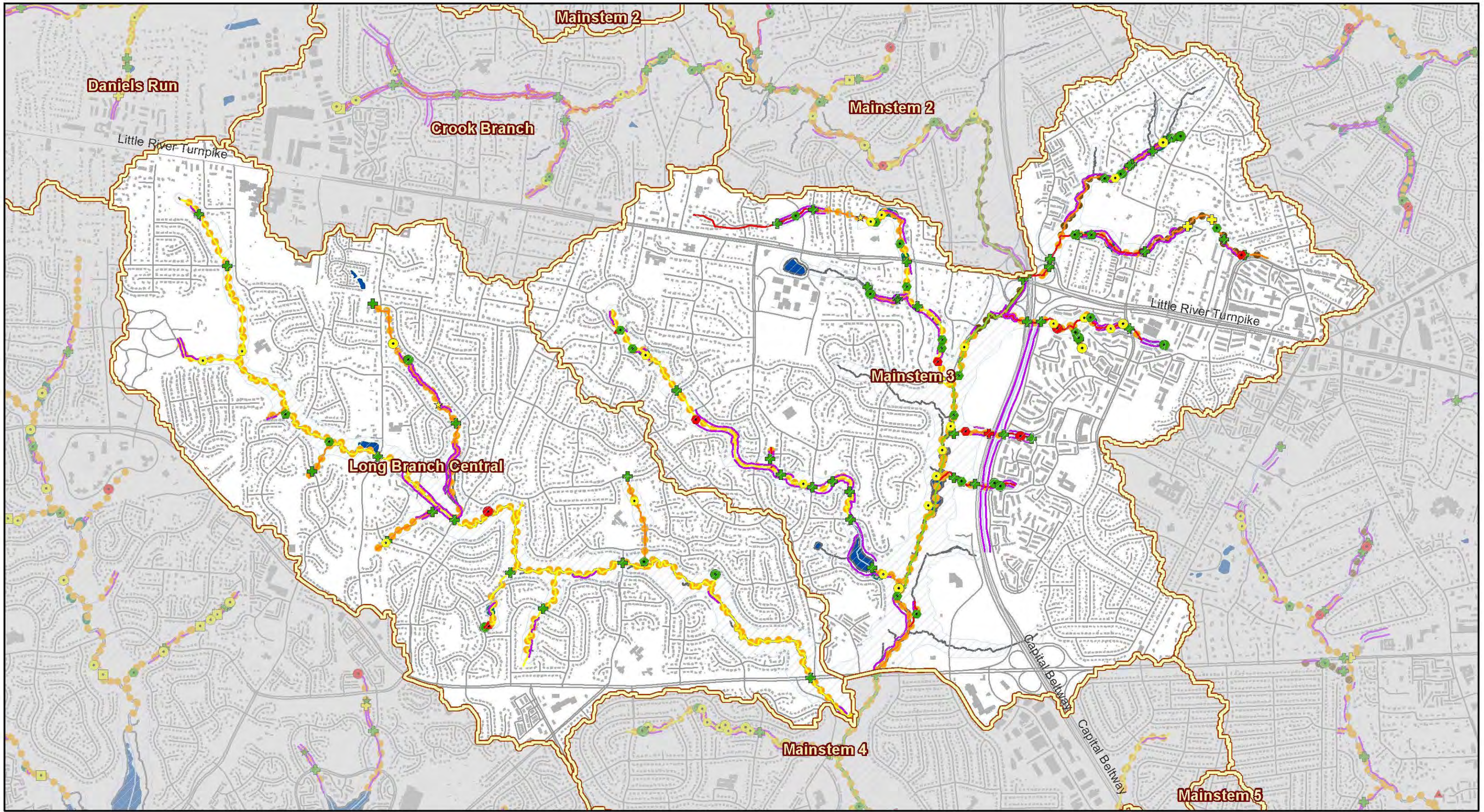
0 0.25 0.5 Miles

- | | | | |
|---------------------|-----------------------|----------------------|---|
| WMA Boundary | Regional Ponds | Subarea | MSMD Flooding/Drainage Complaints |
| 303d Listed Streams | Constructed | Quantity and Quality | STMDRN; SWM/BMP |
| Stormnet Facilities | Planned | Quantity | Public Identified Problem Areas 2003 - 2006 |
| Stormnet Arcs | | | |
| Parcels | | | |

Map 2-14

Stormwater Infrastructure Map

Long Branch Central
Mainstem 3



0 0.25 0.5 Miles

Obstruction Impact	Dump Site Impact	Pipe Impact	Ditch Impact	Utility Impact	Crossing Impact	Head Cut Height
◆ Minor to Moderate	★ Minor to Moderate	● Minor to Moderate	■ Minor to Moderate	⬠ Minor to Moderate	⊕ Minor to Moderate	▲ 0.5' - 1.0'
◇ Moderate to Severe	☆ Moderate to Severe	○ Moderate to Severe	□ Moderate to Severe	⬡ Moderate to Severe	⊕ Moderate to Severe	▲ 1' - 2'
◆ Severe to Extreme	★ Severe to Extreme	● Severe to Extreme	■ Severe to Extreme	⬠ Severe to Extreme	⊕ Severe to Extreme	▲ >2'
Habitat Rating			CEM Category			
— Excellent	— Fair	— Very Poor	● CEM 2 - Incising	□ Resource Protection Area (RPA)	■ Lakes and Ponds	— Deficient Buffer
— Good	— Poor	— Unassessed	○ CEM 3 - Widening	□ WMA Boundary	■ Erosion	

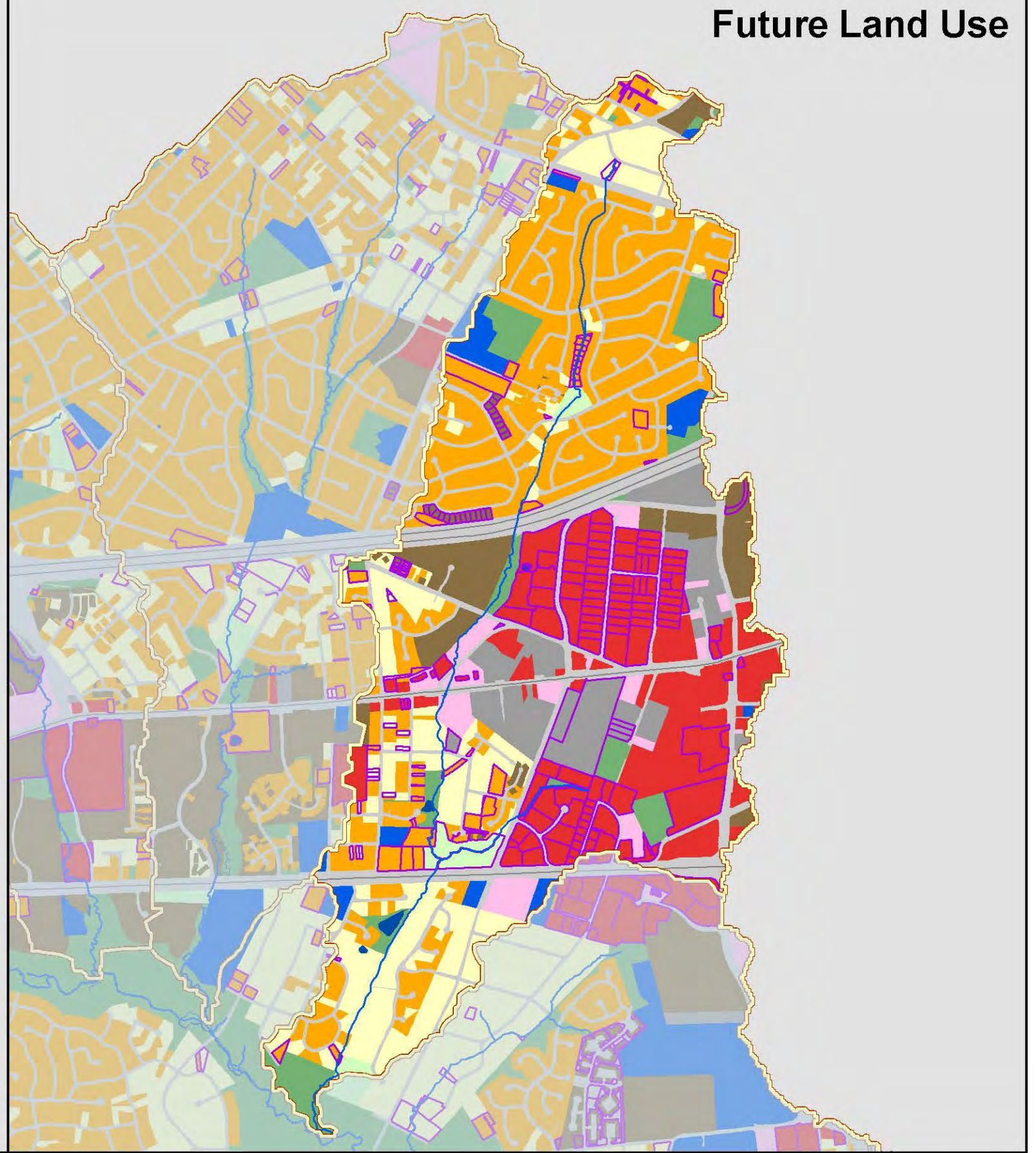
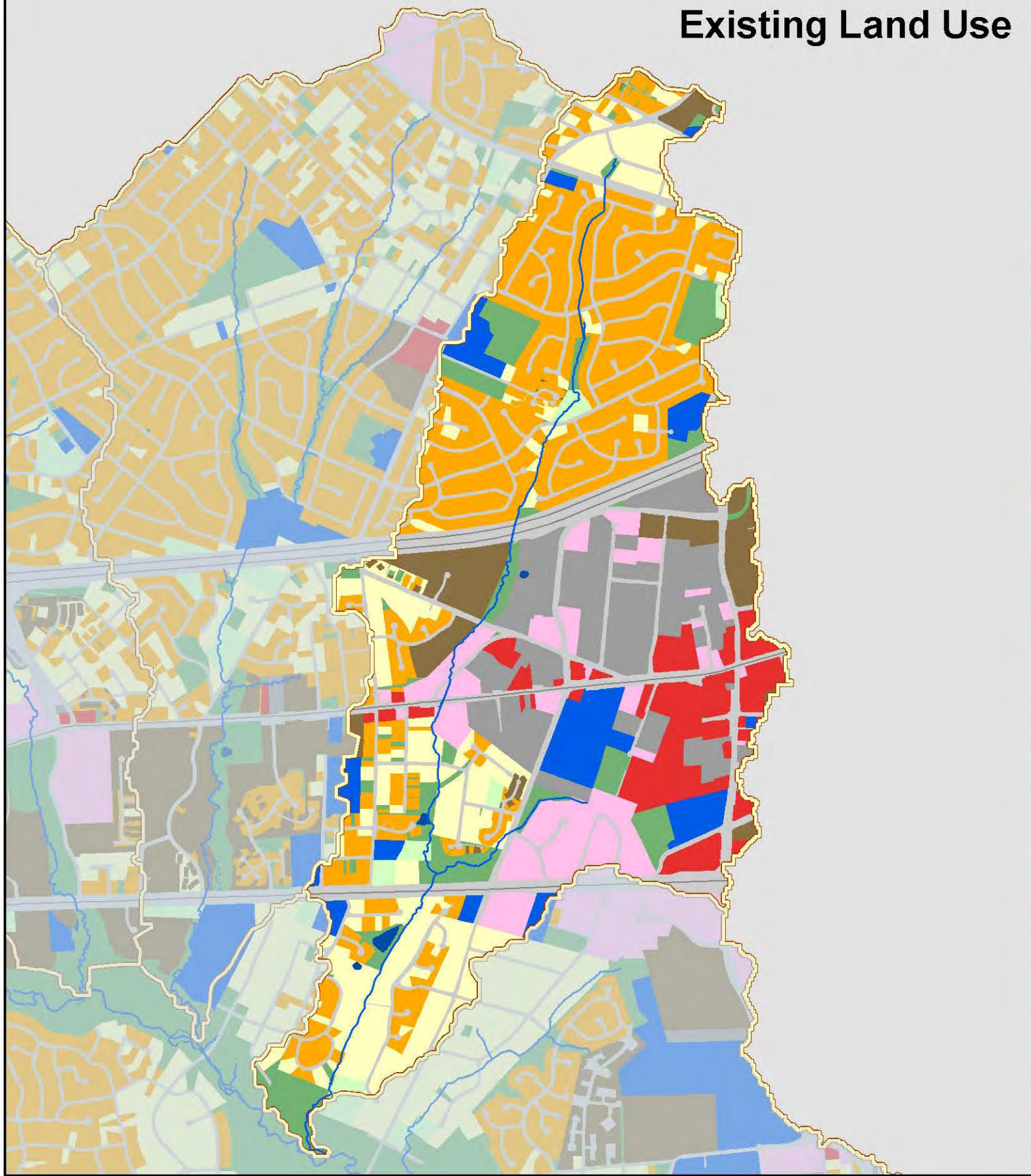
Map 2-15

Stream Condition Map

Long Branch Central
Mainstem 3

Existing Land Use

Future Land Use



Land Use

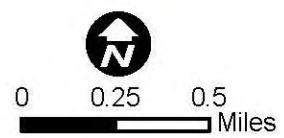
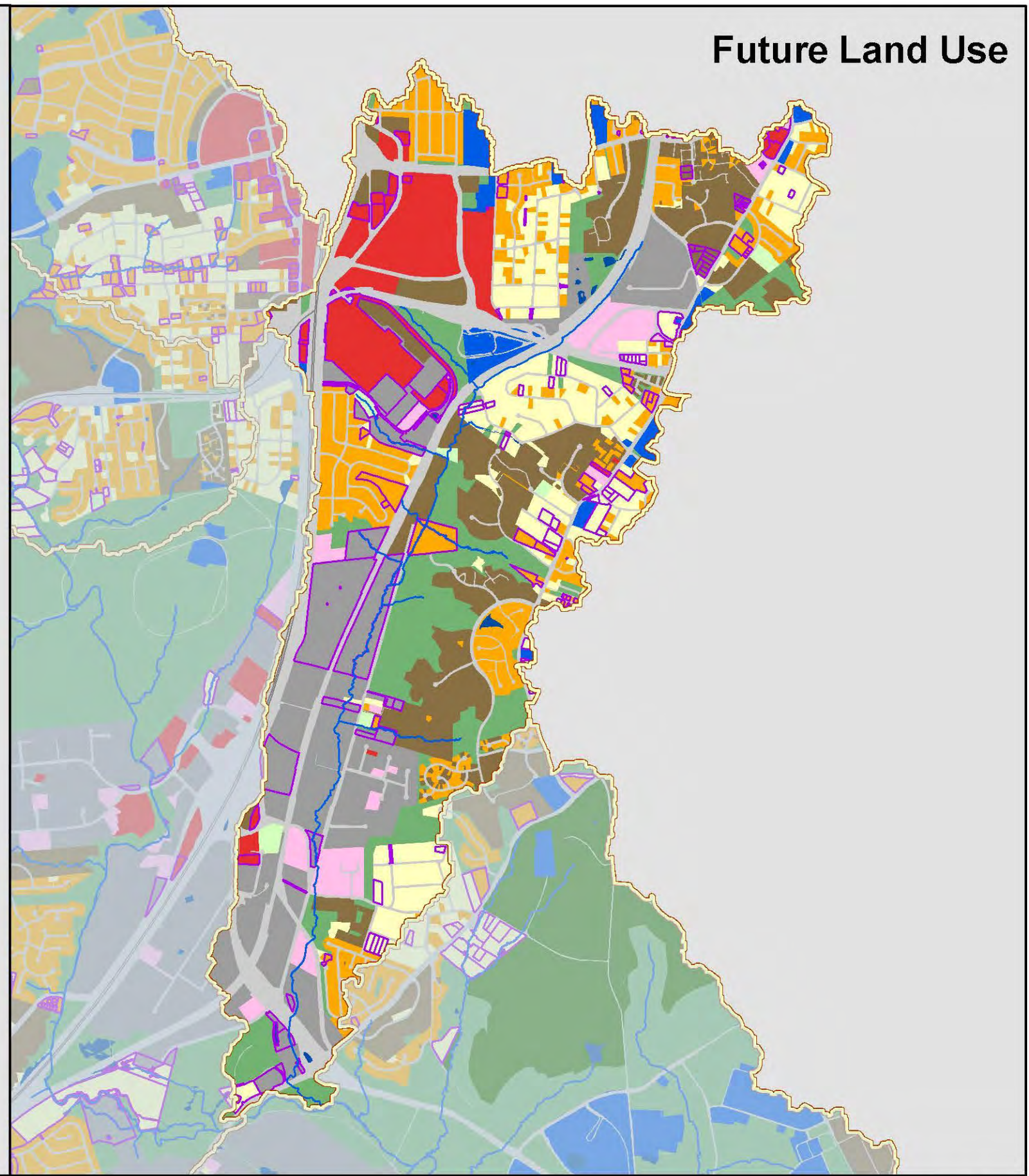
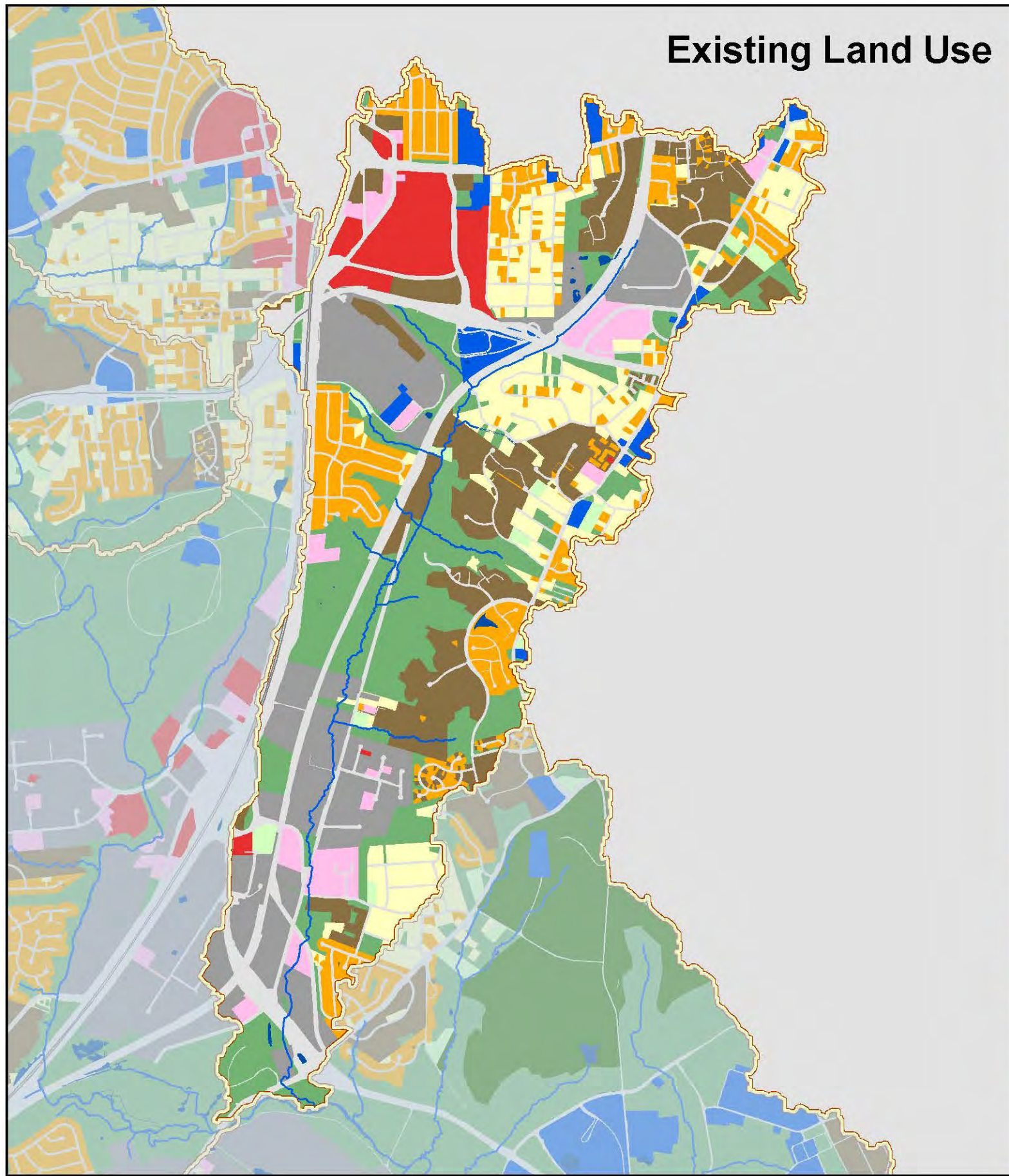
- | | | | | |
|--------------------------|---------------------------|----------------------------|----------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space | WMA Boundary |
| Golf Course | Industrial | Low Intensity Commercial | Transportation | Change in Land Use |
| High Density Residential | Institutional | Medium Density Residential | Water | |

Map 2-16

Land Use Map
Long Branch North

Existing Land Use

Future Land Use

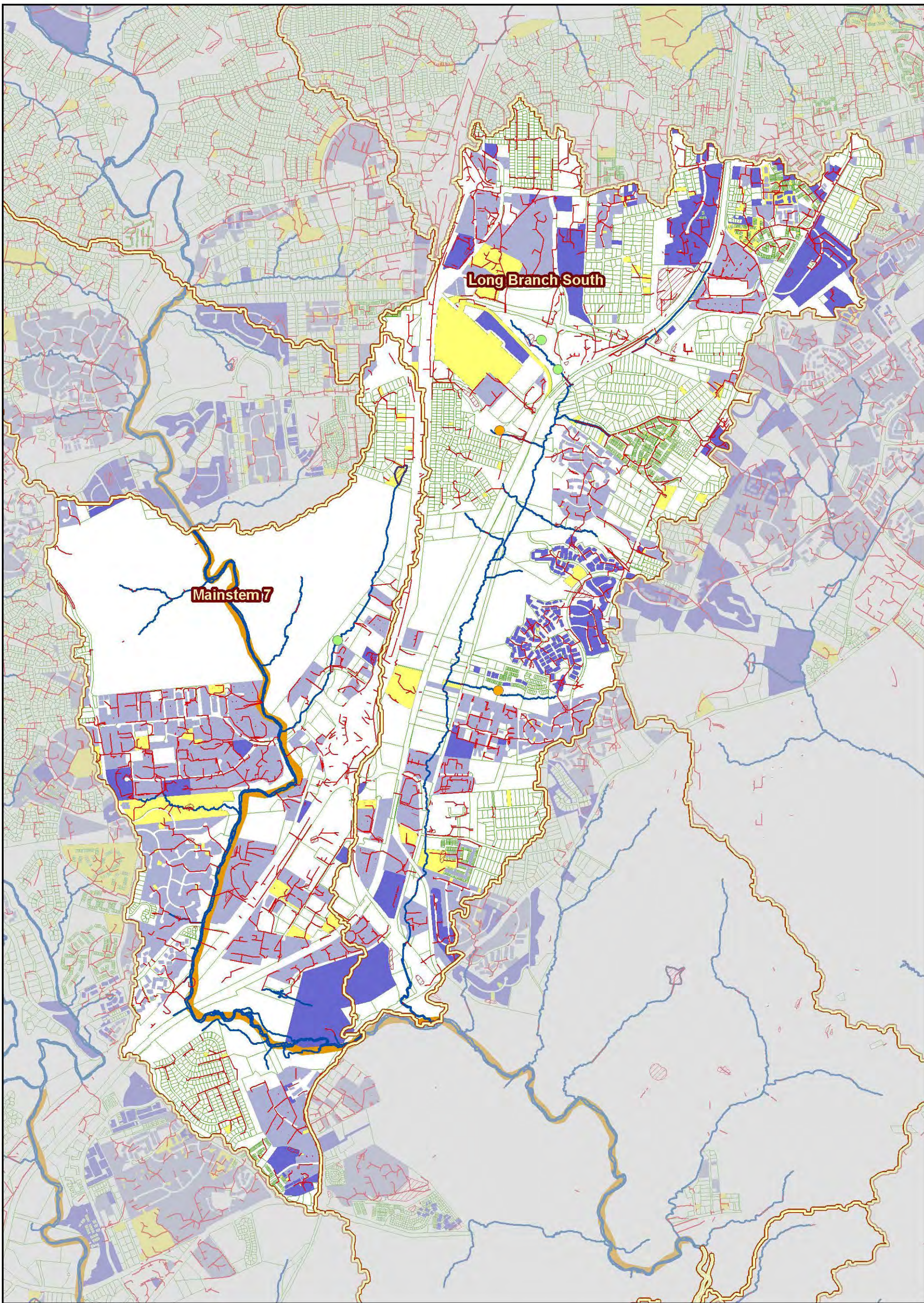




Land Use








- | | | | | |
|--------------------------|---------------------------|----------------------------|----------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space | WMA Boundary |
| Golf Course | Industrial | Low Intensity Commercial | Transportation | Change in Land Use |
| High Density Residential | Institutional | Medium Density Residential | Water | |





Map 2-17

Land Use Map
Long Branch South

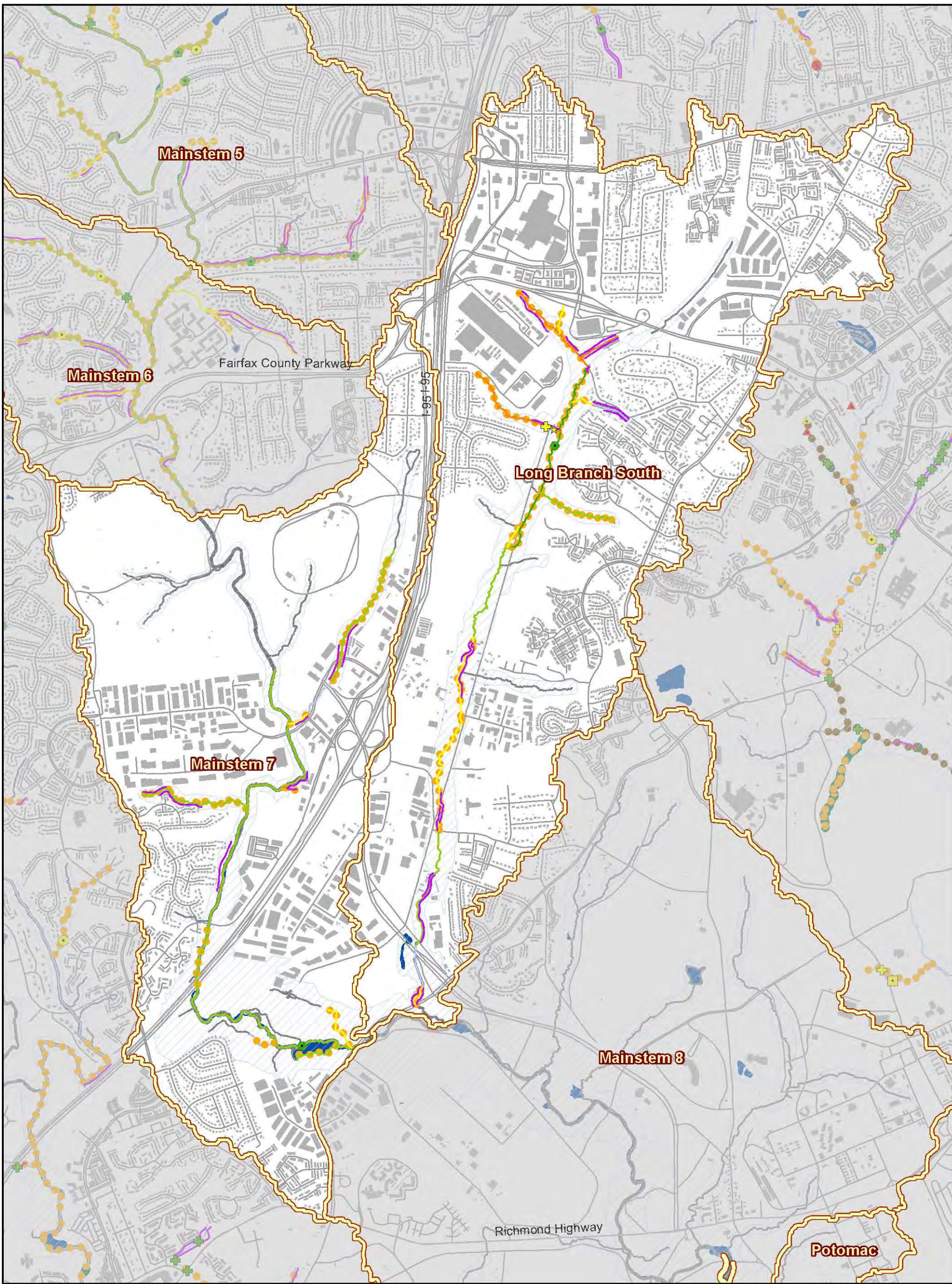




0 0.25 0.5 Miles

-  WMA Boundary
-  303d Listed Streams
-  Stormwater Facilities
-  Stormwater Pipes
-  Parcels
-  MSMD Flooding/Drainage Complaints
-  Public Identified Problem Areas 2003 - 2006

- Regional Ponds**
-  Constructed
-  Planned
- BMP Control Type**
-  Quantity and Quality
-  Quantity

Map 2-18
**Stormwater
 Infrastructure
 Map**
 Mainstem 7
 Long Branch South



0 0.25 0.5 Miles

Obstruction Impact ● Minor to Moderate ● Moderate to Severe ● Severe to Extreme	Head Cut Height ▲ 0.5' - 1.0' ▲ 1' - 2' ▲ >2'	Ditch Impact ■ Minor to Moderate ■ Moderate to Severe ■ Severe to Extreme	Crossing Impact + Minor to Moderate + Moderate to Severe + Severe to Extreme
Dump Site Impact ★ Minor to Moderate ★ Moderate to Severe ★ Severe to Extreme	Pipe Impact ● Minor to Moderate ● Moderate to Severe ● Severe to Extreme	Utility Impact ◆ Minor to Moderate ◆ Moderate to Severe ◆ Severe to Extreme	□ WMA Boundary ▨ Resource Protection Area (RPA) ■ Lakes and Ponds — Deficient Buffer
Habitat Rating — Excellent — Good — Fair — Poor — Very Poor — Unassessed	CEM Category ● CEM 2 - Incising ● CEM 3 - Widening	— Erosion	

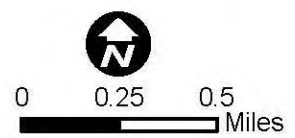
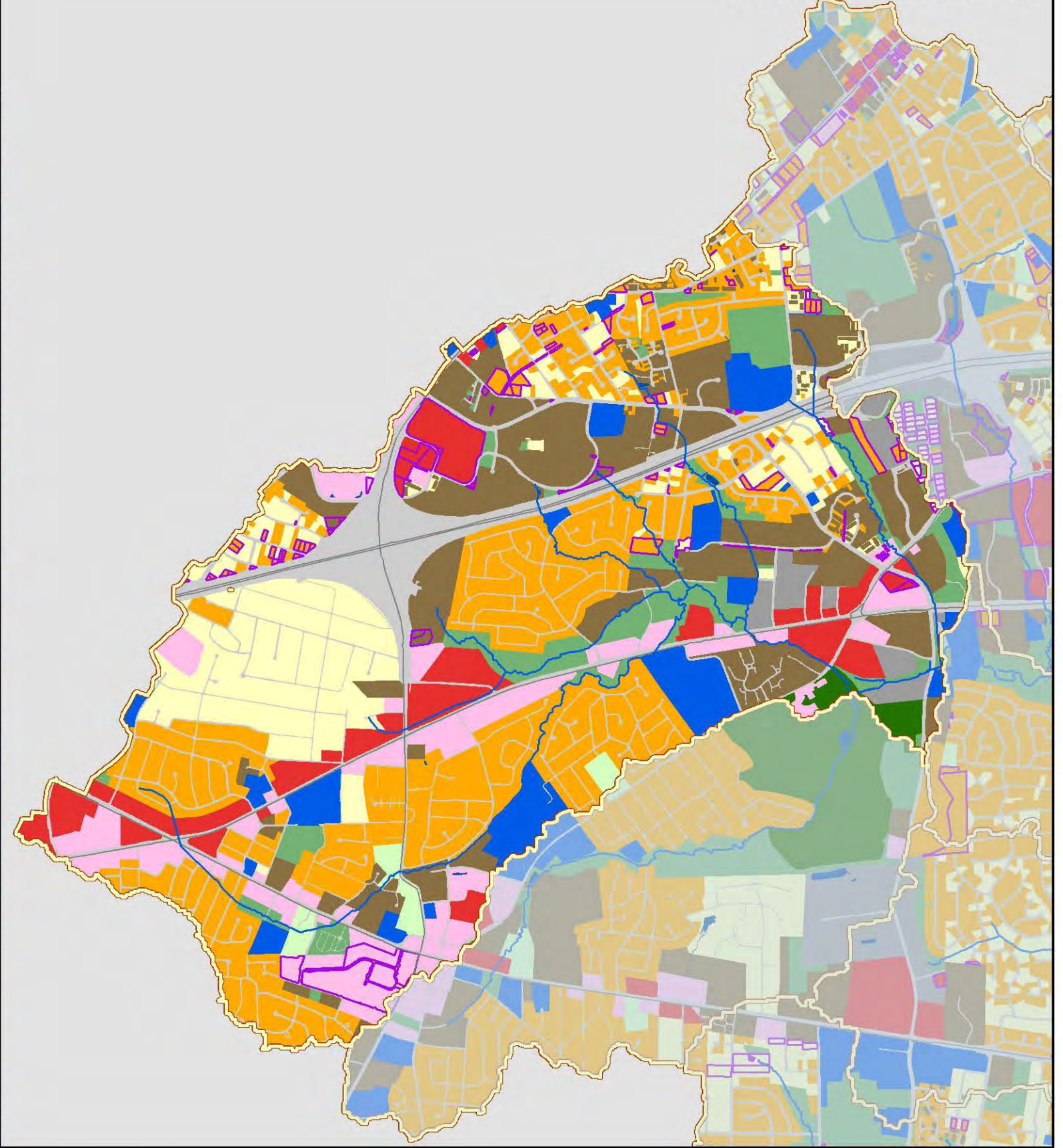
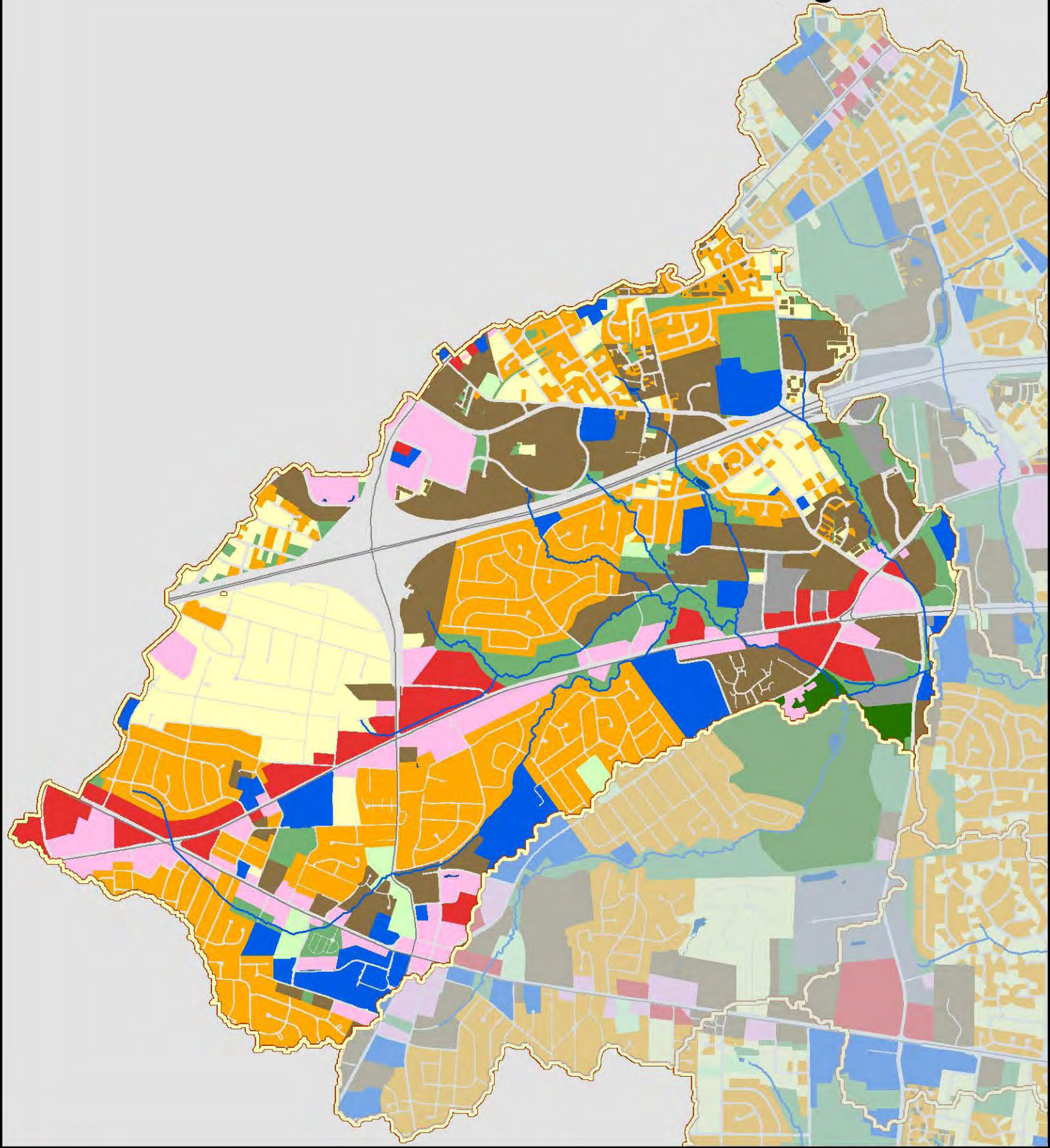
Map 2-19

Stream Condition Map

Mainstem 7
Long Branch South

Existing Land Use

Future Land Use

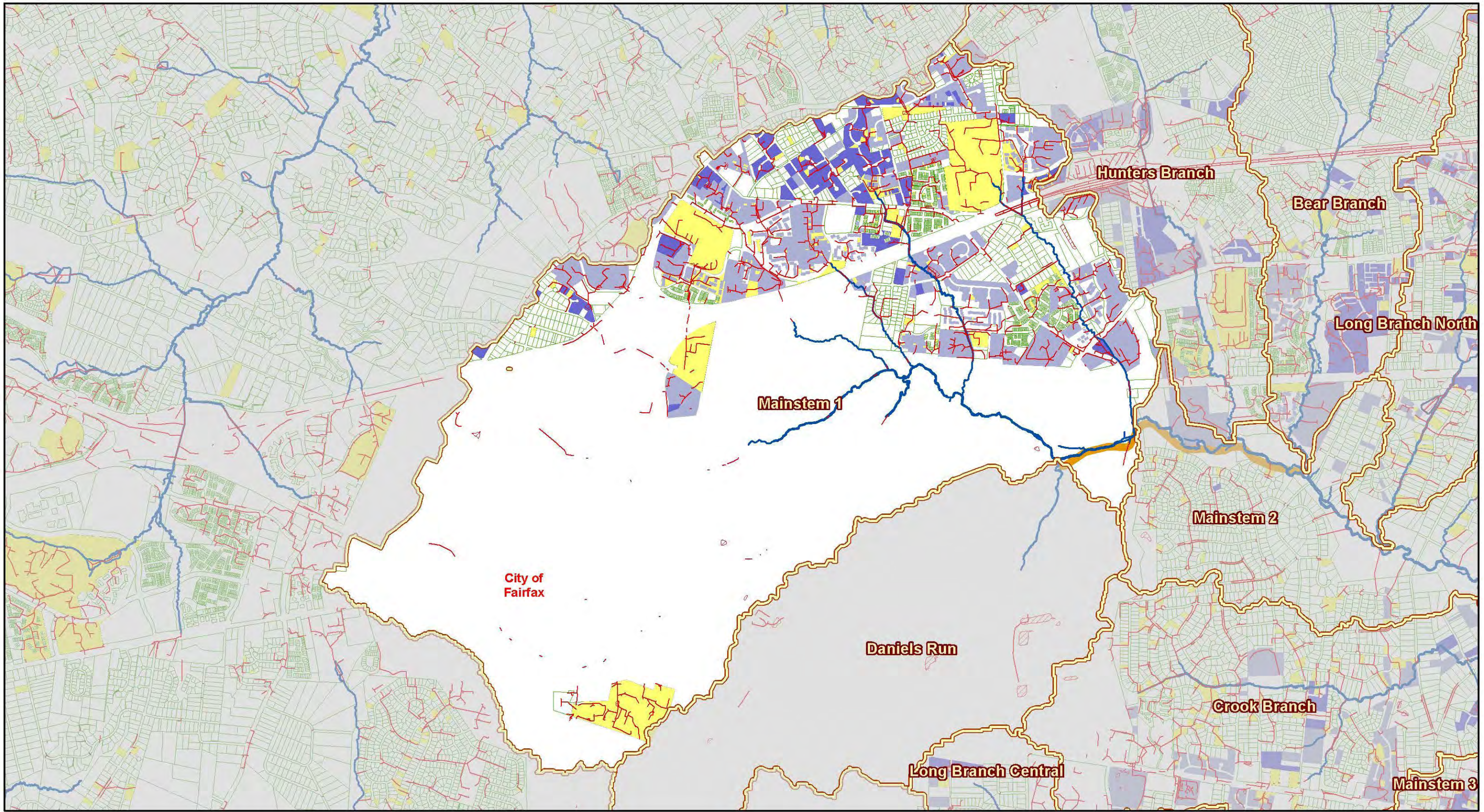


Land Use

- | | | | | |
|--------------------------|---------------------------|----------------------------|----------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space | WMA Boundary |
| Golf Course | Industrial | Low Intensity Commercial | Transportation | Change in Land Use |
| High Density Residential | Institutional | Medium Density Residential | Water | |

Map 2-20

Land Use Map
Mainstem 1



0 0.25 0.5 Miles

- WMA Boundary
- 303d Listed Streams
- Stormnet Facilities
- Stormnet Arcs
- Parcels

- Regional Ponds**
- Constructed
 - Planned

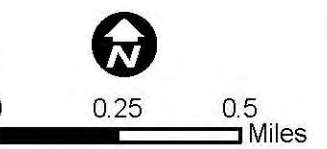
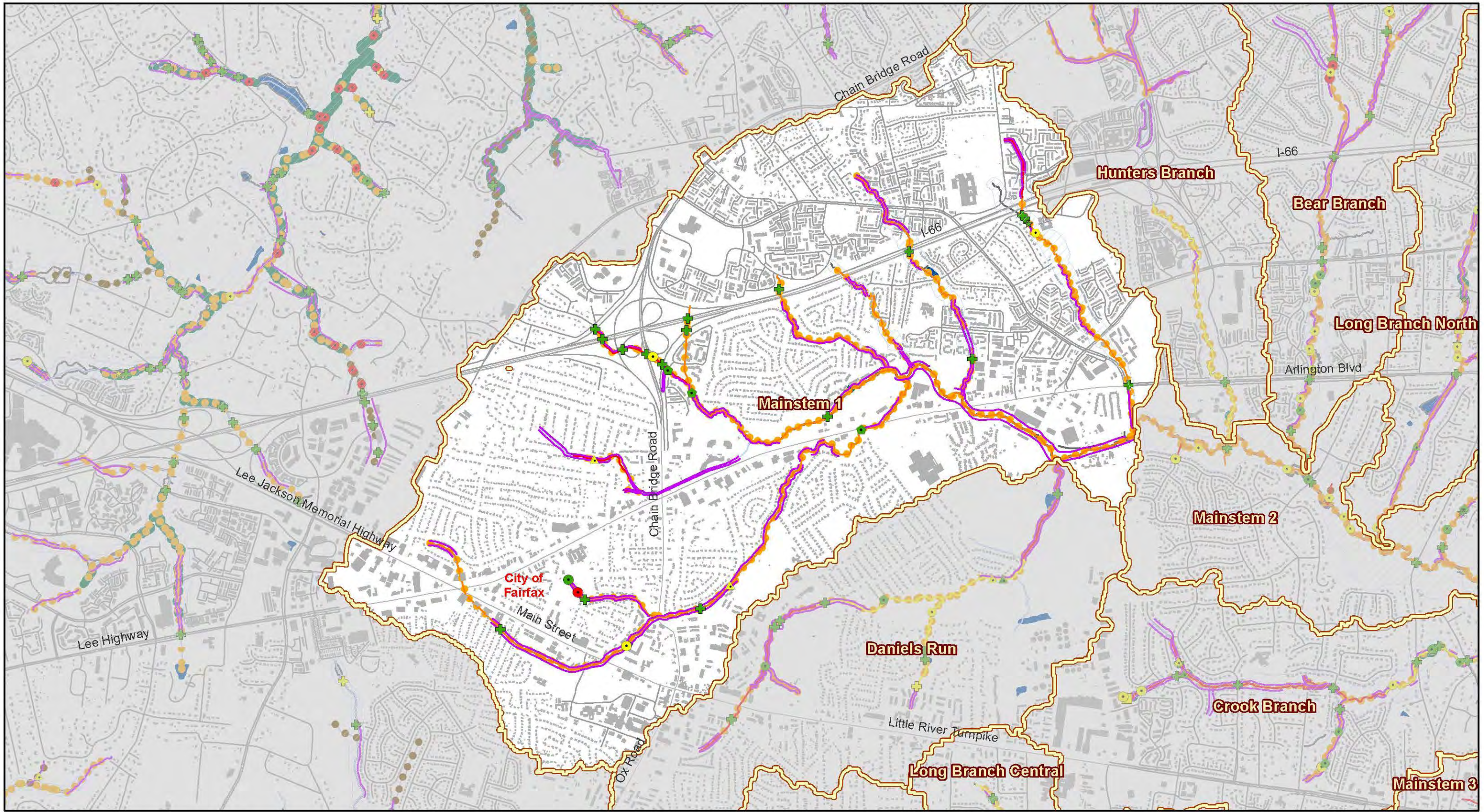
- Subarea**
- Quantity and Quality
 - Quantity

- MSMD Flooding/Drainage Complaints**
- STMDRN; SWM/BMP
 - Public Identified Problem Areas 2003 - 2006

Map 2-21

Stormwater Infrastructure Map

Mainstem 1



Obstruction Impact	Dump Site Impact	Pipe Impact	Ditch Impact	Utility Impact	Crossing Impact	Head Cut Height
Minor to Moderate	Minor to Moderate	Minor to Moderate	Minor to Moderate	Minor to Moderate	Minor to Moderate	0.5' - 1.0'
Moderate to Severe	Moderate to Severe	Moderate to Severe	Moderate to Severe	Moderate to Severe	Moderate to Severe	1' - 2'
Severe to Extreme	Severe to Extreme	Severe to Extreme	Severe to Extreme	Severe to Extreme	Severe to Extreme	>2'

Habitat Rating			CEM Category	
Excellent	Fair	Very Poor	CEM 2 - Incising	CEM 3 - Widening
Good	Poor	Unassessed		

Resource Protection Area (RPA)	Lakes and Ponds	Deficient Buffer	Erosion
Resource Protection Area (RPA)	Lakes and Ponds	Deficient Buffer	Erosion
WMA Boundary			

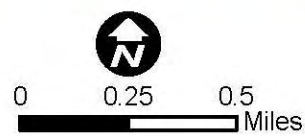
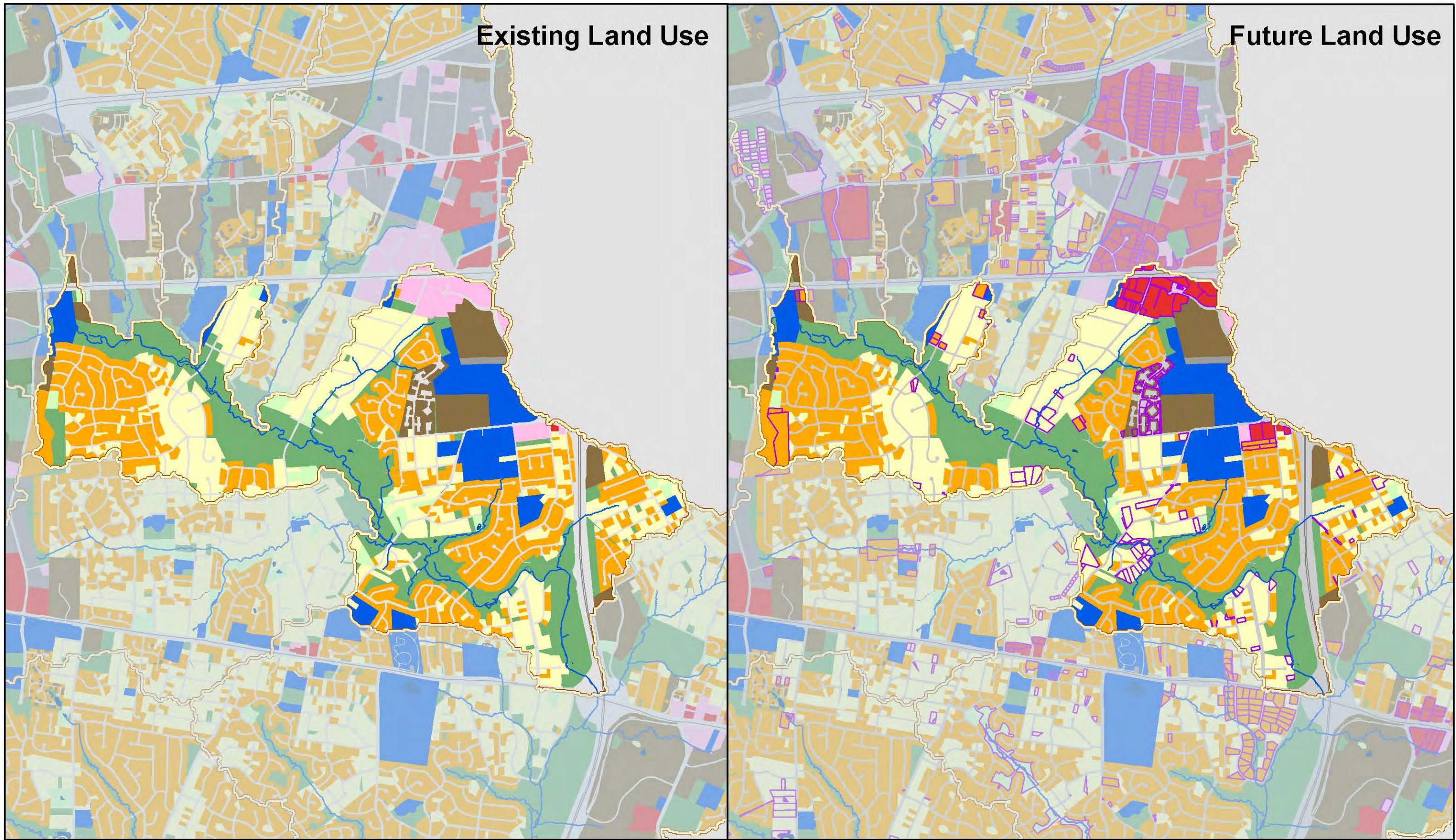
Map 2-22

Stream Condition Map

Mainstem 1

Existing Land Use

Future Land Use



Land Use

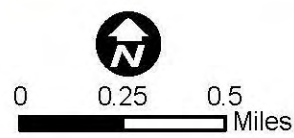
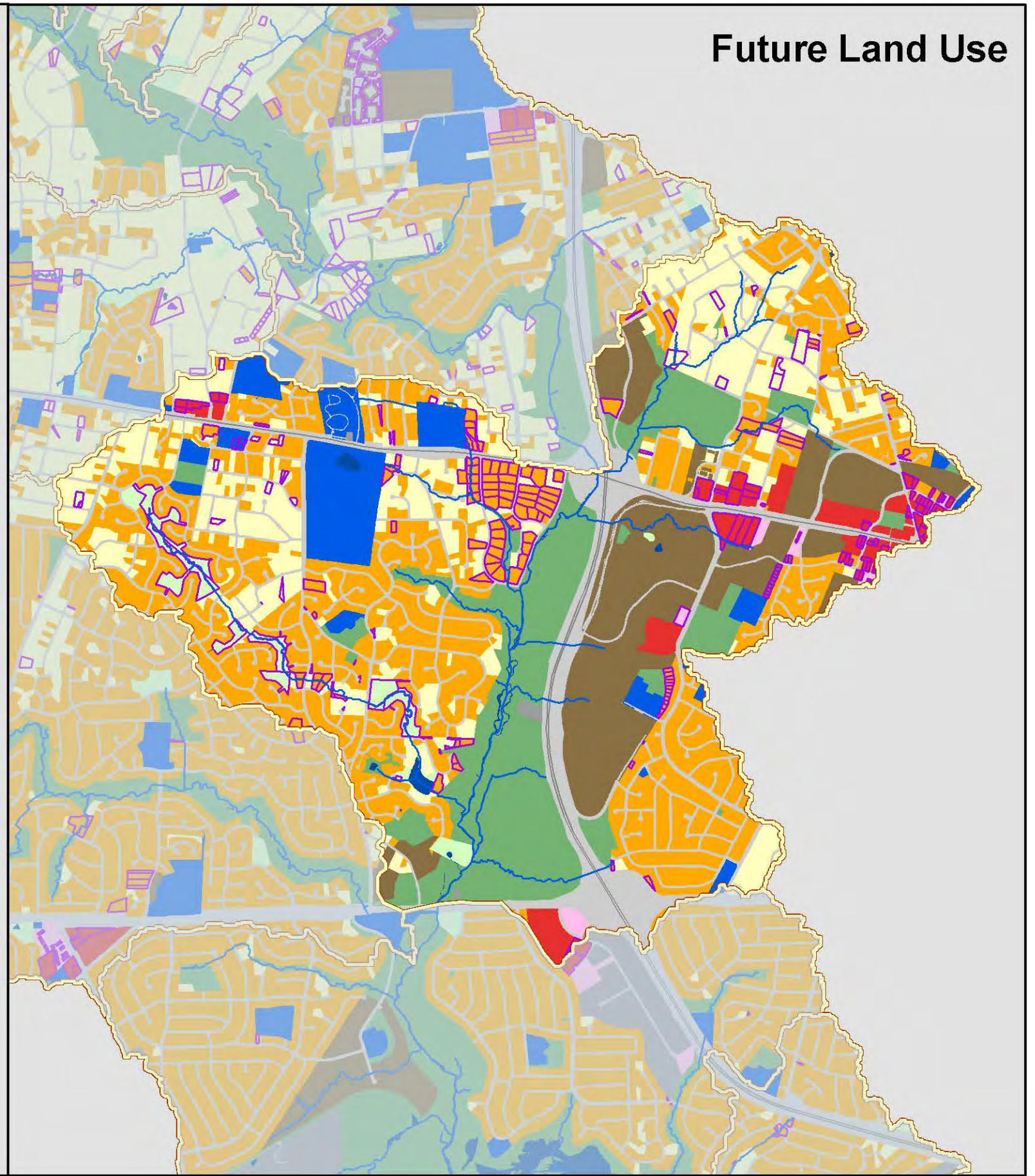
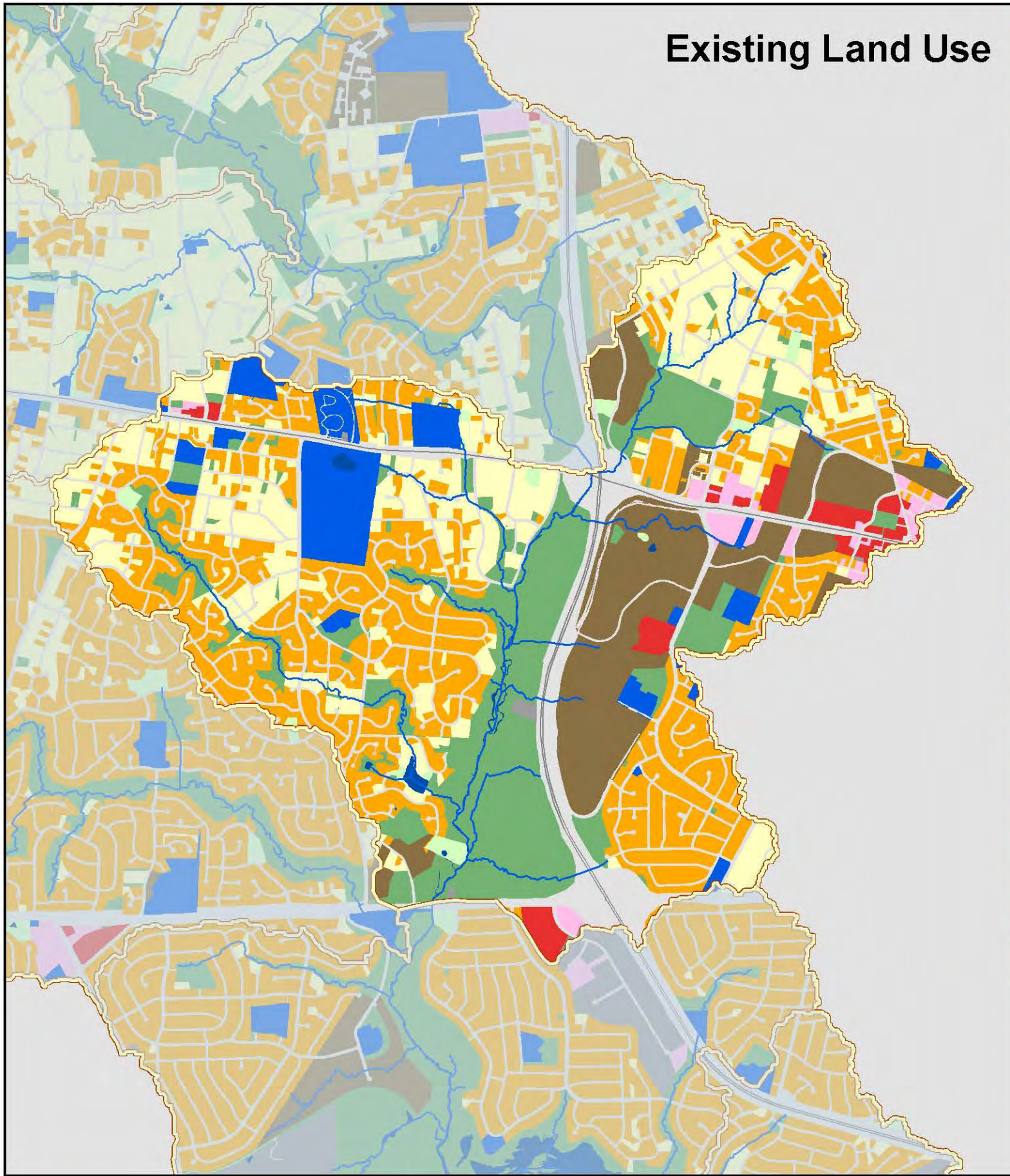
- | | | | |
|--------------------------|---------------------------|----------------------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space |
| Golf Course | Industrial | Low Intensity Commercial | Transportation |
| High Density Residential | Institutional | Medium Density Residential | Water |
| | | | WMA Boundary |
| | | | Change in Land Use |

Map 2-23

Land Use Map
Mainstem 2

Existing Land Use

Future Land Use



Land Use

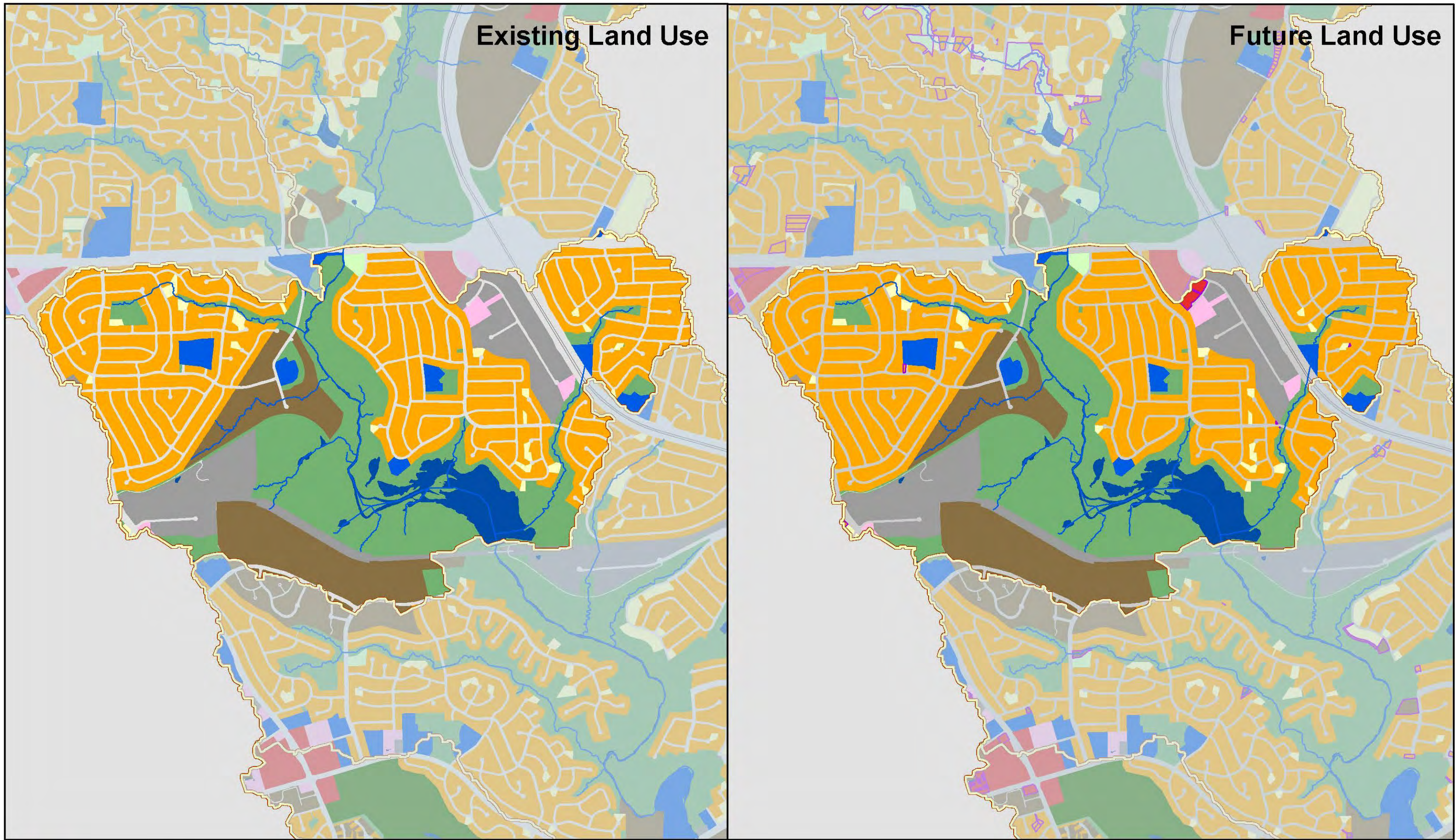
- | | | | | |
|--------------------------|---------------------------|----------------------------|----------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space | WMA Boundary |
| Golf Course | Industrial | Low Intensity Commercial | Transportation | Change in Land Use |
| High Density Residential | Institutional | Medium Density Residential | Water | |

Map 2-24

Land Use Map
Mainstem 3

Existing Land Use

Future Land Use

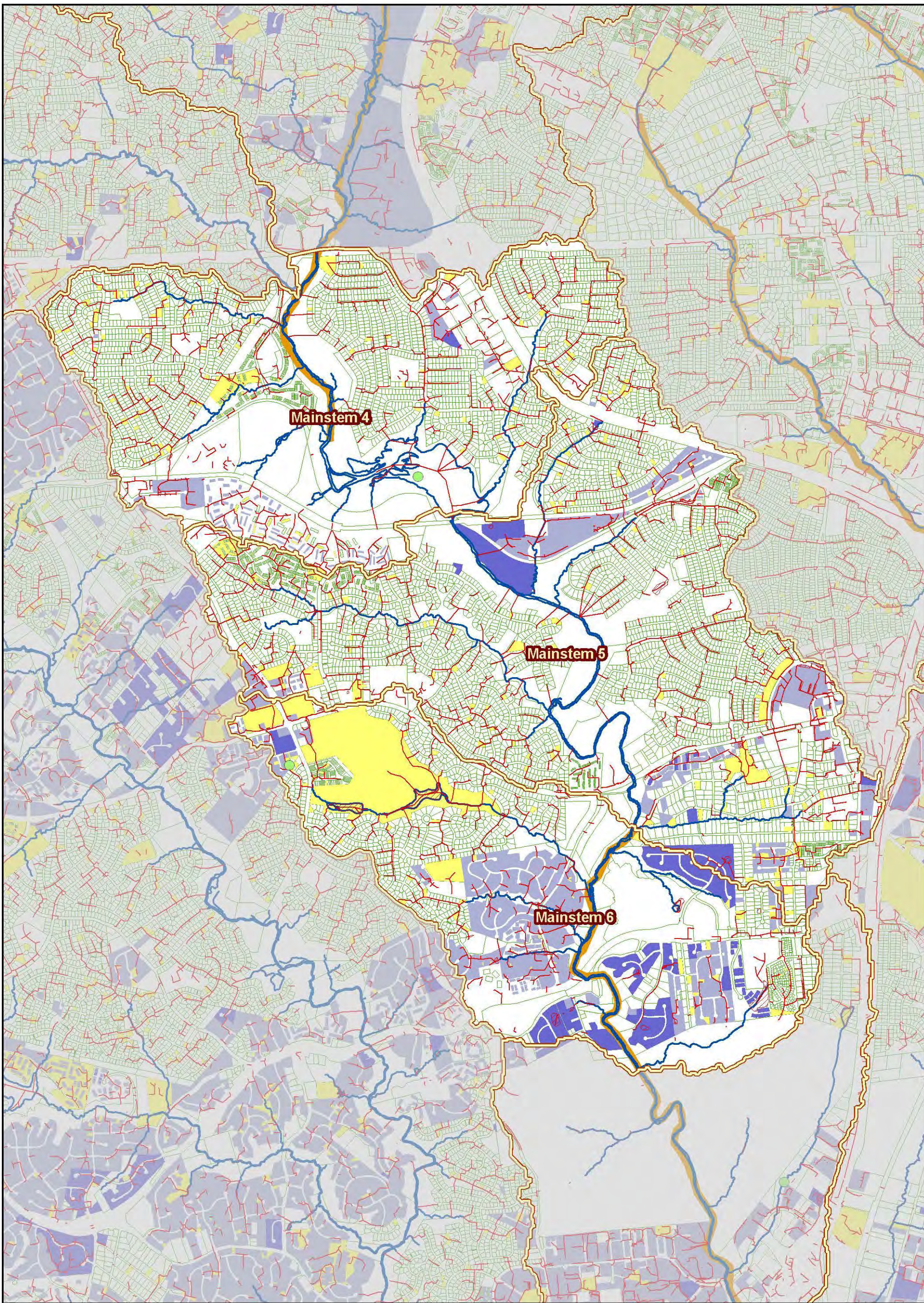


Land Use

- | | | | |
|--------------------------|---------------------------|----------------------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space |
| Golf Course | Industrial | Low Intensity Commercial | Transportation |
| High Density Residential | Institutional | Medium Density Residential | Water |
| | | | WMA Boundary |
| | | | Change in Land Use |

Map 2-25

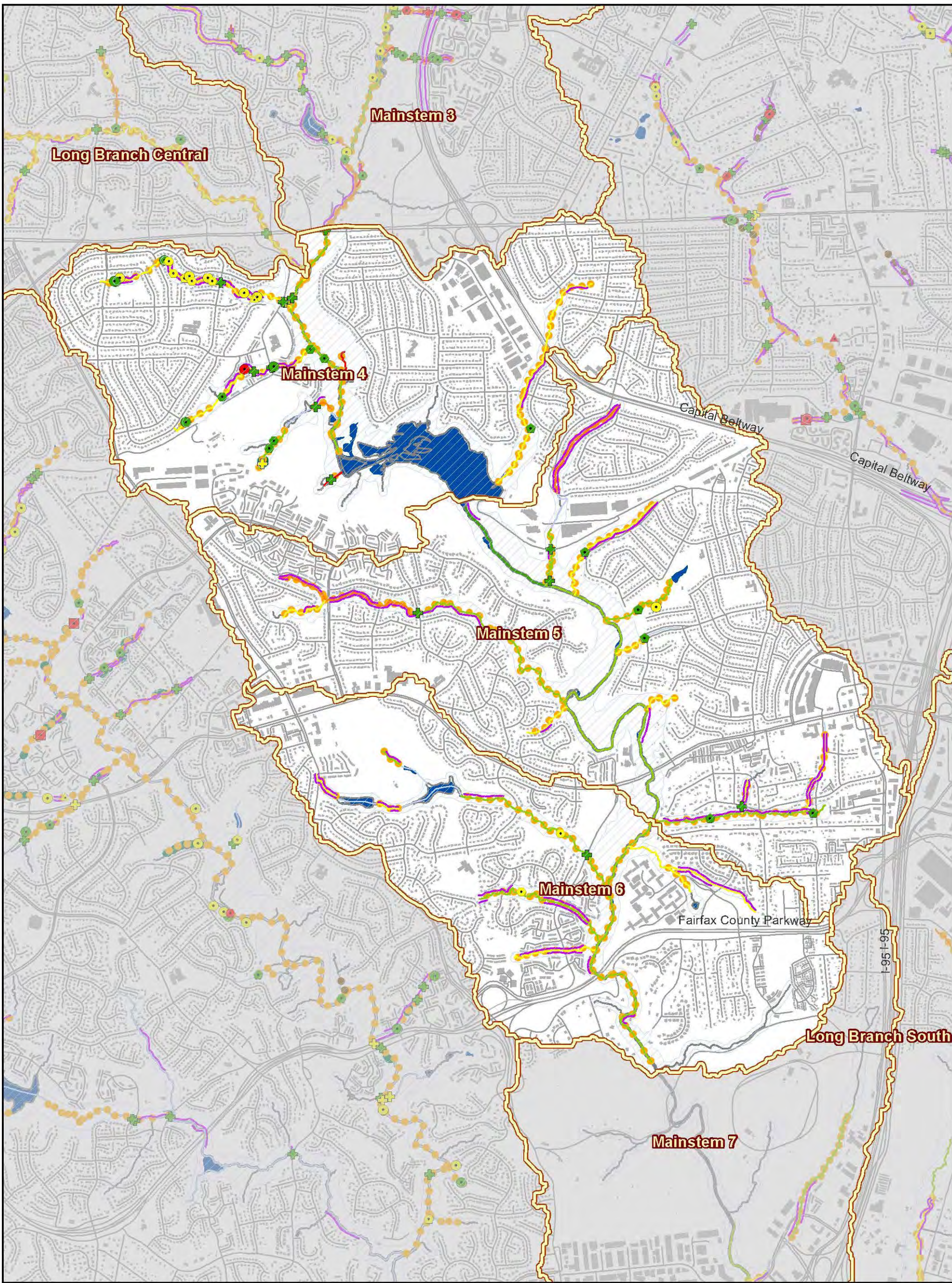

Land Use Map
Mainstem 4




0 0.25 0.5 Miles

- | | |
|-----------------------|---|
| WMA Boundary | Subarea |
| 303d Listed Streams | Quantity and Quality |
| Stormnet Facilities | Quantity |
| Stormnet Arcs | MSMD Flooding/Drainage Complaints |
| Parcels | STMDRN; SWM/BMP |
| Regional Ponds | Public Identified Problem Areas 2003 - 2006 |
| Constructed | |
| Planned | |

Map 2-26
**Stormwater
 Infrastructure
 Map**
 Mainstem 4
 Mainstem 5
 Mainstem 6

0 0.25 0.5 Miles



- Obstruction Impact**
- Minor to Moderate
 - Moderate to Severe
 - Severe to Extreme
- Dump Site Impact**
- ★ Minor to Moderate
 - ★ Moderate to Severe
 - ★ Severe to Extreme
- Habitat Rating**
- Excellent
 - Good
 - Fair
 - Poor
 - Very Poor
 - Unassessed

- Head Cut Height**
- ▲ 0.5' - 1.0'
 - ▲ 1' - 2'
 - ▲ >2'
- Pipe Impact**
- Minor to Moderate
 - Moderate to Severe
 - Severe to Extreme

- Ditch Impact**
- Minor to Moderate
 - Moderate to Severe
 - Severe to Extreme
- Utility Impact**
- ◆ Minor to Moderate
 - ◆ Moderate to Severe
 - ◆ Severe to Extreme
- CEM Category**
- CEM 2 - Incising
 - CEM 3 - Widening

- Crossing Impact**
- ✚ Minor to Moderate
 - ✚ Moderate to Severe
 - ✚ Severe to Extreme
- ▭ WMA Boundary
 - ▭ Resource Protection Area (RPA)
 - Deficient Buffer
 - Erosion
 - Lakes and Ponds

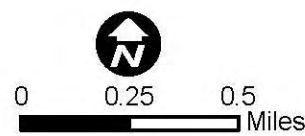
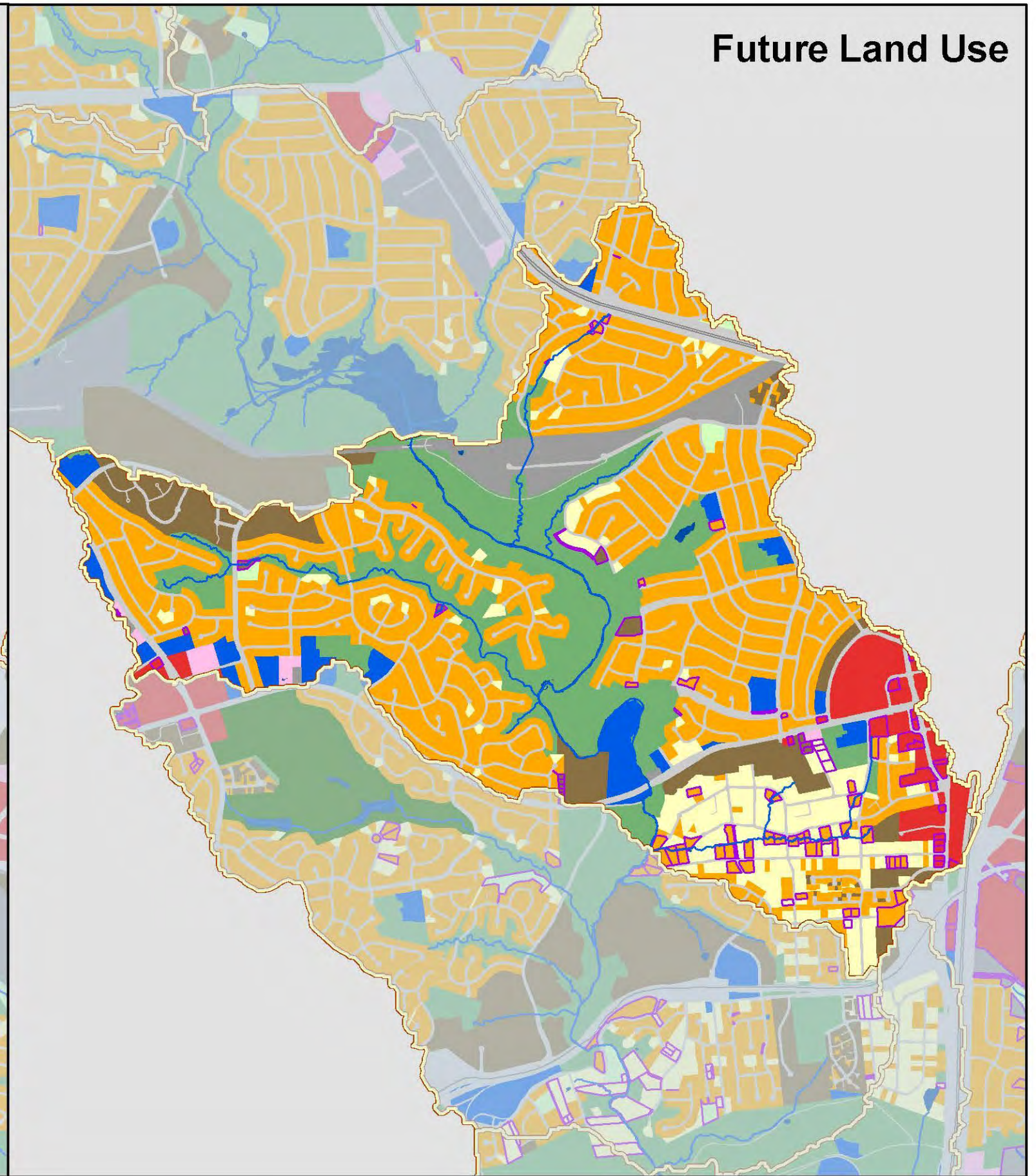
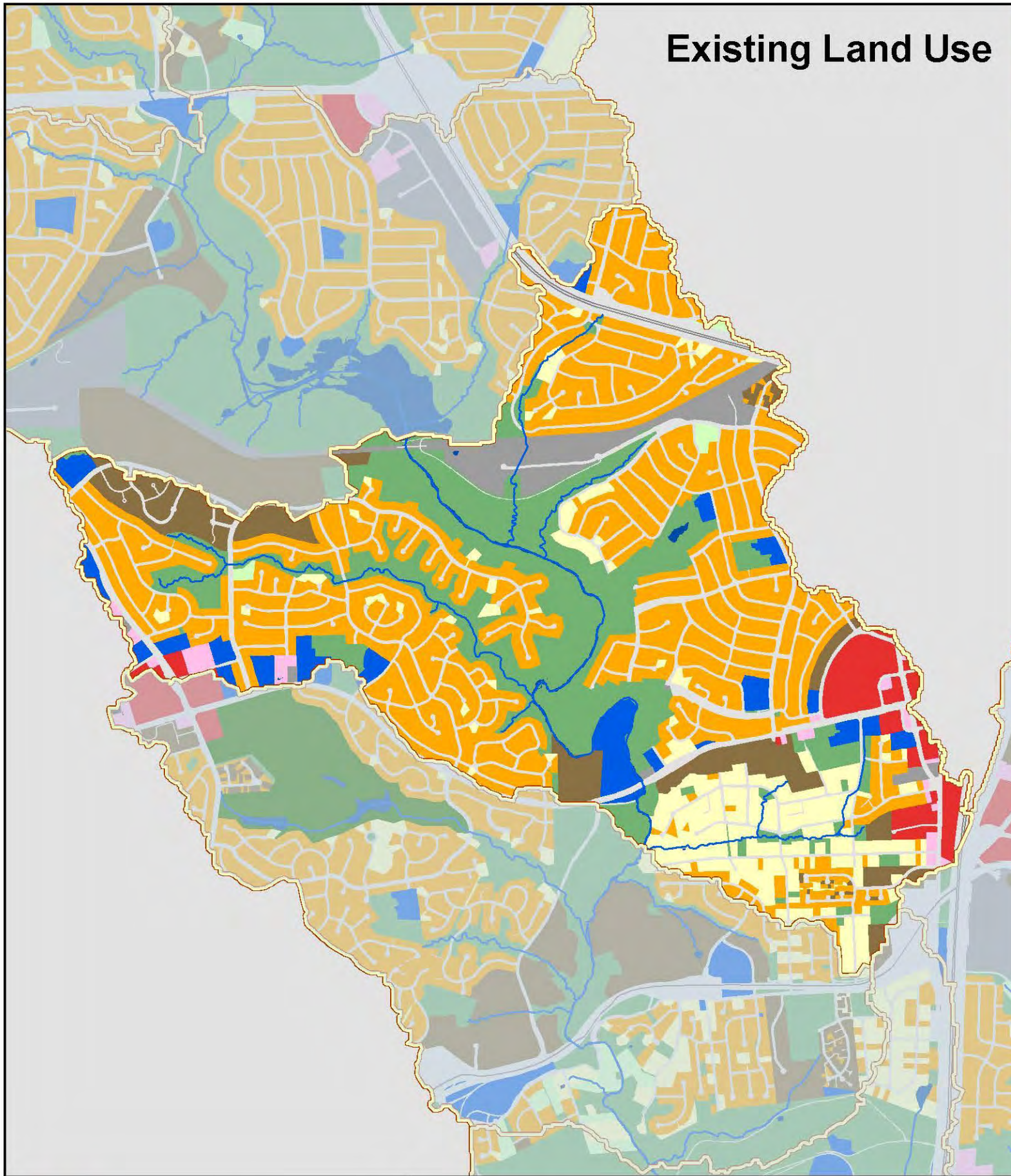
Map 2-27

Stream Condition Map

Mainstem 4
Mainstem 5
Mainstem 6

Existing Land Use

Future Land Use



Land Use

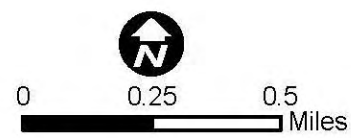
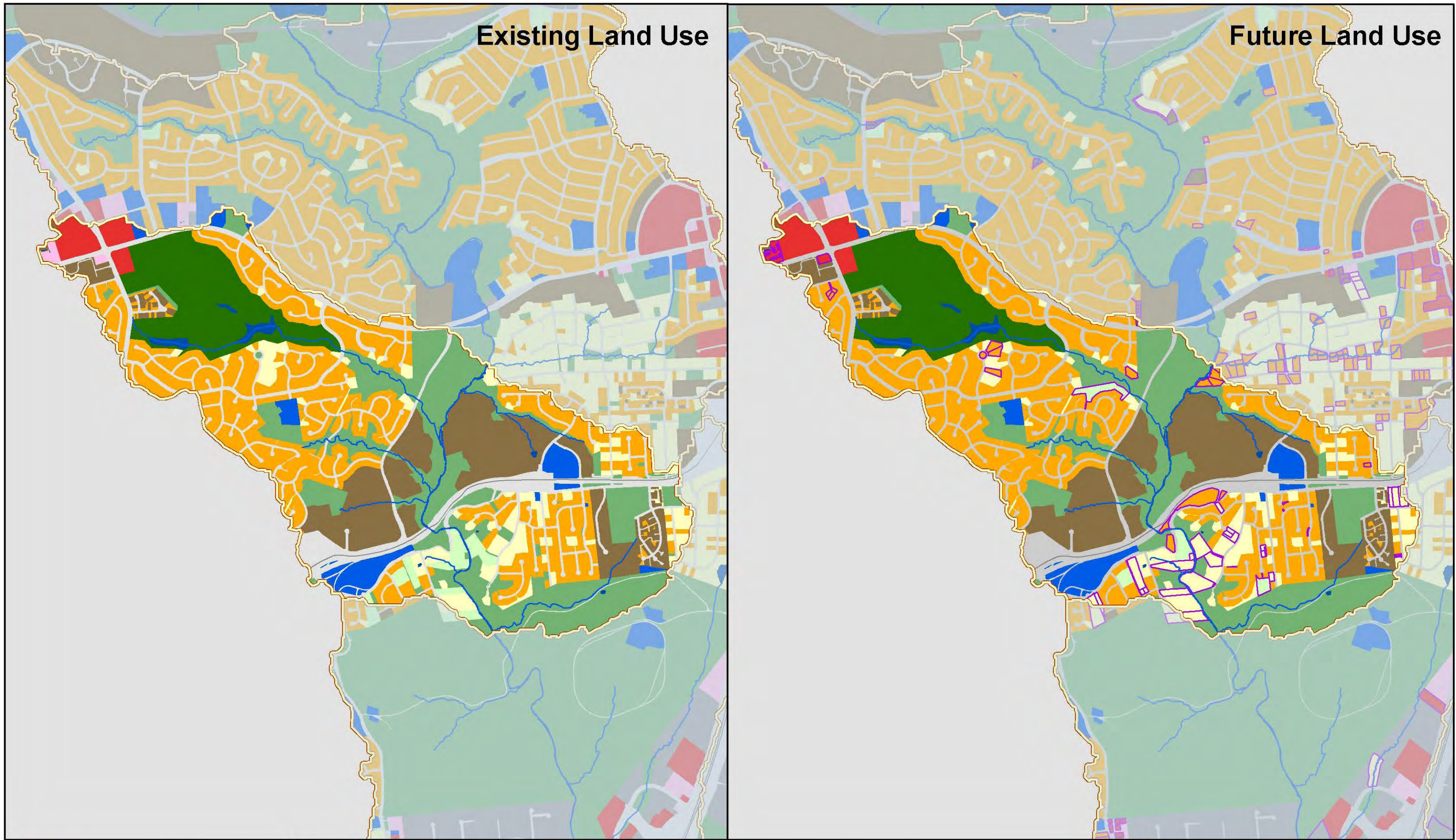
- | | | | | |
|--------------------------|---------------------------|----------------------------|----------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space | WMA Boundary |
| Golf Course | Industrial | Low Intensity Commercial | Transportation | Change in Land Use |
| High Density Residential | Institutional | Medium Density Residential | Water | |

Map 2-28

Land Use Map
Mainstem 5

Existing Land Use

Future Land Use



Land Use

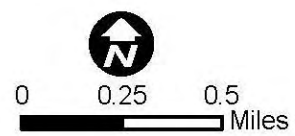
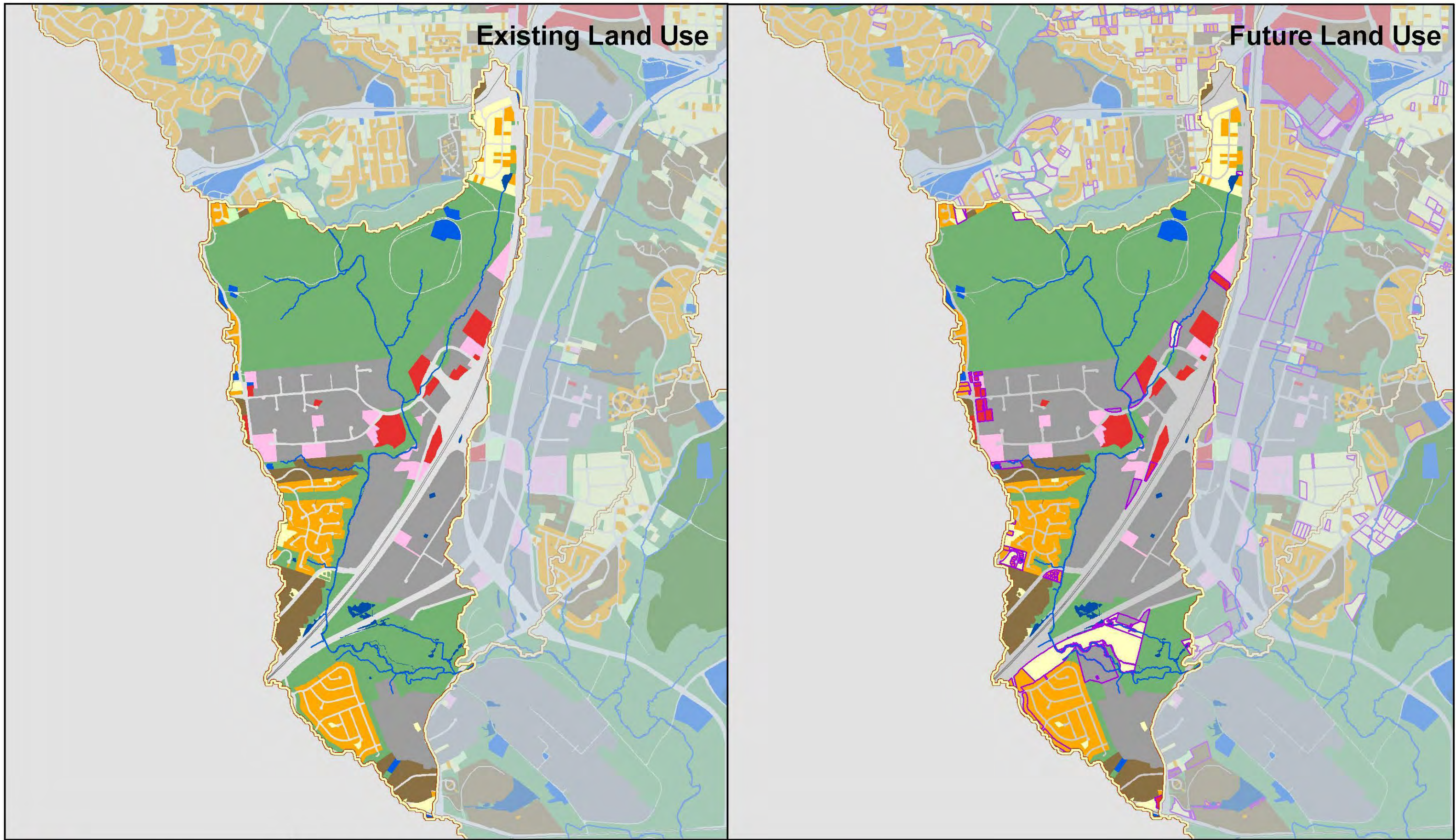
- | | | | | |
|--------------------------|---------------------------|----------------------------|----------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space | WMA Boundary |
| Golf Course | Industrial | Low Intensity Commercial | Transportation | Change in Land Use |
| High Density Residential | Institutional | Medium Density Residential | Water | |

Map 2-29

Land Use Map
Mainstem 6

Existing Land Use

Future Land Use



Land Use

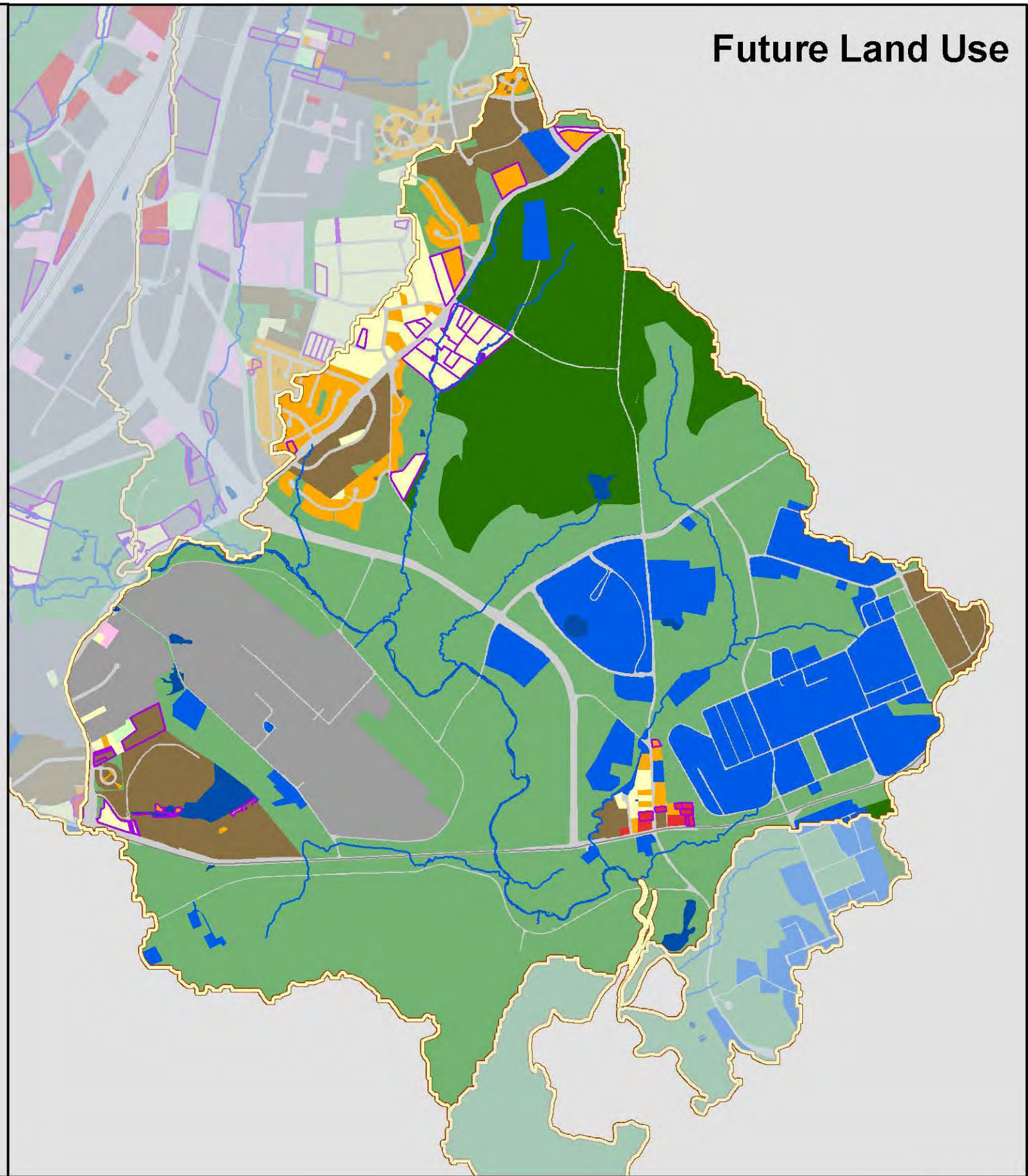
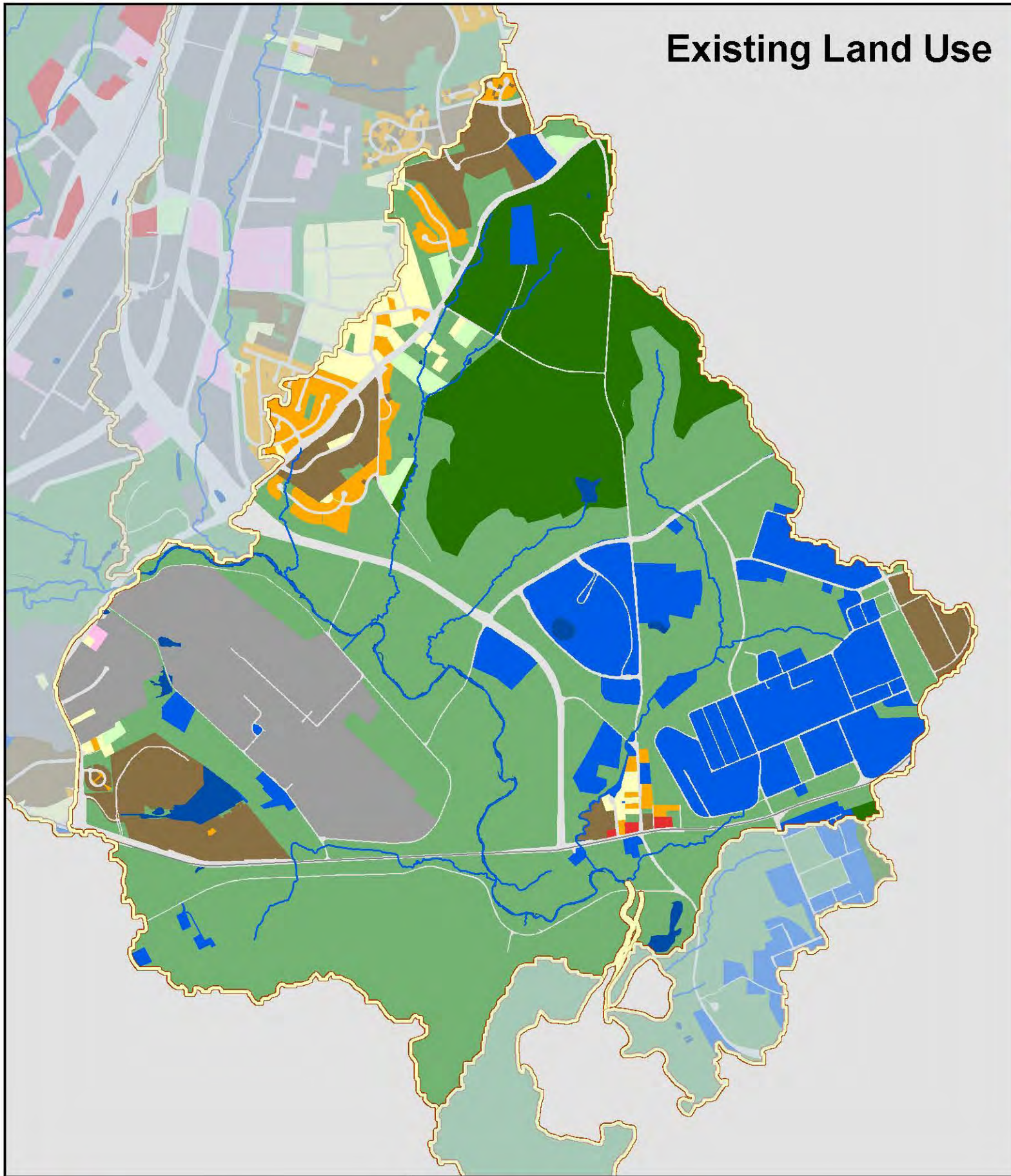
- | | | | |
|--------------------------|---------------------------|----------------------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space |
| Golf Course | Industrial | Low Intensity Commercial | Transportation |
| High Density Residential | Institutional | Medium Density Residential | Water |
| | | | WMA Boundary |
| | | | Change in Land Use |

Map 2-30

Land Use Map
Mainstem 7

Existing Land Use

Future Land Use

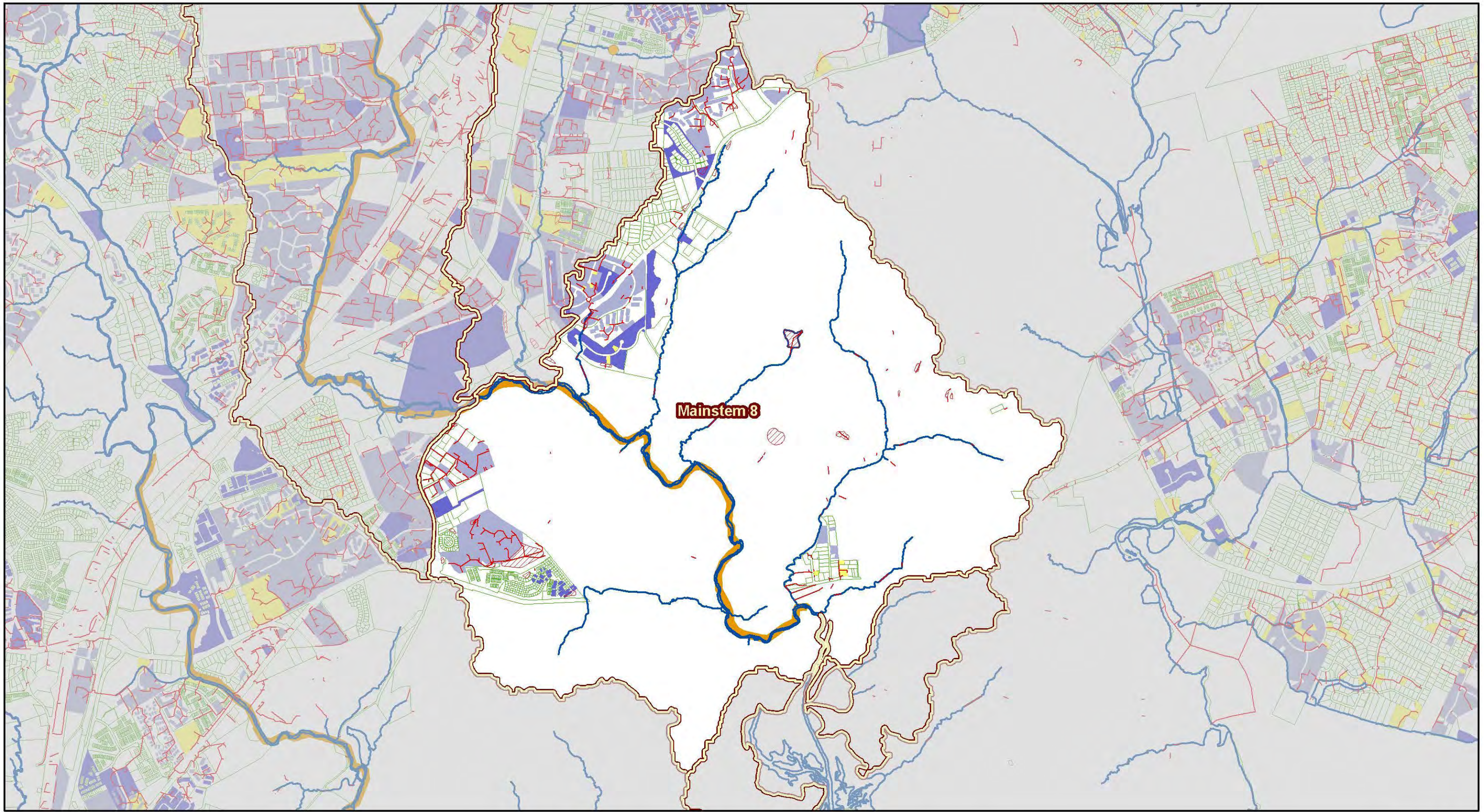


Land Use

- | | | | | |
|--------------------------|---------------------------|----------------------------|----------------|--------------------|
| Estate Residential | High Intensity Commercial | Low Density Residential | Open Space | WMA Boundary |
| Golf Course | Industrial | Low Intensity Commercial | Transportation | Change in Land Use |
| High Density Residential | Institutional | Medium Density Residential | Water | |

Map 2-31

Land Use Map
Mainstem 8



Mainstem 8



0 0.25 0.5 Miles

- | | | | |
|---------------------|-----------------------|----------------------|---|
| WMA Boundary | Regional Ponds | Subarea | MSMD Flooding/Drainage Complaints |
| 303d Listed Streams | Constructed | Quantity and Quality | STMDRN; SWM/BMP |
| Stormnet Facilities | Planned | Quantity | Public Identified Problem Areas 2003 - 2006 |
| Stormnet Arcs | | | |
| Parcels | | | |

Map 2-32

Stormwater Infrastructure Map

Mainstem 8

