Northeastern Jones Falls Small Watershed Action Plan

Volume 2: Appendices D & E

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Final

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In Consultation with:
Northeastern Jones Falls SWAP Steering Committee

NORTHEASTERN JONES FALLS
SMALL WATERSHED ACTION PLAN

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Appendix D	Northeastern Jones Falls Characterization Report
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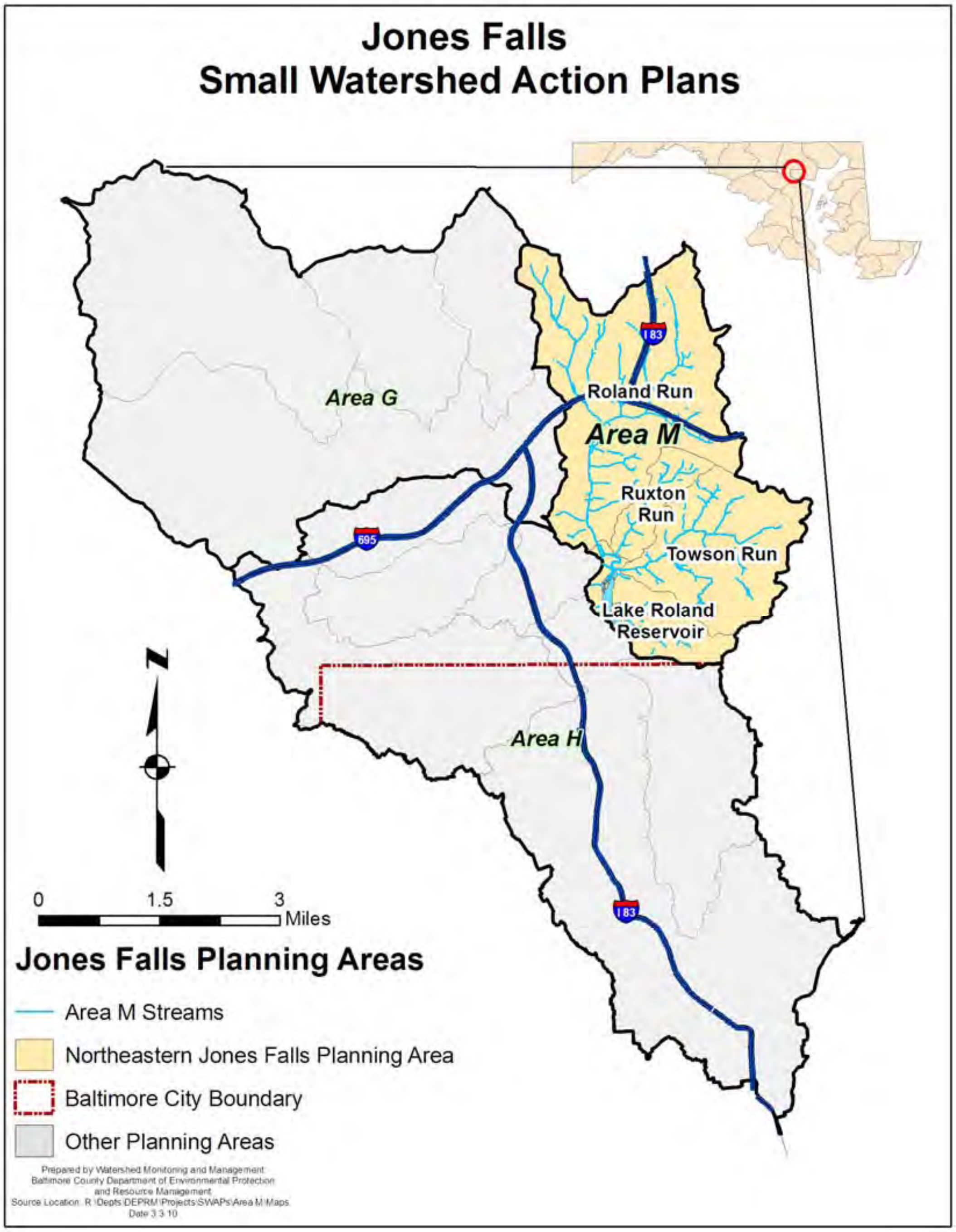
APPENDIX D

NORTHEASTERN JONES FALLS CHARACTERIZATION REPORT

Northeastern Jones Falls Characterization Report



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CHAPTER 1

INTRODUCTION

1.1 Purpose of the Characterization

The Northeastern Jones Falls Characterization Report is intended to summarize information on geomorphological, hydrological, and biological factors that may affect water quality and other natural resources and the condition of the natural resources. In addition, the report identifies and assesses the human impact on the watershed, the management framework within which this activity takes place, and finally identifies restoration and preservation strategies and actions to achieve watershed goals. The information presented in this report will be used as the basis for the formulation of the Northeastern Jones Falls Small Watershed Action Plan (SWAP). This characterization report has two main objectives:

- Summarize watershed information relevant to natural resources and impacts on natural resources, and
- To describe the condition of the natural resources within the watershed.

1.2 Location and Scale of Analysis

The Northeastern Jones Falls watershed is located in the Jones Falls River Basin (02-13-09-04) above the fall line in the Piedmont region of Maryland. The watershed contains Lake Roland and portions of Towson, Ruxton and Timonium. Figure 1-1 shows the location of the planning area in relation to the rest of the Jones Falls watershed. Table 1-1 displays the distribution of acreage between the four subwatersheds, while Figure 1-2 depicts the location of these subwatersheds within the Northeastern Jones Falls watershed.

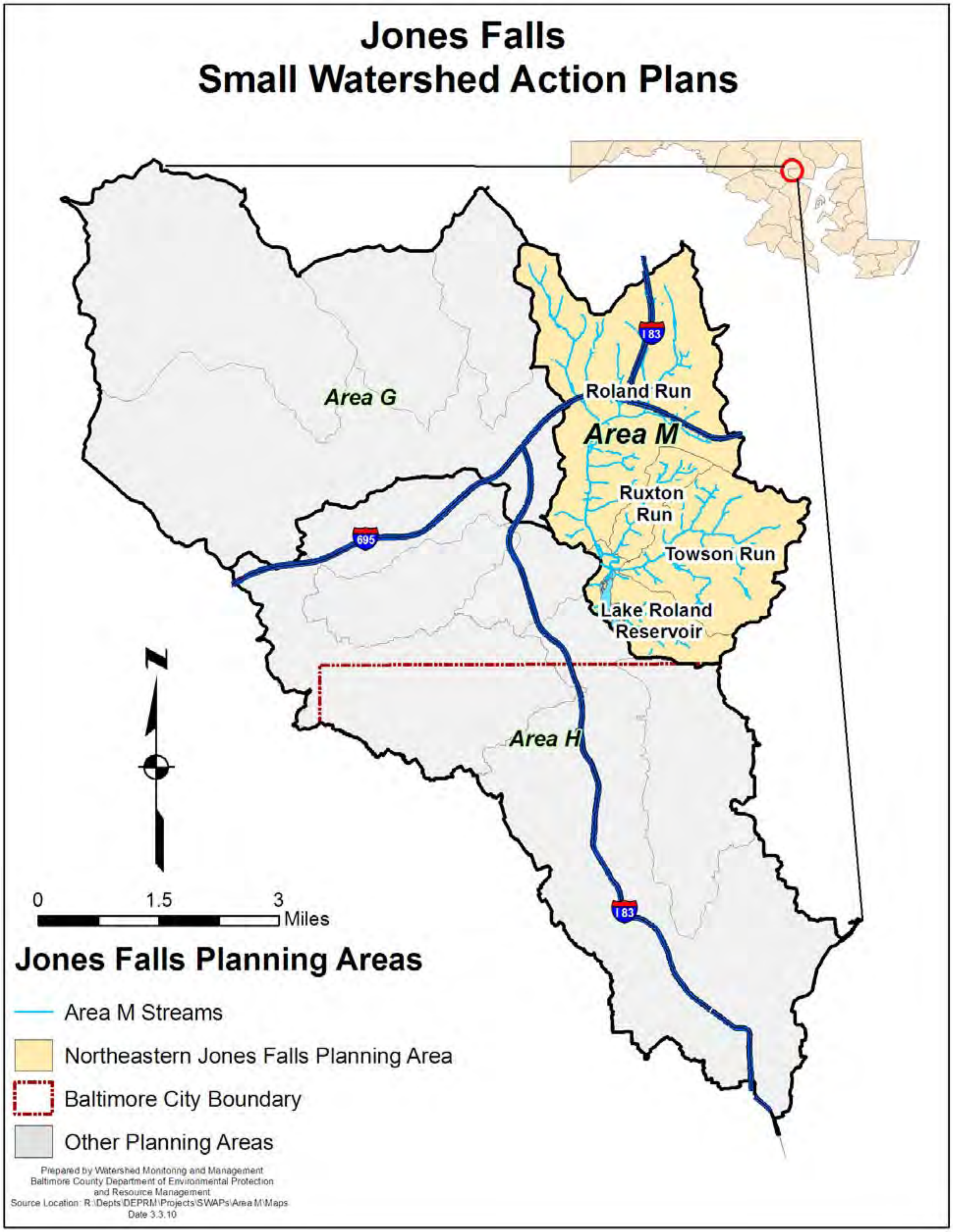

Figure 1-1: Northeastern Jones Falls Watershed in Relation to Other Small Watershed Action Planning Areas

The analysis presented in this report was conducted at the subwatershed scale in addition to an analysis of the entire Northeastern Jones Falls watershed. The subwatershed scale provides information on smaller drainage areas that are often the focus of intense restoration and preservation efforts, and the effect of these efforts may be more easily monitored at that level. Table 1-1 presents the labels used at the subwatershed scale and their respective acreages. Figure 1-2 presents the two levels of scale used in the analysis.

Table 1-1: Northeastern Jones Falls Subwatershed Acreages

Subwatershed Scale	Acres
Roland Run	3,822
Ruxton Run	472
Towson Run	1,846
Lake Roland Direct Drainage*	817
Total	**6,957**

*includes Lake Roland

As Table 1-1 indicates, there are four separate subwatersheds identified for this report.

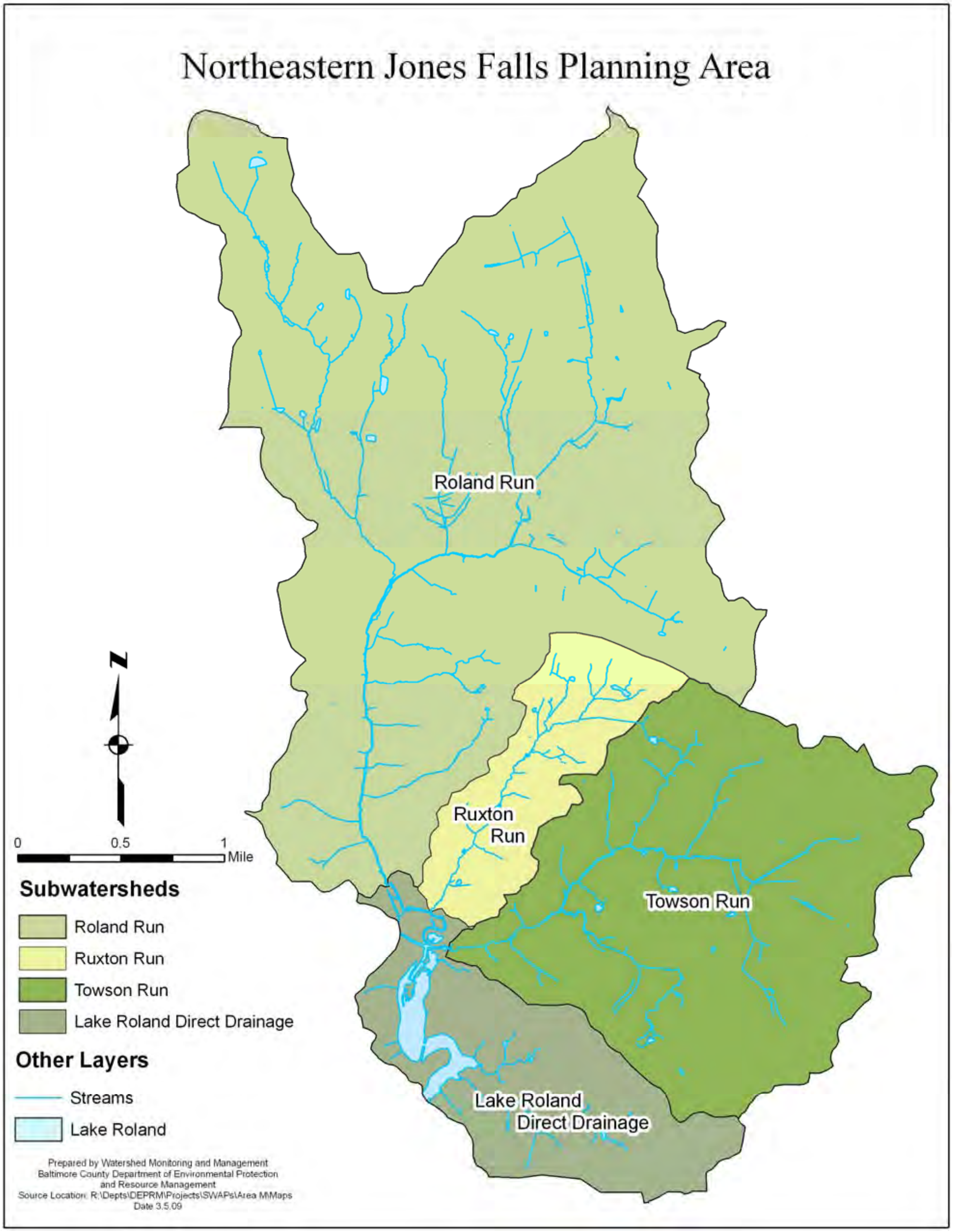

Figure 1-2: Northeastern Jones Falls subwatersheds.

1.3 Report Organization

This report is organized into five chapters. Chapter one presents an overview of the characterization report and general locations and acreage distributions of the study area.

Chapter two presents information on landscape characteristics that may have an effect on natural resources. Included in this chapter are some characteristics that are considered natural resources in their own right, such as, geology and soils. Data is presented on land use, impervious cover, population density, and a number of human modifications to the landscape that affect water quality.

Chapter three focuses on water quality and water quantity, and it relates the landscape characteristics to the potential for degradation or protection.

Chapter four describes the upland assessments conducted to identify major sources of stormwater pollutants and the restoration opportunities for source controls, pervious area management, and improved municipal maintenance.

Chapter five summarizes protection and restoration strategies, including activities that have taken place to date, and their effects on meeting the goals identified by the Northeastern Jones Falls SWAP Steering Committee.

CHAPTER 2

LANDSCAPE AND LAND USE

2.1 Introduction

The physical aspects of a watershed provide the background and context for the associated biological and hydrological processes as well as for the development that takes place on the landscape. In this chapter, we will describe both the natural physical context and the human use and present state of the land in the Northeastern Jones Falls watershed. This will provide the basis for later chapters on water quality, living resources, restoration, and management.

The Northeastern Jones Falls watershed (6,958 acres) represents a portion (19%) of the larger Jones Falls watershed. It is the smallest of three planning areas within the Jones Falls watershed. The Lower Jones Falls Small Watershed Action Plan (SWAP) was completed in the Fall of 2008 and the Upper Jones Falls planning area will be addressed in a future SWAP.

The Northeastern Jones Falls watershed lies entirely within the Piedmont physiographic region of Maryland. The natural Piedmont landscape is characterized by rolling hills, extensive forests, thick soils on deeply weathered crystalline bedrock, and abundant forest litter that minimizes overland flow. Much of the Piedmont, including the Northeastern Jones Falls watershed, was transformed by settlement starting in the 18th Century. Virgin forests were cleared for agriculture, and agricultural land use rose steadily until peaking around the beginning of the 20th Century. The Northeastern Jones Falls watershed sits on part of the northern border of Baltimore City. The core of Baltimore City was developed around the natural harbor starting in the early 1600s. Human development spread out from this core settlement around the harbor up the stream valleys to accommodate the agricultural base needed to supply the growing population. As the commercial aspects of Baltimore City expanded, the agricultural lands nearest the harbor were converted to residential, industrial, and commercial land uses.

This chapter will be presented in two parts: the first will document the natural background state of the natural resources of the watershed, and the second will describe the present state of the landscape as it is now after four centuries of human modification.

2.2 The Natural Landscape

The natural landscape includes many factors that provide the background context and foundation for land use. Among these factors are the physiographic province, the underlying geology and surface soils, the climate that affects the formation and erosion of soils, the stream drainage system, and the forest and wetland cover.

2.2.1 Climate

The climate of the region can be characterized as a humid continental climate with four distinct seasons modified by the proximity of the Chesapeake Bay and Atlantic Ocean (DEPRM, 2000). Rainfall is evenly distributed through all months of the year, with most months averaging between 3.0 and 3.5 inches per month. Storms in the fall, winter, and early spring tend to be of longer duration and lesser intensity than summer storms, which are often convective in nature with scattered high intensity storm cells. The average annual rainfall, as measured at the Baltimore Washington Thurgood Marshall Airport is ~ 42 inches per year. The average annual snowfall is approximately 21 inches, with the majority of accumulation in December, January, and February.

The climate of a region affects the rate and form of soil formation and erosion patterns, and with the interaction of the underlying geology, the stream drainage network pattern and the resulting topography. The climate also affects the vegetative growth and species composition of the terrestrial ecosystem.

2.2.2 Physiographic Province and Topography

2.2.2.1 Location and watershed delineation

The Northeastern Jones Falls watershed lies entirely within the Piedmont Physiographic Province. The highest point of the planning area is located at 600 feet in elevation in the Northwestern tip of the Roland Run subwatershed. The lowest points in the watershed are located at the confluence of the four subwatersheds and around Lake Roland. The Piedmont Physiographic Province is characterized by rolling hills of varying steepness.

All points of land are contained in nested watersheds based on water drainage patterns. Maryland divides its waters into 138, 8-digit watersheds, a scale finer than the USGS 8-digit hydrologic unit codes. Maryland's 8-digit watersheds contain, on average, 75 square miles. The Jones Falls watershed is a below average-sized 8-digit watershed that contains about 37,000 acres, or 57.82 square miles. The Northeastern Jones Falls planning area is 6,958 acres or 10.9 square miles in extent. For development of the Small Watershed Action Plan the Northeastern Jones Falls watershed has been further divided into 4 subwatersheds (Figure 2-1). All data will be presented on the basis of these subwatersheds.

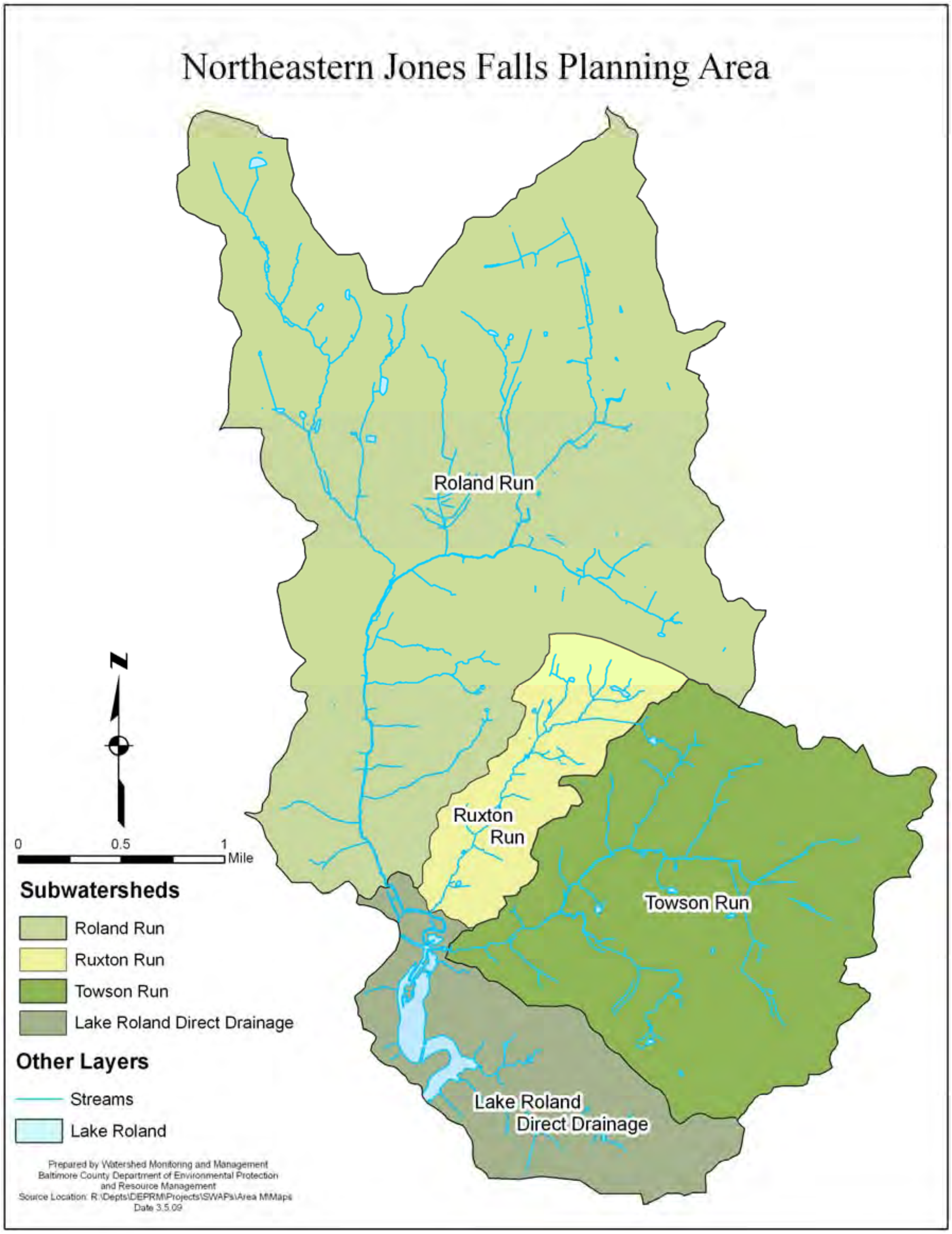

Figure 2-1: Northeastern Jones Falls Planning Area Subwatersheds

2.2.2.2 Topography

The shape of the land, including its steepness and degree of concavity, affect surface water flows and soil erosion, as well as the suitability for development. Steep slopes are more prone to overland flow and soil erosion, and therefore have a greater potential for generation of pollutants.

For this project the slopes were determined based on the soil data layers and divided into five categories: low slopes (0-3%), low to medium slopes (3 %- 8%), medium slopes (8%-15%), steep slopes (15%-25%) and extremely steep slopes (>25 %). Table 2-1 displays the results, in percentage of the area in each category, by subwatershed.

Table 2-1: Northeastern Jones Falls Subwatershed Slope Categories (%)

Subwatershed	**Slope Category**				
	Low	**Low-Medium**	**Medium**	**Steep**	**Extremely Steep**
Roland Run	16.8	46.0	22.5	12.1	2.6
Towson Run	7.1	52.3	25.2	7.5	7.9
Ruxton Run	8.5	45.6	27.9	17.9	0.0
Lake Roland Direct Drainage	12.1	39.0	23.1	9.2	12.8
% of Total	**13.1**	**46.9**	**23.7**	**10.9**	**5.0**

The subwatershed with the highest proportion of steep and extremely steep slopes is Lake Roland Direct Drainage subwatershed (22% of the area). This subwatershed contains relatively broken topography, making it more prone to erosion, depending on soil type and land cover. Conversely, Roland Run has the highest proportion of relatively flat land, making it less prone to erosion, again depending on soil type and land cover. Figure 2-2 displays the distribution of the topographic slope categories throughout the Northeastern Jones Falls Planning Area.

2.2.3 Geology

Table 2-2 displays the geology of the subwatersheds, showing both the percent distribution and the geological type. The metamorphic rock that underlies most of the Northeastern Jones Falls watershed and much of the Piedmont consists mainly of crystalline schist and gneiss with smaller areas of marble. In general, the schist and gneiss formations have relatively low infiltration rates, giving them lower groundwater recharge rates and less vulnerability to contamination.

The geological formations of the Northeastern Jones Falls watershed are shown in Figure 2-3. These formations affect the chemical composition of surface and groundwater, as well as the recharge rate to groundwater and wells. They are also key to soil formation. As such, the geology is closely correlated with water quality in pristine systems, and affects the buffering of pollution to stream systems in developed areas.

Table 2-2: Geological Composition by Subwatershed (%)

Geology	**Type**	**Roland Run**	**Ruxton Run**	**Towson Run**	**Lake Roland Direct Drainage**
Baltimore Gneiss	Metamorphic	6.7	96.1	94.4	90.5
Cockeysville Marble	Metamorphic	45.4	0	0	1.1
Loch Raven Schist	Metamorphic	21.6	0	0	1.5
Oella Formation	Metamorphic	0	0	0	6.3
Patuxent Formation	Unconsolidated	20.8	0	0	0
Setters Formation/Gneiss	Metamorphic	5.6	3.8	0.9	1
Slaughterhouse Gneiss	Metamorphic	0	0	4.7	0

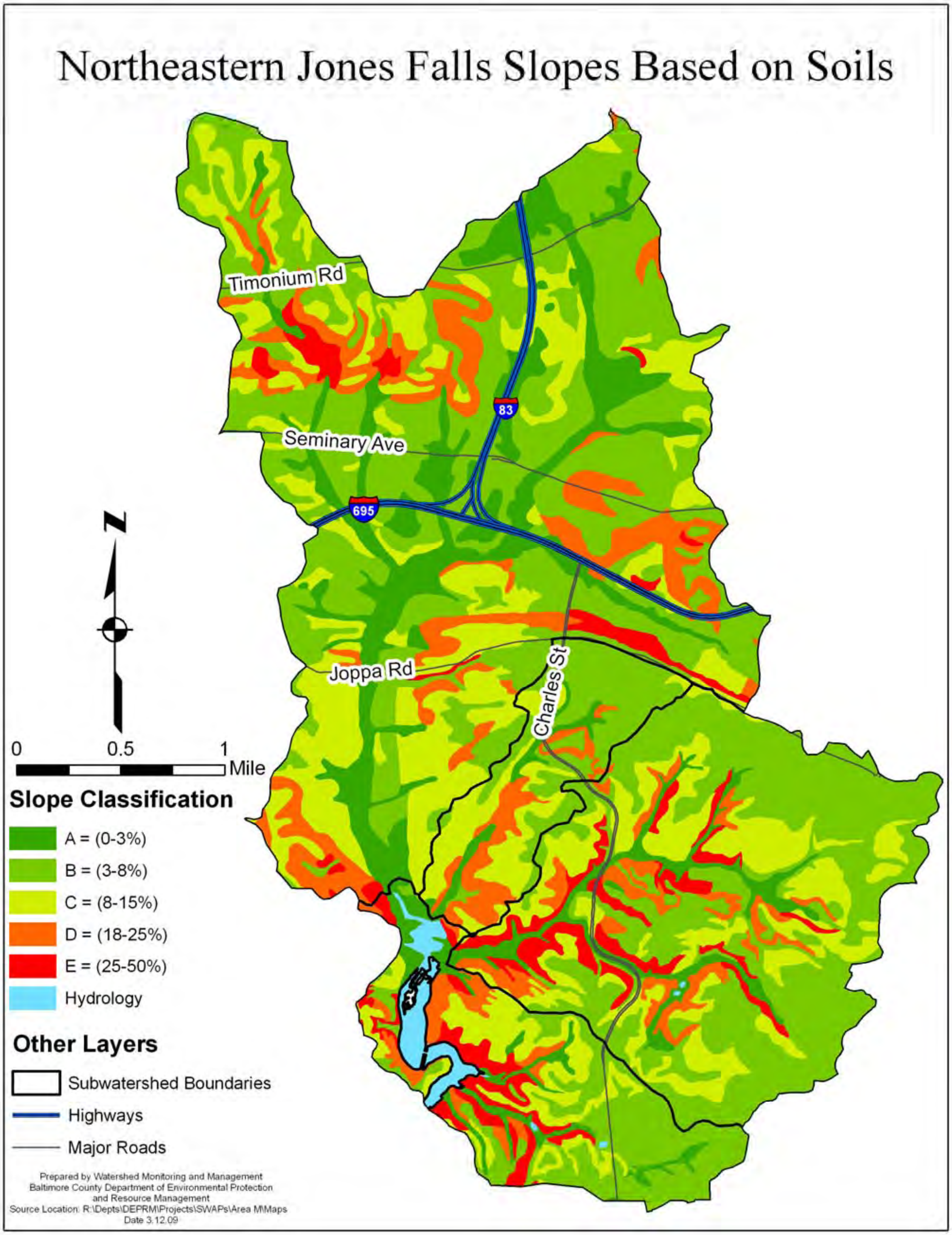

Figure 2-2: Northeastern Jones Falls Watershed Topography

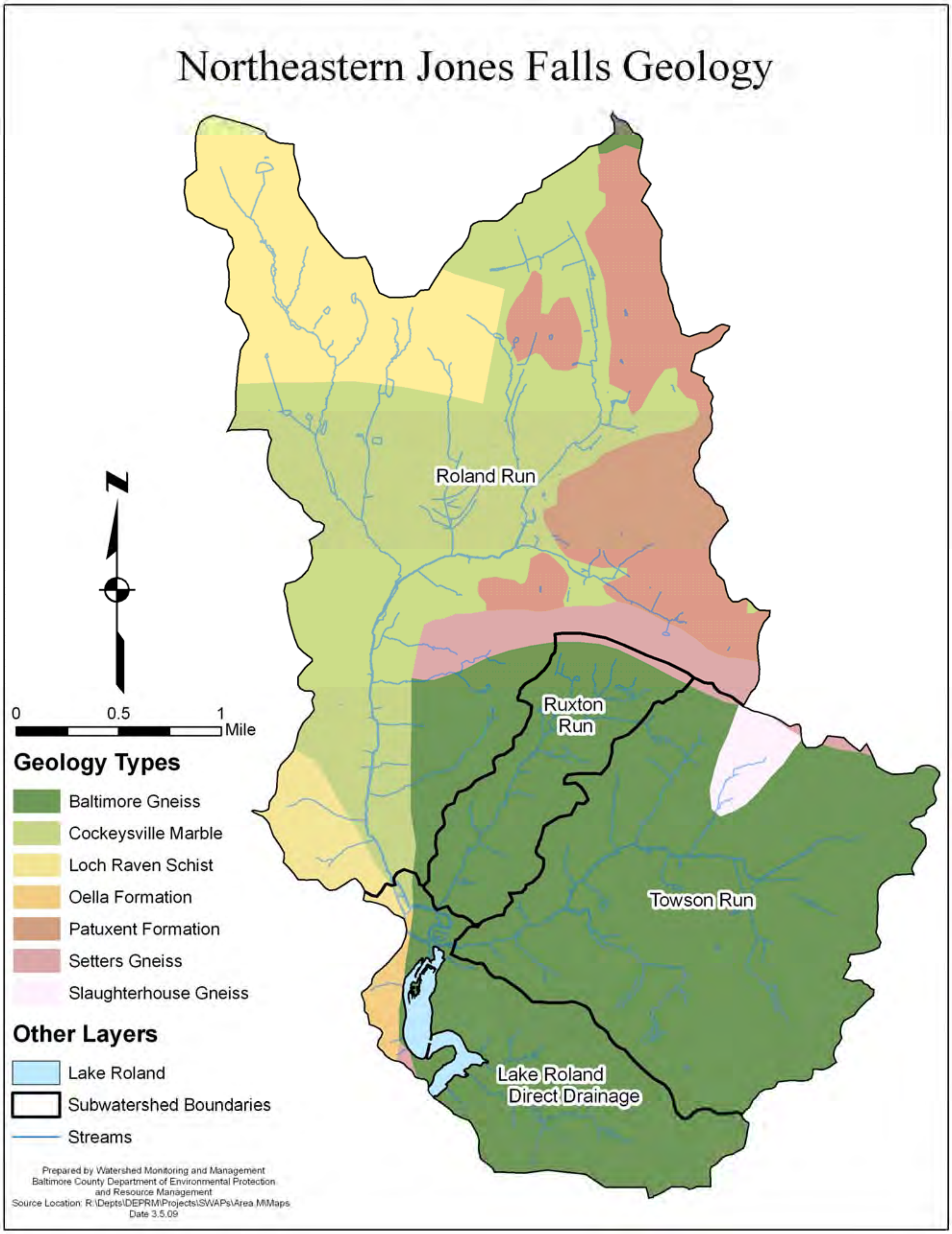

Figure 2-3: Northeastern Jones Falls Watershed Geology

2.2.4 Soils

Soil type and moisture conditions greatly affect how land may be used and the potential for vegetation and habitat on the land. Soil conditions are also one determining factor for water quality and quantity in streams and rivers. Soils are an important factor to incorporate in targeting projects aimed at improving water quality or habitat.

Piedmont soils are developed from highly metamorphosed schist, gneiss, and granite. Local soil conditions vary greatly from site to site.

2.2.4.1 Hydrologic Soil Groups

The Natural Resource Conservation Service classifies soils into four Hydrologic Soil Groups (HSGs) based on the soil's runoff potential. Runoff potential is the opposite of infiltration capacity; soils with high infiltration capacity will have low runoff potential, and vice versa. The four Hydrologic Soils Groups are A, B, C and D, where A's have the smallest runoff potential and D's the greatest. Soils with low runoff potential will be less prone to erosion, and their higher infiltration rates result in faster throughflow of precipitation to groundwater.

Details of the hydrological soils classification can be found in 'Urban Hydrology for Small Watersheds' published by the Engineering Division of the Natural Resource Conservation Service, United States Department of Agriculture, Technical Release–55.

Group A is sand, loamy sand or sandy loam types of soils. It has low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission.
Group B is silt loam or loam. It has a moderate infiltration rate when thoroughly wetted and consists chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.
Group C soils are sandy clay loam. They have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure.
Group D soils are clay loam, silty clay loam, sandy clay, silty clay or clay. This HSG has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.

The soils data analysis is based on the Baltimore County Soil Survey of Baltimore County, Maryland (Reybold, et.al. 1976). The data are summarized in Table 2-3 and Figure 2-4.

Table 2-3: Northeastern Jones Falls Subwatershed Hydrologic Soil Categories (acres)

Subwatershed Scale	Hydrologic Soil Group (acres)			
	A	B	C	D
Roland Run	373.0	2,435.9	620.0	393.5
Towson Run	0.0	1,117.6	600.2	128.5
Ruxton Run	0.0	354.5	78.5	38.6
Lake Roland Direct Drainage	0.0	323.6	350.7	78.9
Total	**373.0**	**4,231.6**	**1,649.4**	**639.5**

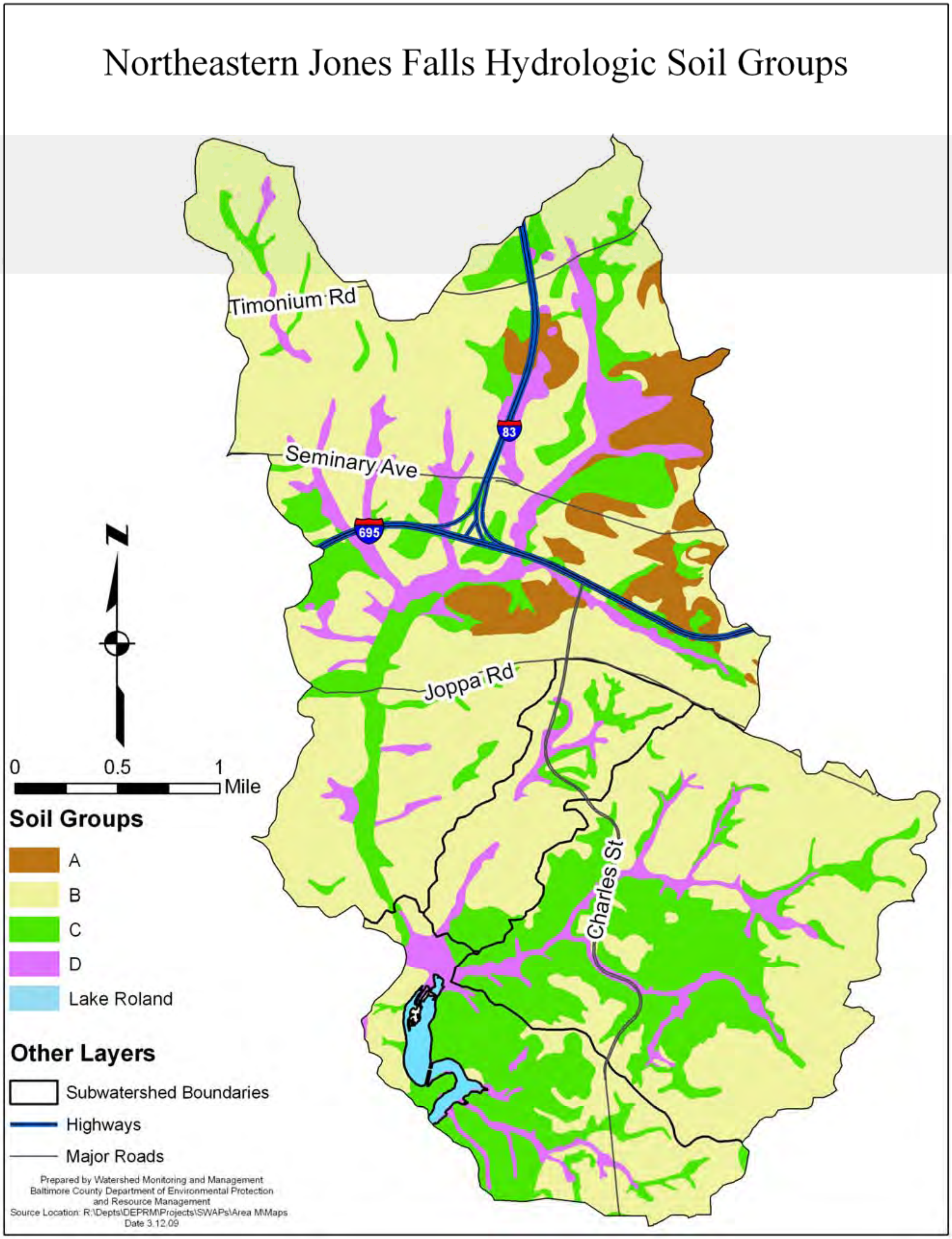

Figure 2-4: Northeastern Jones Falls Hydrological Soil Groups

2.2.4.2 Soil Erodibility

The erodibility of the soil is its intrinsic susceptibility to erosion. It is one factor (known as the K factor) in the Universal Soil Loss Equation, which estimates the rate of erosion at a particular site. Erodibility is based on the physical and chemical properties of the soil, which determine how strongly soil particles cohere with one another. Figure 2-5 shows soil erodibility in the Northeastern Jones Falls watershed, and Table 2-4 is the summary by subwatershed. Low erodibility is defined as a K factor < .24, medium is K between .24 and .32, and high is K>.32. These three classes are based on groupings in the data that resulted in three classes. They also represent the breaks used in the Baltimore County – Steep Slopes and Erodible Soils Analysis for determining riparian buffer widths. They are not the same as MDNR's or MDOP's categories, but overlap with them.

The subwatersheds with the highest values for erodibility offer the greatest potential for interventions addressing soil conservation such as riparian buffer forestation. Best management practices concerned with keeping topsoil in place would be ideal for implementation in these watersheds. This indicator would be useful when combined with additional information about cropland, slope steepness, and distance to streams, as this would indicate areas where one best management practice, the retirement of highly erodible land, would be most useful. High values for this indicator also raise warning flags about other, more urban activities near streams, such as road construction or utility placements.

Overall, the Northeastern Jones Falls watershed shows a fairly even distribution of soil erodibility meaning a large proportion of the watershed's soils are prone to at least moderate erosion. The medium and high erodibility classes represent 75% of the distribution. Only the Roland Run subwatershed has over 25% highly erodible soils. This would rate as a priority subwatershed for maintaining protective land cover.

Table 2-4: Northeastern Jones Falls Subwatershed Soil Erodibility Categories (acres (%))

Subwatershed Scale	Soil Erodibility Category (acres/%)		
	Low	**Medium**	**High**
Roland Run	348.5 (9%)	2482.9 (65%)	991.0 (26%)
Towson Run	364.6 (20%)	1426.5 (77%)	55.1 (3%)
Ruxton Run	72.7 (15%)	376.5 (80%)	22.5 (5%)
Lake Roland Direct Drainage	221.2 (29%)	482.4 (63%)	56.6 (7%)
Total	**1,007.0 (15%)**	**4,768.3 (69%)**	**1,125.2 (16%)**

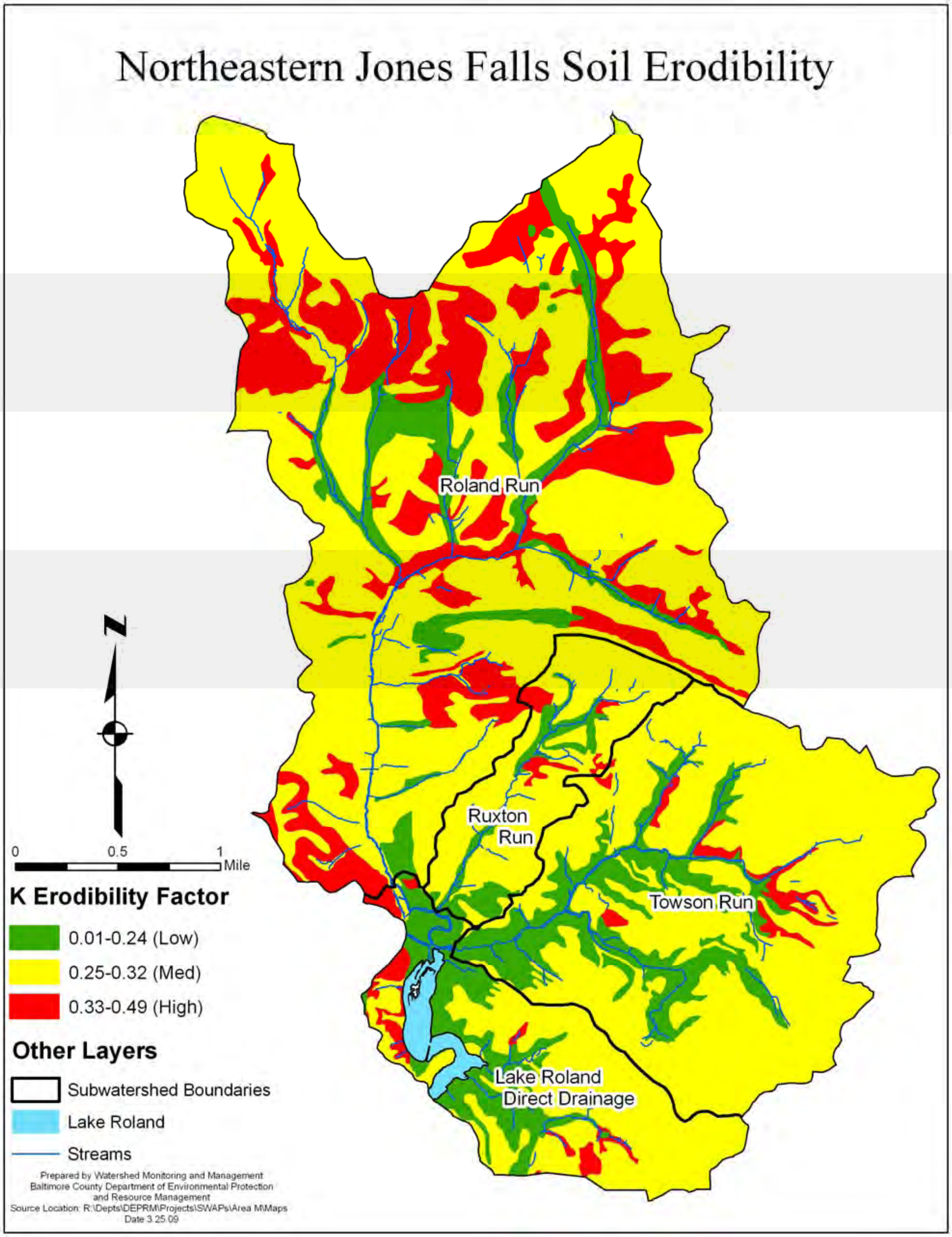

Figure 2-5. Soil Erodibility based on the K factor

2.2.5 Forest

The entire Chesapeake watershed, including the Northeastern Jones Falls watershed, consisted overwhelmingly of old-growth forest at the time of European settlement. Forest cover provides the greatest protection among land cover types for the quality of the soil and water. In pristine systems, forest and soils co-evolve, and in turn shape the hydrological cycle; these systems operate within a natural range of variability, assuring healthy habitat and water quality. In human-impacted systems, forest cover still provides many of these benefits, and can help protect water quality if judiciously planned.

2.2.5.1 Forest Cover

The forest area has been greatly reduced in the Northeastern Jones Falls watershed since European settlement. Based on the Maryland Department of Planning 2007 land use classification system only ~14% forest cover remains.

Table 2-5 shows that the Northeastern Jones Falls watershed contains 646 acres of forest, which is less than 10% of the total area. The Roland Run subwatershed contains the most forested acres while Lake Roland Direct Drainage has the highest percentage forested. These areas are a potential priority for preservation. In the Towson Run subwatershed, on the campus of Towson University, there is an occurrence of state rare Spiral Pondweed (*Potamogeton spirillus)* on the west end of campus. Robert E. Lee Park, which lies partly within the Lake Roland Subwatershed, contains a Natural Heritage Area, which is regulated so that the species and structure are maintained. State rare Few-flowered Panicgrass (*Dichanthelium oligosanthes*) and state threatened Fringed Gentian (*Gentianopsis crinita*) and Serpentine Aster (*Aster depauperatus*) exist here.

Table 2-5: Northeastern Jones Falls Subwatershed Forested Area

Subwatershed	Total Acres	Forested Acres	% Forested
Roland Run	3,822.4	281.8	7.4
Towson Run	1,846.2	150.8	8.2
Ruxton Run	471.7	18.1	3.8
Lake Roland Direct Drainage	760.7	195.2	25.7
Planning Area Totals	**6,901.0**	**645.9**	**9.4**

With the exception of Lake Roland Direct Drainage, all of the subwatersheds contain less than 10% forest cover. All of these areas therefore provide ample opportunity for potential forest restoration.

2.2.6 Stream Systems

Stream systems are a watershed's circulatory system, and the most visible attribute of the hydrological cycle. The stream system is an intrinsic part of the landscape, and closely reflects conditions on the land. The streams are a fundamental natural resource, with myriad benefits for plants, animals, and humans. Maintaining a healthy stream system is a priority for many individuals and organizations, and requires insuring that stream flows and water quality closely mimic the conditions found in un-impacted watersheds. Streams are the flowing surface waters, and are distinct from both groundwater and standing surface water (such as lakes), though they are connected with both of them.

2.2.6.1 Stream System Characteristics

The Northeastern Jones Falls watershed contains approximately 44 miles of streams, all of which drain to Lake Roland and ultimately the Inner Harbor and the Chesapeake Bay.

The Jones Falls Watershed, which is classified as an 8-digit watershed by the State of Maryland, is part of the larger Chesapeake Bay Watershed. The Northeastern Jones Falls Watershed is a subset of the Jones Falls and is separated into 4 subwatersheds. Table 2-6 shows the stream mileage and density by subwatershed. Figure 2-6 shows the stream network and the 4 sub-watersheds.

Table 2-6: Northeastern Jones Falls Streams Mileage and Density

Subwatershed	Total Stream Miles	Stream Miles/Sq. Mile
Roland Run	22.9	3.8
Towson Run	11.5	4.0
Ruxton Run	3.8	5.1
Lake Roland Direct Drainage	5.5	4.7
Total	**43.7**	**4.0**

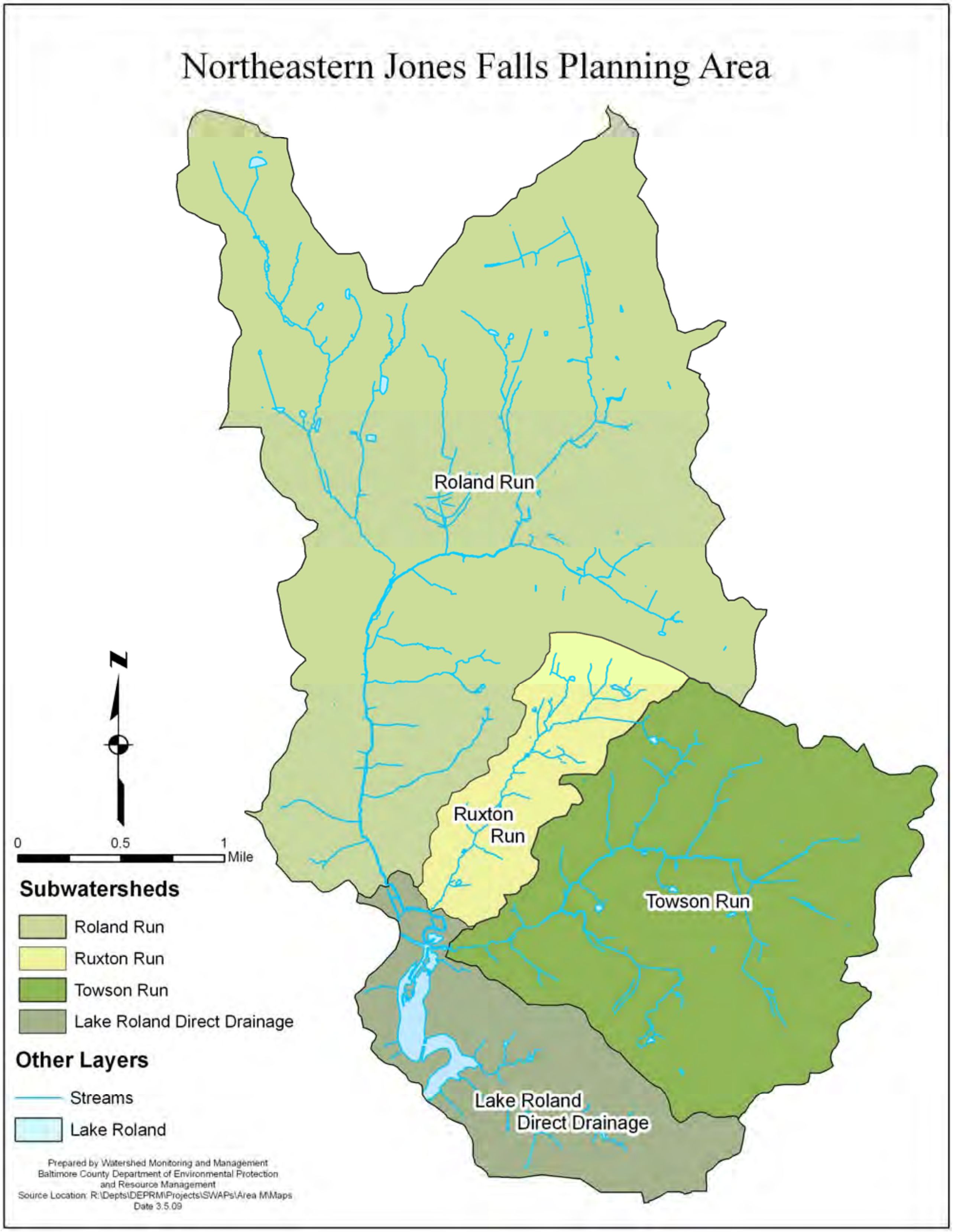

Figure 2-6: Northeastern Jones Falls Watershed Stream Network & Subwatersheds

2.2.6.2 Stream Riparian Buffers

Forested buffer areas along streams play a crucial role in improving water quality, reducing surface runoff, stabilizing stream banks, trapping sediment, mitigating floods, and providing the required habitat for all types of stream life, including fish. Tree roots capture and remove pollutants including excess nutrients from shallow flowing water, and their structure helps prevent erosion and slow down water flow, reducing sediment load and the risk of flooding. Shading from the tree canopy provides the cooler water temperatures necessary for much stream life, especially cold-water species like trout. In smaller streams, such as those surveyed, terrestrial plant material falling into the stream is the primary source of food for stream life. Trees provide seasonal food in the form of leaves and plant parts for stream life at the base of the food chain, while fallen tree branches and trunks provide a more consistent, slow-release food source throughout the year. Tree roots and snags also provide important habitat for fish and other aquatic species. Maintaining healthy streams and forest buffers are important for reducing the nutrient and sediment loadings to the Chesapeake Bay. When stream buffers are converted from forests to agriculture or residential development, many of these benefits are lost, and the health of the stream declines.

The vegetative condition of the riparian buffer, based on 100 feet of buffer on either side of the stream, was analyzed by subwatershed. Three conditions were identified: forested, impervious or open previous. Table 2-7 and Figure 2-7 show the results of the buffer analysis.

Table 2-7: Land Use in the 100 Foot Riparian Buffer – Acres (%)

Subwatershed	Forested	Open Pervious	Impervious	Total
Roland Run	99.6 (23)	102.6 (23)	240.1 (54)	**442.3**
Towson Run	77.3 (37)	31.0 (15)	100.6 (48)	**208.9**
Ruxton Run	29.5 (36)	25.7 (31)	27.1 (33)	**82.3**
Lake Roland Direct Drainage	30.1 (28)	64.7 (60)	12.3 (12)	**107.1**
Total	**236.5 (28)**	**224.0 (27)**	**380.1 (45)**	**840.6**

Towson Run and Ruxton Run show the highest percentage of forested buffer area. The percentage of the riparian buffer that is forested ranges from a high of 37% (Towson Run) to a low of 23% (Roland Run). The open pervious condition, covering 27% (224 acres) of the riparian buffer, represents potential opportunities for reforestation of the riparian buffer. Riparian buffer covered by impervious surfaces are less likely to be remediated, but may represent an opportunity to remove impervious cover and reforest the buffer during redevelopment activities.

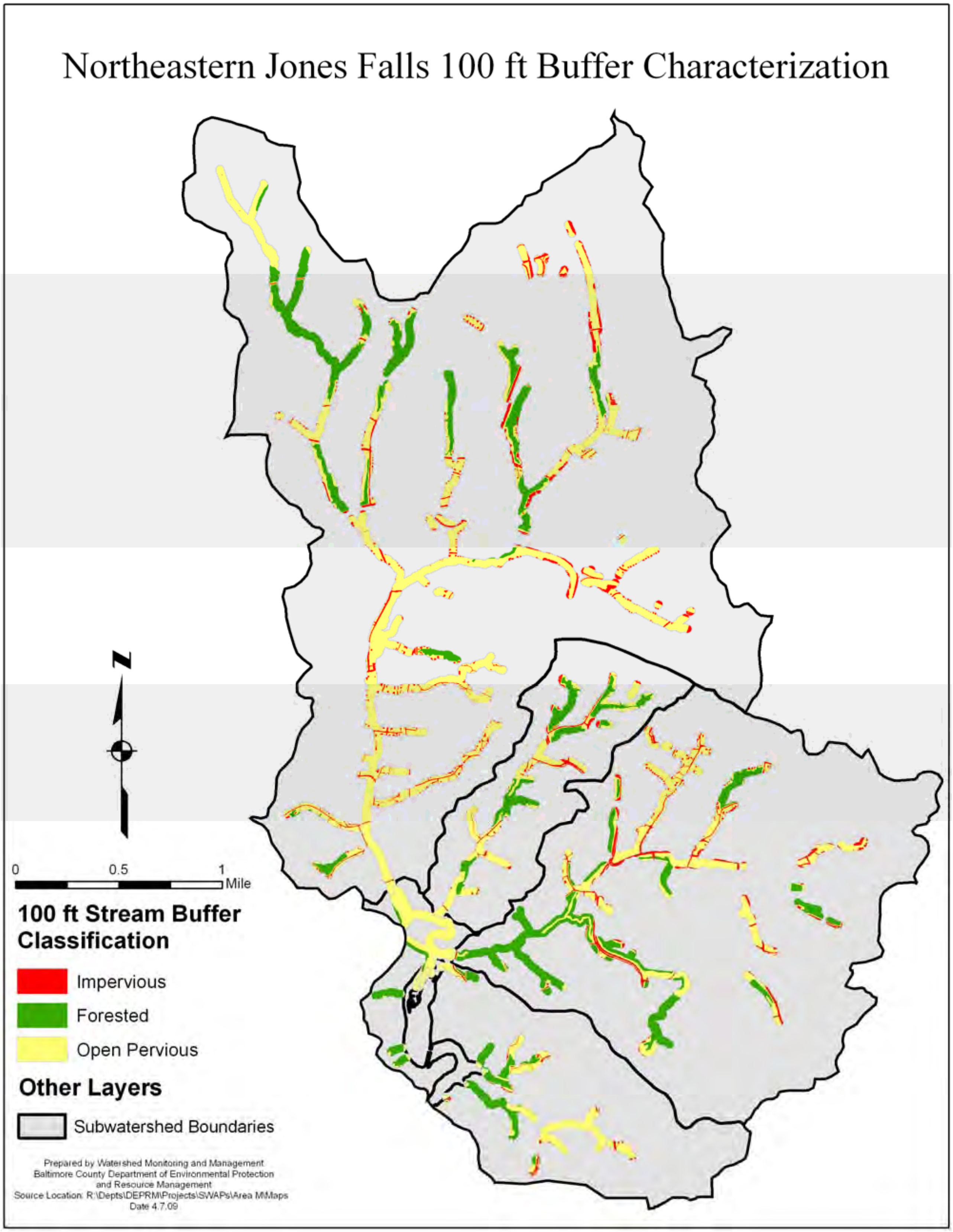

Figure 2-7. Northeastern Jones Falls 100 ft. Riparian Buffer Condition

2.3 The Human Modified Landscape

The natural landscape has been modified for human use over time. The intensity of this modification has increased, starting with the colonization of Maryland in the 1600s. This modification has resulted in environmental impacts to both the terrestrial and aquatic ecosystems. This section will provide a characterization of the human modified landscape and how that modification is associated with impacts to the natural ecosystem. The characterization will progress from the general characteristics of land use and land cover to specific issues including population, impervious cover, drinking water and wastewater, storm water systems, discharge permits, zoning, and build-out analysis.

2.3.1 Land Use and Land Cover

The Northeastern Jones Falls watershed has 6,901 acres of land. The dominating land use types are: residential 4,155 acres (60%), commercial 701 acres (11%) and institutional land 587 acres (9%).

Land use has pronounced impacts on water quality and habitat. A forested watershed absorbs nutrients and slows the flow of water into streams. Roads, parking areas, roofs and other human constructions are collectively called impervious surface. Impervious surfaces block the natural filtration of rain into the ground. Unlike many natural surfaces, impervious surfaces concentrate stormwater runoff, accelerate flow rates and direct stormwater to the nearest stream. This can cause bank erosion and destruction of in-stream and riparian habitat. Watersheds with small amounts of impervious surface tend to have better water quality in local streams than watersheds with greater amounts of impervious surface. Agricultural land, if not properly managed, can cause substantial increases in nutrients and coliform bacteria in streams.

The map of land use in the Northeastern Jones Falls watershed is summarized in Table 2-8 and presented in Figure 2-8. Land use data are based on the Maryland Department of Planning (MDP) 2007 land use GIS data layer.

Table 2-8. Northeastern Jones Falls Watershed Specific Land Use – acres (%)

Land Use	Roland Run	Towson Run	Ruxton Run	Lake Roland Direct Drainage	Total
Low Density Residential	725.1 (19)	206.9 (11)	251.7 (53)	202.2 (27)	1385.9 (20)
Medium Density Residential	1,586.1 (41)	465.3 (25)	57.8 (12)	123.7 (16)	2232.9 (32)
High Density Residential	247.9 (6)	225.7 (12)	0.3 (<1)	62.2 (8)	536.1 (8)
Commercial	376.0 (10)	314.0 (17)	5.4 (1)	5.8 (1)	701.2 (10)
Industrial	139.4 (4)	0.0 (0)	0.0 (0)	0.0 (0)	139.4 (2)
Institutional	61.4 (2)	425.8 (23)	71.3 (15)	28.1 (4)	586.6 (9)
Open Urban	234.3 (6)	40.1 (2)	50.9 (11)	63.7 (8)	389 (6)
Cropland	10.6 (<1)	0.0 (0)	0.0 (0)	0.0 (0)	10.6 (<1)
Pasture	20.4 (1)	0.0 (0)	0.0 (0)	0.0 (0)	20.4 (<1)
Deciduous Forest	242.2 (6)	133.2 (7)	0.0 (0)	141.2 (19)	516.6 (7)
Evergreen Forest	0.0 (0)	0.0 (0)	0.0 (0)	0.3 (0)	0.3 (<1)
Brush	12.3 (<1)	0.0 (0)	2.9 (1)	7.7 (1)	22.9 (<1)
Large Lot Agriculture	8.4 (<1)	0.0 (0)	0.0 (0)	0.0 (0)	8.4 (<1)
Large Lot Forest	54.7 (1)	35.3 (2)	30.4 (6)	80.3 (11)	200.7 (3)
Water	0.0 (0)	0.0 (0)	0.0 (0)	9.9 (1)	9.9 (<1)
Wetlands	0.2 (<1)	0.0 (0)	1.0 (<1)	33.2 (4)	34.4 (<1)
Transportation	103.4 (3)	0.0 (0)	0.0 (0)	0.0 (0)	103.4 (1)

Table 2-9. Northeastern Jones Falls Watershed General Land Use – acres

Land Use	Roland Run	Towson Run	Ruxton Run	Lake Roland Direct Drainage	Total
Forested	281.8	150.8	18.1	195.2	**645.9**
Agriculture	35.2	0.0	0.0	0.0	**35.2**
Urban Land Use	3,505.2	1,695.4	452.6	525.9	**6,179.1**
Other	0.2	0.0	1.0	43.1	**44.3**

The 2007 land use GIS layer includes two new categories, large lot agriculture and large lot forest. In estimating agriculture and forest land use types, acreages in these categories were assumed to be 50% low-density residential and 50% agriculture or forest respectively based on GIS orthos. The single large lot agriculture parcel in the study area was deemed to be the pasture type of agriculture rather than crop, based on GIS orthos.

A very limited amount of agriculture, 0.5%, is still present in the Northeastern Jones Falls planning area, 3 separate areas located in the Roland Run subwatershed. GIS orthos show this land to be in pasture despite the GIS data showing one area as cropland. Forest cover accounts for only 9% of the land use. Urban/suburban residential development accounts for 60% of the land use in Northeastern Jones Falls Watershed, with the majority (52%) in medium and low-density residential land use.

Commercial land use, consisting mainly of retail and wholesale operations, represents 11% of the land cover within the Northeastern Jones Falls watershed.

Note that the 56.7 acres that is Lake Roland is not included in this analysis.

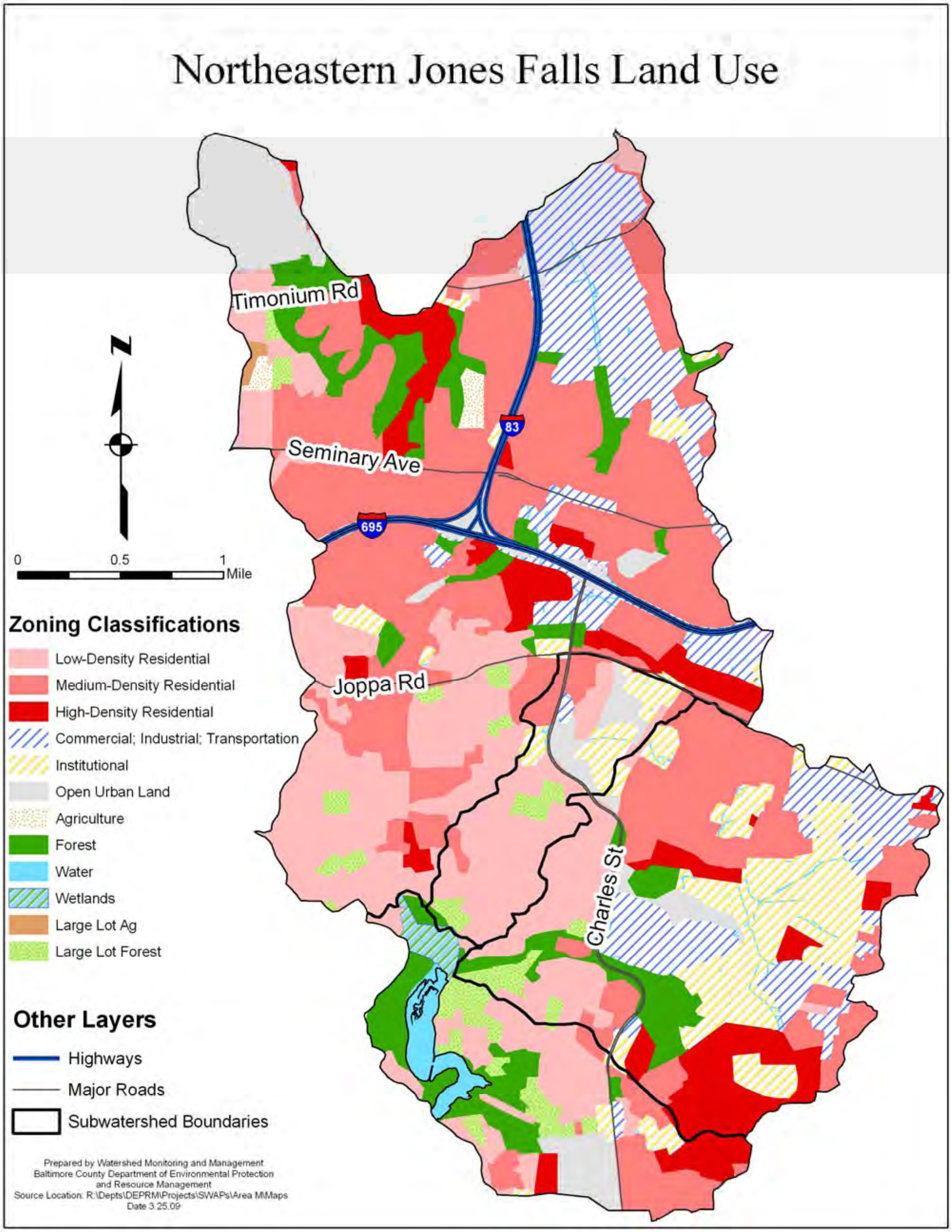

Figure 2-8: Land Use in the Northeastern Jones Falls Watershed.

2.3.2 Population

Population estimates based on the 2000 US census were used to evaluate the intensity of land use. A higher per acre population represents a more intense use of the land and potential for environmental degradation. However, smart growth principles are intended to direct future growth to areas of existing services, mainly where development has already occurred. This will result in less land conversion to residential and supporting commercial land uses and in the conservation of lesser impacting land uses, such as, forest and agriculture.

The development of urban/suburban communities leads to an increase in population density and results in a larger concentration of impervious surfaces. A correlation has been established showing a degredation in water quality with an increase in impervious coverage (Figure 2-10). Table 2-10 shows the subwatershed population sizes along with a calculation of the population density based on both the subwatershed acreage and the subwatershed impervious cover acreage. The population density distribution is displayed in Figure 2-9.

Table 2-10: Northeastern Jones Falls Subwatershed Population Data

Subwatershed	Total Population (2000 census)	SWAP Area (acres)	Population Density (per acre)	Population Density (per impervious acre)
Roland Run	15,025	3,822.4	3.9	15.3
Towson Run	13,726	1,846.2	7.4	25.5
Ruxton Run	1,248	471.7	2.7	16.2
Lake Roland Direct Drainage	2,216	760.7	2.9	20.8
Total	**32,215**	**6,901**	**4.7**	**18.9**

Towson and Roland Run are shown to be the most populous subwatersheds in the study area. This is most likely due to the low density zoning of the Ruxton Run and Lake Roland areas. See Section 2.3.8 and Figure 2-13.

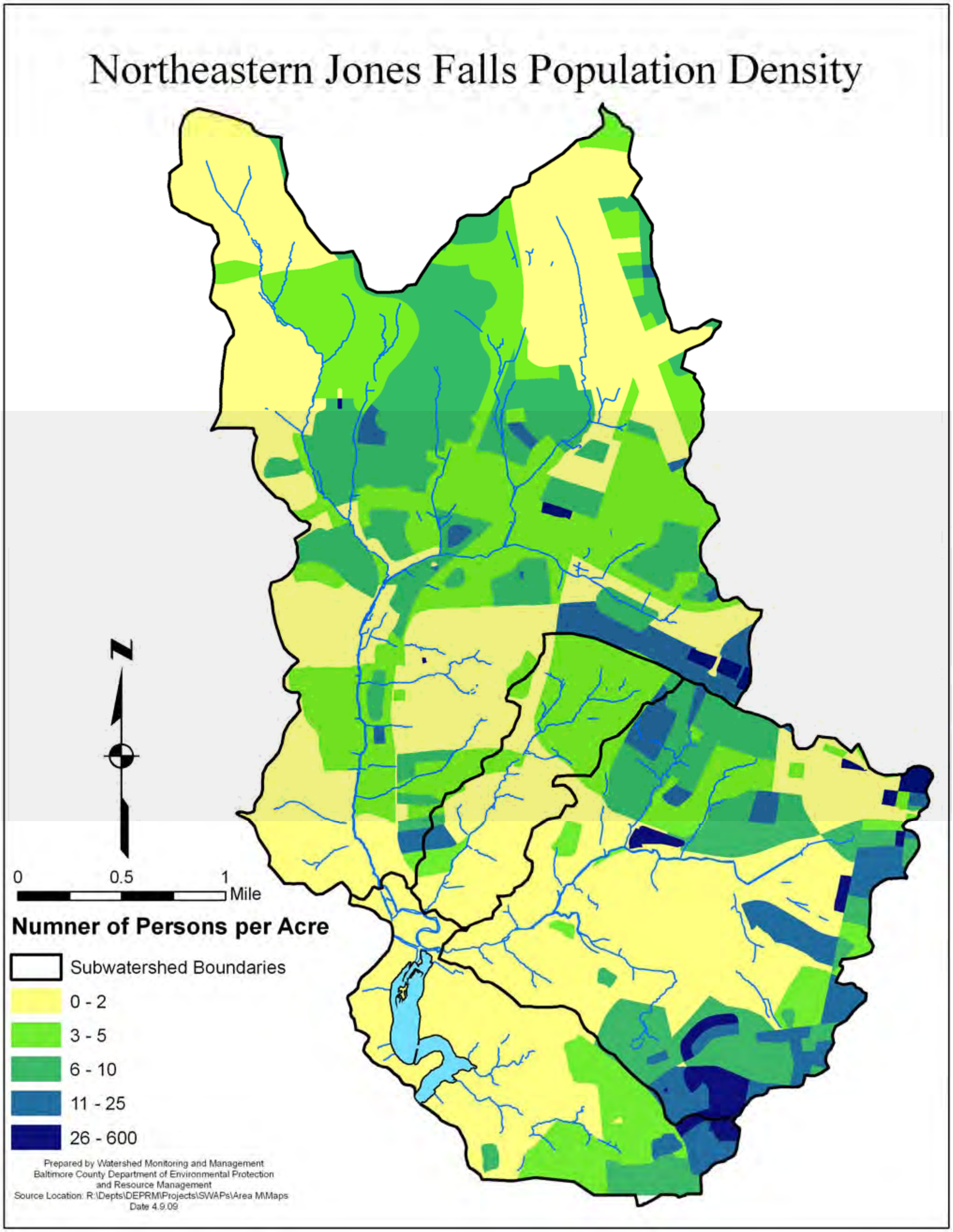

Figure 2-9: Population in the Northeastern Jones Falls Watershed

2.3.3 Impervious Surfaces

Roads, parking areas, roofs and other human constructions are collectively called impervious surface. Impervious surface blocks the natural seepage of rain into the ground and the natural filtration from soil and vegetation. Unlike many natural surfaces, impervious surface typically concentrates stormwater runoff, accelerates flow rates and directs stormwater to the nearest stream. This water has a high amount of energy and results in stream erosion that degrades habitat. Watersheds with small amounts of impervious surface tend to have better water quality in local streams than watersheds with greater amounts of impervious surface. Some aquatic species tend to disappear when the proportion of impervious area in the watershed reaches some threshold level. While this level varies by species, it can be quite low. The exact level of impervious area that can be tolerated depends partly on the watershed, and remains a topic of discussion among fisheries experts. Other species, e.g. macro-invertebrates, are also negatively impacted by increases in the impervious area, though the pertinent knowledge is often incomplete.

The Center for Watershed Protection has developed an impervious surface model to predict stream quality based on the amount of impervious cover in a drainage area. Stream quality can be a measure of the habitat, the biological community, or the chemical/physical characteristics of the stream. This model is shown graphically in Figure 2-10. The model would predict slight impact in drainage areas with less than 10% impervious cover. These watersheds would be sensitive in that an increase in impervious cover would result in degradation of stream quality. Watersheds that have an impervious cover between 10% and 25% are impacted and would show signs of degradation. The possibility exists to restore these streams to some semblance of a healthy and habitat supporting stream. When the impervious cover exceeds 25% the streams are usually damaged with much of the stream either piped or channelized. Management of these streams may focus on the reduction of downstream impacts through pollutant load reduction, but the ability to return the stream to healthy functions is remote. Once the impervious cover exceeds 60% in a watershed most of the natural stream system is gone. Again, restoration may focus on protecting downstream resources through pollutant load reduction. In both the damaged and severely damaged streams an additional restoration goal will be to make the remaining stream system aesthetically pleasing and an amenity to the community.

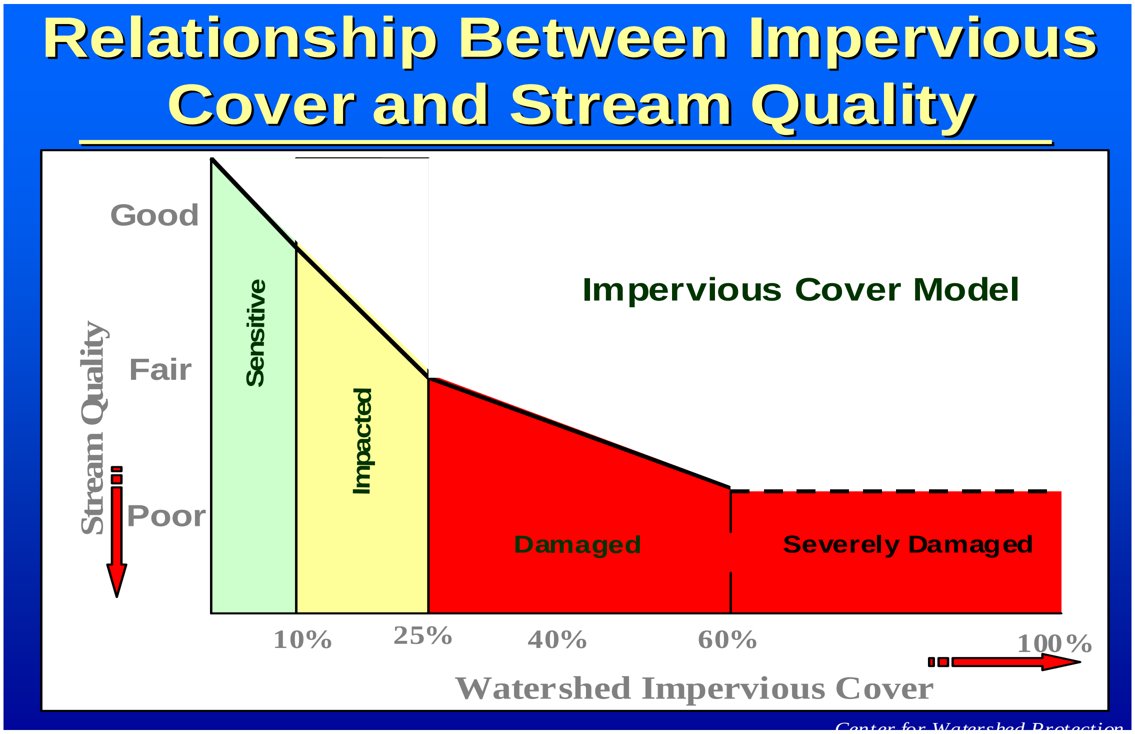

Figure 2-10: Impervious Cover Model

To derive estimates of impervious surface acreages in the Northeastern Jones Falls, the 2005 roads and building GIS data layers were quantified and combined.

Table 2-11 shows the impervious cover and the calculated percent impervious by subwatershed for the Northeastern Jones Falls watershed. The total amount of impervious surface in the watershed is estimated to be 1,705 acres or 25% of the watershed area. This is right at the lower threshold of a damaged watershed. Compared to less urbanized watersheds in Baltimore County, this is a relatively high level of imperviousness.

Table 2-11. Estimated Impervious Surface in the Northeastern Jones Falls

Subwatershed	Acres Car Habitat	Acres Buildings	% Impervious
Roland Run	626.5	356.0	25.7
Towson Run	321.7	216.7	29.2
Ruxton Run	47.3	29.7	16.3
Lake Roland Direct Drainage	64.5	42.3	14.0
Total	**1060.0**	**644.6**	**24.7**

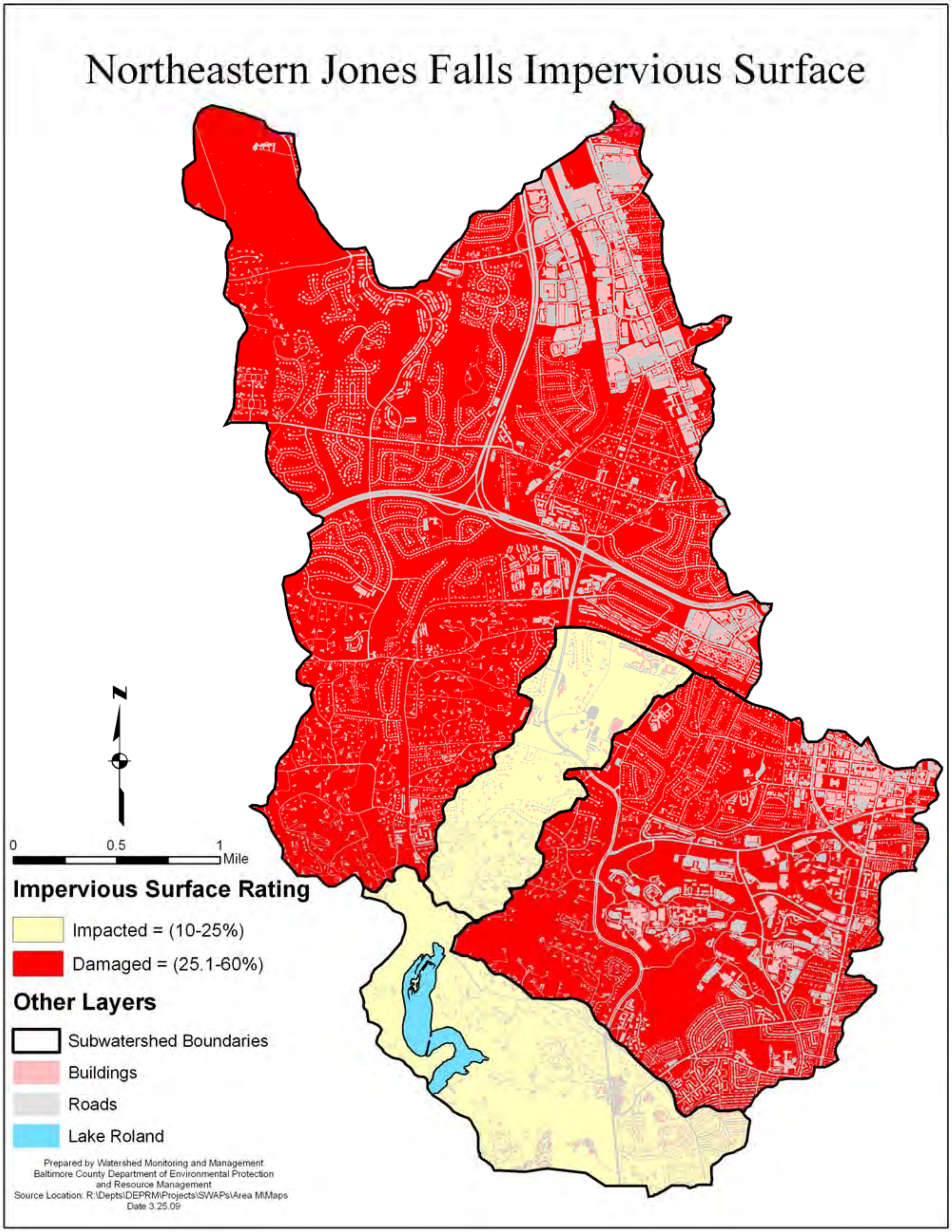

Figure 2-11: Impervious Cover Ratings by Subwatershed

2.3.4 Drinking Water

Drinking water is a fundamental need for human development. Drinking water can be supplied by either public distribution systems or by wells associated with individual developed properties. Having an adequate supply of drinking water is essential to maintaining the human population in a region. Most of the development within the Northeastern Jones Falls planning area is served by public water.

2.3.4.1 Public Water Supply

Environmental impacts associated with a public supply of water include the potential for increased residential development with the resulting impacts associated with any increase in impervious cover (see 2.3.3) and the potential for leaks from the system. Leaks from public water supply systems introduce chlorine into the aquatic system potentially resulting in the death of aquatic organisms. In addition, major leaks may cause erosion, which introduces sediment into the stream channels and which may bury aquatic benthic communities and degrade habitat.

2.3.5 Wastewater

Wastewater is treated and disposed of in two ways, either through individual wastewater treatment systems (septic systems) or through public conveyance to a treatment facility. Residential wastewater consists of all of the water that is typically used by residents, including, wash water, bathing water, human waste deposal water, and any other rinse water (paint brush, floor washing, etc). Industrial operations also dispose of any water used as part of their operation through a permitted and monitored discharge process. Depending on the operation the water could contain any number of contaminants, including metals, organic compounds, detergents, or synthetic compounds. All of these wastes have the potential to harm the natural environment.

2.3.5.1 Septic Systems

Properly functioning septic systems provide treatment for virtually all of the phosphorus, but leak nitrogen in the form of nitrates. Depending on the location of the system the nitrates may either be reduced or eliminated through denitrification as the water passes through riparian buffers, particularly forested riparian buffers. Failing systems can result in increased contamination of the aquatic environment through increased releases of nitrogen, phosphorus, and other chemicals. They can also result in increased bacterial contamination of the waterways and potential for human health concerns. Table 2-14 shows residential and commercial/ industrial septic hookups.

2.3.5.2 Public Sewer

A public sewer system conveys wastewater from individual residences or businesses to a facility that treats the wastewater prior to discharge. The system itself consists of the piping system and cleanouts on the individual properties that are owned by the property owner. The individual landowner is responsible for the maintenance of this part of the system. The part of the system that is in the public right-of-way is owned and maintained by the local government. The public system consists of the gravity piping system, access manholes, pumping stations, and force mains. There is one active pumping station located in the Lake Roland Direct Drainage subwatershed. Tables 2-12 and 2-13 show sewer piping length and sewer piping length per square mile by subwatershed respectively. Table 2-14 shows residential and commercial /industrial sewer hookups.

Table 2-12: Sewer Piping Length

Subwatershed	Pressurized Main (ft)	Pressurized Main Abandoned (ft)	Gravity Main (ft)	Gravity Main Abandoned (ft)	Total
Roland Run	5,310.3	17.4	331,641.9	2,797.6	**339,767.2**
Towson Run	264.1	2,477.6	180,779.4	4,021.2	**187,542.3**
Ruxton Run	0.0	0.0	26,717.7	0.0	**26,717.7**
Lake Roland Direct Drainage	1,094.9	1,410.2	41,802.8	0.0	**44,307.9**
Total	**6,669.3**	**3,905.2**	**580,941.8**	**6,818.8**	**598,335.1**

Table 2-13: Sewer Piping Length Per Square Mile

Subwatershed	Square Miles	Pressurized Main (ft/mi^2)	Gravity Main (ft/mi^2)
Roland Run	6.0	889.1	55,528.2
Towson Run	2.9	91.1	62,661.8
Ruxton Run	0.7	0.0	36,252.0
Lake Roland Direct Drainage	1.3	857.4	32,735.2
Total	**10.9**	**611.9**	**53,297.4**

Table 2-14 Sewer and Septic Hookups in the Northeastern Jones Falls

Subwatershed	Residential Septic Hookups	Residential Sewer Hookups	Commercial / Industrial Septic Hookups	Commercial / Industrial Sewer Hookups
Roland Run	341	4,725	118	1091
Towson Run	140	3,308	18	510
Ruxton Run	75	223	0	14
Lake Roland Direct Drainage	98	718	1	90
Total				

Environmental impacts associated with the public sewer system are usually the result of sewage overflows. These overflows usually result from blockages within the sewage system, pumping station failure, or rainwater inflows exceeding the capacity of the pipe. The EPA reports there are at least 40,000 of these incidents in the U.S. per year. The environmental and human health consequences of these overflows can be serious. E. Coli bacteria and other pathogens can be present, posing health risks to individuals who may come in contact with contaminated water. Sewer overflows can also contain high levels of nitrogen and phosphorus that are toxic to aquatic life and feed organisms that deplete oxygen in waterways. High levels of sediment are also present in these overflows, which can clog streams and block sunlight from reaching essential aquatic plants.

2.3.5.3 Waste Water Treatment Facilities

There are no wastewater treatment facilities in the Northeastern Jones Falls subwatershed. All sewered wastewater in the planning area is piped to the Back River Wastewater Treatment Facility.

2.3.6 Stormwater

Stormwater consists of the surface and shallow subsurface water that runs off during and immediately after storm events. As indicated above, impervious surfaces increase the amount of runoff that makes its way to the streams. Soil characteristics and slope also affect the amount of water that runs off, as well as the amount and intensity of rainfall. Stormwater can carry pollutants from impervious surfaces and agricultural operations into the streams. The increase in the amount of runoff due to impervious surfaces (high) and agricultural operations (moderate) can result in stream erosion that destroys natural habitat and the ecosystem services of streams such as nutrient reduction.

2.3.6.1 Storm Drainage System

The storm drainage system consists of either curb and gutter with associated inlets and piping system or drainage swales. The function of either system is to remove water quickly from roadways to prevent flooding and potentially hazardous situations. However, the environmental impact from the two types of systems is different. The curb and gutter system with inlets, piping and storm drain outfalls quickly and efficiently removes water from impervious surfaces and routes that water to low spots in the topography, usually directly to the stream. This type of system delivers not only increased volumes of water, but untreated pollutants associated with impervious surfaces. Drainage swales (road side ditches) do not move the water as efficiently as curb and gutter systems and therefore the water is slowed somewhat prior to entering the stream. The drainage swales also allow some infiltration into the soil thus reducing the amount of water eventually delivered. The infiltration and the slower movement of water also provide filtering of pollutants. Table 2-15 shows the components of the storm drain system by subwatershed in Northeastern Jones Falls. Outfall data was obtained by combining data from the Baltimore County major and minor outfall shapefiles. Storm drain inlets and piping data was taken from the county GIS 'UTILITY' feature classes.

Table 2-15: Northeastern Jones Falls Storm Drain System

Subwatershed	Storm Drain Outfalls (#)	Storm Drain Inlets (#)	Storm Drain Piping (ft)
Roland Run	102	733	144,143
Towson Run	33	379	58,018
Ruxton Run	4	25	4,506
Lake Roland Direct Drainage	10	83	13,925
Total	**149**	**1,220**	**220,592**

2.3.6.2 Stormwater Management Facilities

Starting in the mid-1980s stormwater management was required by Maryland Department of the Environment for new development to control the quantity of runoff. Within that set of regulations was an exemption for large lot subdivisions (>2 acres). Large lot subdivisions only had to provide stormwater management for roads. The stormwater management regulations evolved from the initial requirement of water quantity control to including water quality control in the early 1990s; and in 2000 a new stormwater design manual was released by Maryland Department of the Environment requiring additional water quality and quantity controls along with stormwater management for large lot subdivisions. Then in 2007 Maryland passed the Stormwater Management Act of 2007. The Act requires that environmental site design (ESD), through the use of nonstructural best management practices and other better site design techniques, be implemented to the maximum extent practicable.

There are a variety of types of stormwater management facilities that have different pollutant removal capabilities. The initial dry pond design for water quantity management has the lowest pollutant removal efficiency, while those facilities that infiltrate or filter the water have among the highest pollutant removal capabilities.

The following Figure 2-12 and Table 2-16 illustrate the stormwater management (SWM) facilities in the Northeastern Jones Falls watershed. Figure 2-12 shows that the stormwater management facilities are fairly well scattered throughout the watershed. A total of 50 facilities are represented. The facility type and drainage area to the facility are listed by subwatershed in Table 2-16.

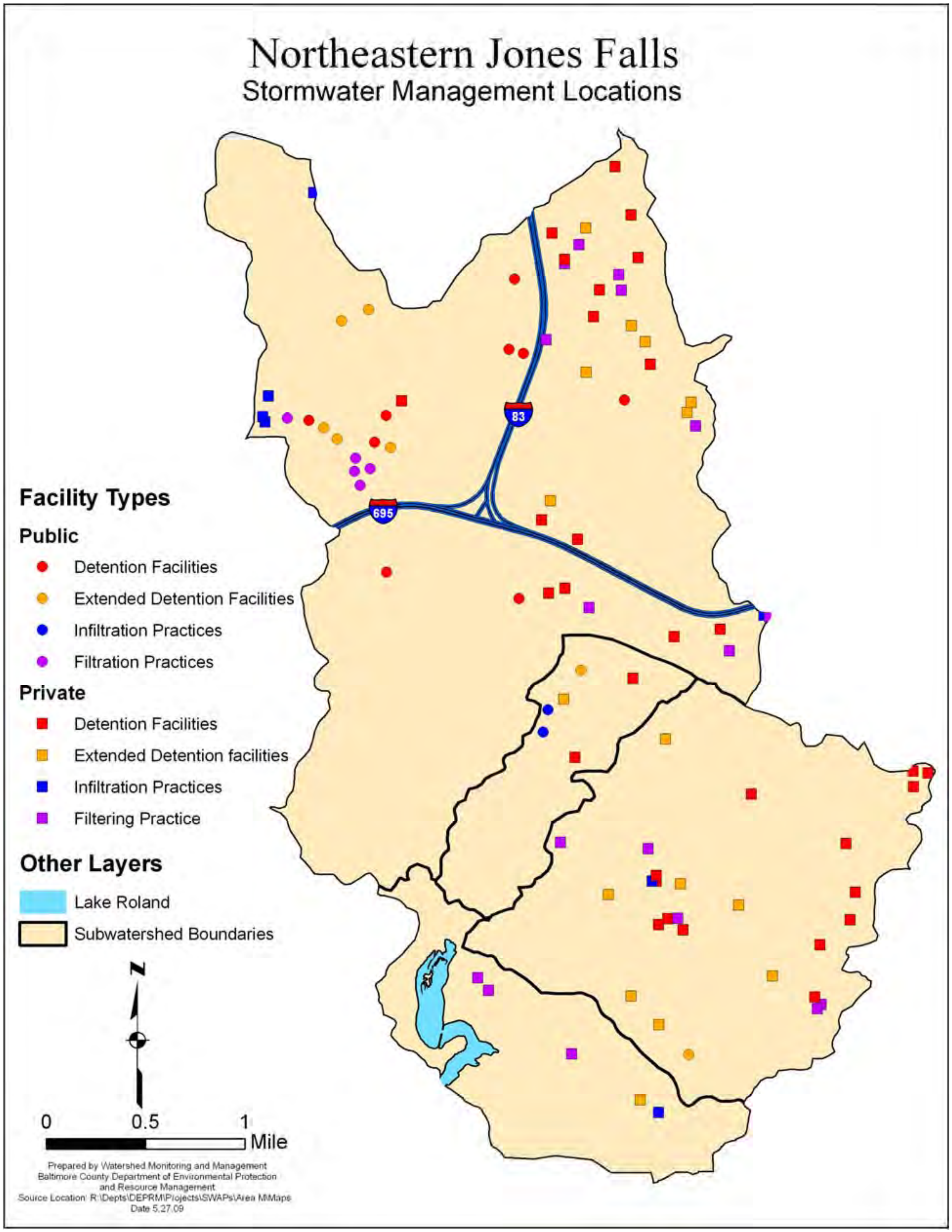

Figure 2-12: Stormwater Management in the Northeastern Jones Falls SWAP Area

Table 2-16: Northeastern Jones Falls Stormwater Management Facilities

Subwatershed	Roland Run	Towson Run	Ruxton Run	Lake Roland Reservoir	Totals
Dry Pond Hydro (#) Drainage Area (acres)	23 380.4	13 45.3	1 10.6	0 0.0	37 436.3
Wet Ponds (#) Drainage Area (acres)	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
Infiltration (#) Drainage Area (acres)	4 4.1	1 1.3	2 4.9	1 1.4	9 11.7
Filtration (#) Drainage Area (acres)	10 57.4	7 10.2	0 0.0	4 7.4	21 75.0
Extended Detention (#) Drainage Area (acres)	17 246.1	10 92.2	3 24.4	1 14.6	31 377.3
Other (#) Drainage Area (acres)	0 0.0	0 0.0	0 0.0	0 0.0	0 0.0
TOTAL (#) ***TOTAL (acres)***	54 688.0	31 149.0	6 39.9	6 23.4	97 900.3

Data in Table 2-16 comes from the 2009 SWM shapefile and 2009 digitized drainage areas. Table 2-16 reveals that the dry detention structures are the best-represented storm water management design in terms of number of facilities. These structures have the lowest pollution removal efficiency and therefore present the best opportunities for conversion to a more efficient design. Note that there are no wet ponds or wetland facilities in the planning area.

Table 2-17 shows the percentage of urban land use areas in the Northeastern Jones Falls that are treated by stormwater management. Note the total *urban* acres treated are less than total acres treated as there are portions of forest and agricultural land use that drain to SWM facilities.

Table 2-17: Northeastern Jones Falls Urban Areas Treated by SWM

Subwatershed	Total Acres	Urban Land Use Acres	Urban Acres Treated by SWM	Urban Land Use Treated by SWM (%)
Roland Run	3,822	3,505	572	16
Towson Run	1,846	1,695	141	6
Ruxton Run	472	453	40	9
Lake Roland Direct Drainage	761	526	23	4
Total	**6,901**	**6,179**	**776**	**13**

2.3.7 NPDES Permits

Facilities that discharge municipal or industrial wastewater, or conduct activities that can contribute pollutants to a waterway are required to obtain a National Pollutant Discharge Elimination System (NPDES) permit. Table 2-18 shows the number of NPDES permits in each of the four subwatersheds in the Northeastern Jones Falls.

Table 2-18: NPDES Permits in the Northeastern Jones Falls Watershed

Subwatershed	# Industrial	#General	# Pools	# Of Permits
Roland Run	4	4	4	12
Towson Run	0	1	3	4
Ruxton Run	0	0	0	0
Lake Roland Direct Drainage	0	0	1	1
Total	**4**	**5**	**8**	**17**

2.3.8 Zoning

"Zoning is the legal mechanism by which county government is able, for the sake of protecting the public health, safety, morals, and/or general welfare, to limit an owner's right to use privately-owned land." (Baltimore County Office of Planning, 2003). Zoning therefore controls the development patterns that are observed over time. The county and city have independently developed the zoning codes that are in place in the Northeastern Jones Falls watershed. The current zoning is displayed in Figure 2-13. As can be seen from this figure, there are a wide variety of zoning types; however, the majority fall into one of the residential zoning types. Table 2-19 shows county zoning data and Table 2-20 shows this same data broken out by subshed.

Baltimore County began incorporating smart growth management policies in the late 1960s. The urban rural demarcation line (URDL) that was established in 1967 identified the areas of the County that had or would receive public water and sewer infrastructure, and therefore would accommodate urban residential, commercial and employment development. In the rural areas, reliance on private well and septic systems limited the amount of development that could be accommodated, and thereby helped ensure the area's continued use for agriculture, natural resource protection, and low-density rural residential uses. Figure 2-13 shows the location of the URDL within the SWAP area.

Table 2-19: Northeastern Jones Falls Zoning

Zoning Code (county)	Zoning Description	Allowed Units/Acre	Total (acres)	Total (%)
RC-5	Rural Residential	-	314.7	4.5
RC-6	Rural Conservation/Residential	-	0.0	0.0
RC-7	Resource Preservation	-	190.9	2.7
RC-50	Resource Conservation Critical Area		0.0	0.0
DR-1	Density Residential	1	979.6	14.1
DR-2	Density Residential	2	2,060.3	29.6
DR-3.5	Density Residential	3.5	1,436.2	20.6
DR-5.5	Density Residential	5.5	776.2	11.2
DR-10.5	Density Residential	10.5	185.2	2.7
DR-16	Density Residential	16	234.5	3.4
RAE-1	Residential Apartment	40	0.0	0.0
RAE-2	Residential Apartment	80	2.4	0.0
Commercial	Offices/Businesses	-	582.4	8.4
Manufacturing	Industrial	-	193.0	2.8

Table 2-20: Northeastern Jones Falls Zoning by Subshed

Zoning Code (county)	Zoning Description	Allowed Units/Acre	Total (acres)	Total (%)
Roland Run				
RC-5	Rural Residential	-	314.7	
RC-7	Resource Preservation	-	12.5	
DR-1	Density Residential	1	417.7	
DR-2	Density Residential	2	888.9	
DR-3.5	Density Residential	3.5	1,064.3	
DR-5.5	Density Residential	5.5	494.8	
DR-16	Density Residential	16	114.2	
Commercial	Offices/Businesses	-	322.4	
Manufacturing	Industrial	-	193.0	
Towson Run				
DR-1	Density Residential	1	150.0	
DR-2	Density Residential	2	659.4	
DR-3.5	Density Residential	3.5	249.2	
DR-5.5	Density Residential	5.5	278.3	
DR-10.5	Density Residential	10.5	147.0	
DR-16	Density Residential	16	106.3	
RAE-2	Residential Apartment	80	2.4	
Commercial	Offices/Businesses	-	253.7	
Ruxton Run				
RC-7	Resource Preservation	-	2.4	
DR-1	Density Residential	1	123.7	
DR-2	Density Residential	2	336.5	
DR-3.5	Density Residential	3.5	9.1	
Lake Roland Direct Drainage				
RC-7	Resource Preservation	-	119.6	
DR-1	Density Residential	1	287.9	
DR-2	Density Residential	2	175.6	
DR-3.5	Density Residential	3.5	113.6	
DR-5.5	Density Residential	5.5	3.1	
DR-10.5	Density Residential	10.5	38.2	
DR-16	Density Residential	16	14.0	
Commercial	Offices/Businesses	-	6.3	

The Northeastern Jones Falls watershed has 5,672 acres of residentially zoned area, the predominant assessment class at 89% of the watershed area. The remainder (11%) is commercial and manufacturing totaling 775 acres throughout the Northeastern Jones Falls watershed. Note there is no land within the watershed boundaries zoned for agriculture (RC-2), watershed protection (RC-4), resource preservation (RC-50) or environmental enhancement (RC-8).

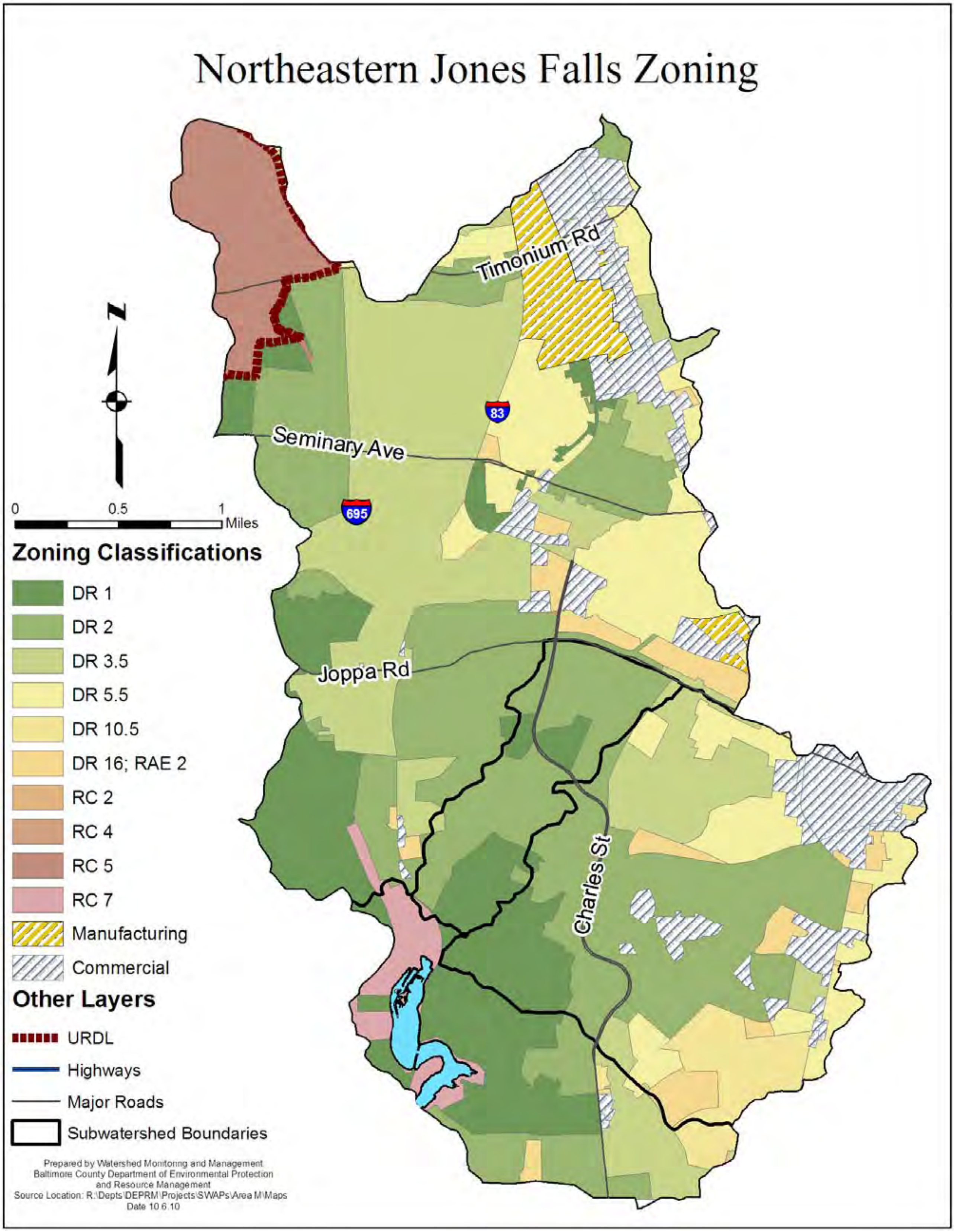

Figure 2-13: Zoning in the Northeastern Jones Falls Watershed

2.3.9 Historic Development

Figure 2-15 below shows the decade of development for each building in the SWAP area. The first stormwater regulations requiring treatment for water quality were enacted in 1983. Regulations for quantity came in to effect in 1993. In 2003, rules were updated to require more stringent requirements of the 2000 Maryland Stormwater Design Manual. The Stormwater Management Act of 2007 was incorporated into the County's regulations in May 2010.

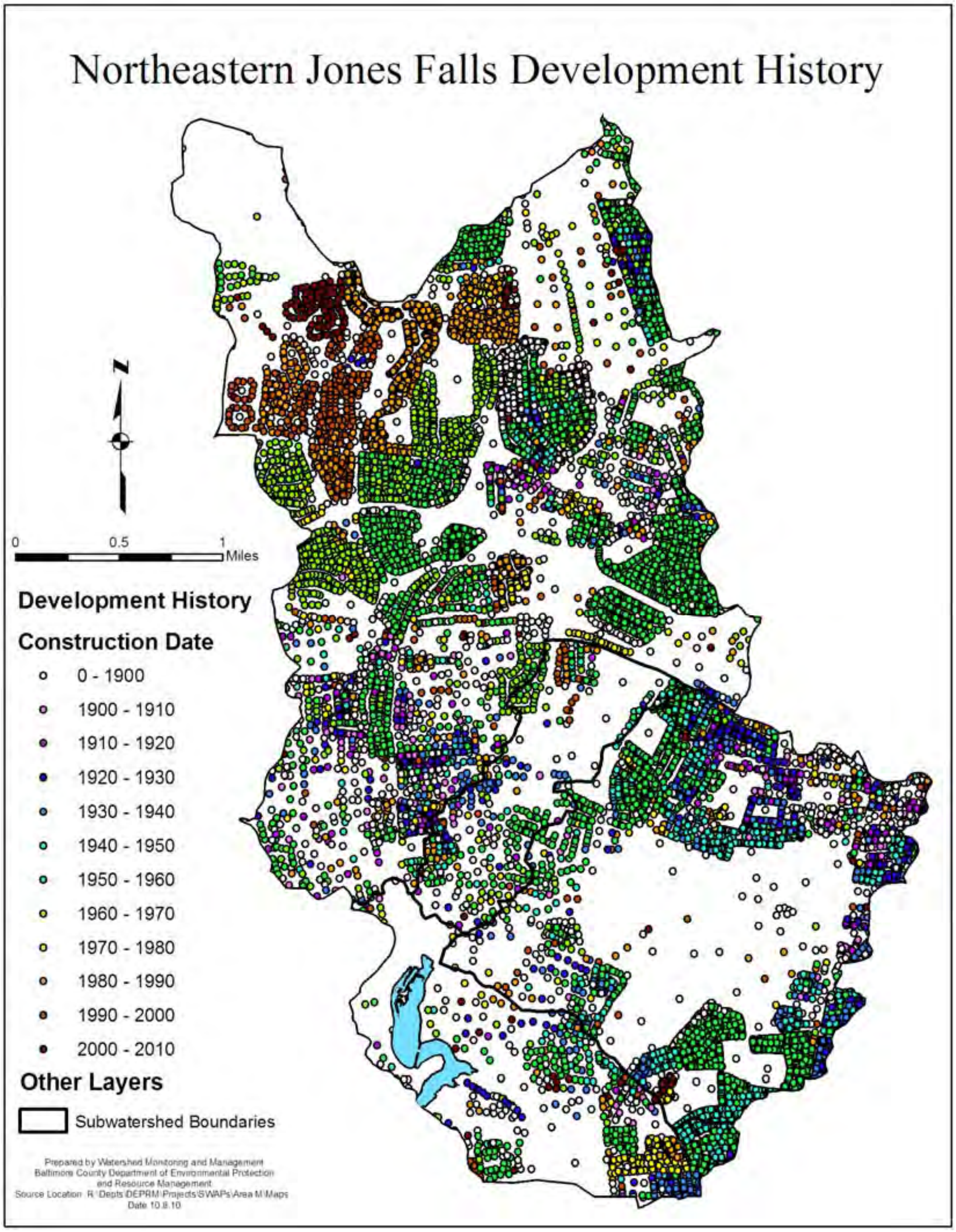

Figure 2-15: Development History in the Northeastern Jones Falls Watershed

CHAPTER 3

WATER QUALITY, LIVING RESOURCES AND HABITAT

3.1 Introduction

In addition to water quality maintenance and improvement, the Small Watershed Action Plan or SWAP program aims to provide for plants, animals, and their habitat. Natural communities require many habitat characteristics for survival. Among these are land, water, and biological conditions within ranges that support for their need for food, water, shelter, and reproduction. In this chapter, we will characterize the water quality, living resources and habitat of the Northeastern Jones Falls watershed based on available data.

Water is an integral part of the habitat of all species. Living resources, including all animals and plants, require water to survive. They and their habitats are intimately connected to water quality and availability. Living resources respond to changes in water and habitat conditions in ways that help us interpret the status of water bodies and the effects of watershed conditions. In some cases, water quality is measured in terms of its ability to support specific living resources like trout or shellfish. Information on living resources is presented here both to provide a gauge of water quality and to evaluate habitat conditions in the watershed. This information can help to determine if current watershed management practices are adequately providing for the needs of natural communities.

3.2 Water Quality Monitoring Data

Baltimore County conducts chemical, biological, and illicit connection monitoring within the Northeastern Jones Falls planning area. Section 3.2.1 summarizes the chemical monitoring programs for the County, section 3.2.2 summarizes the biological monitoring programs, and section 3.3.3 summarizes the Illicit Connection Program. Section 3.3.4 summarizes the results by subwatershed.

3.2.1 Chemical Data

The chemical monitoring program of Baltimore County is mandated in part by our National Pollutant Discharge Elimination Program (NPDES) – Municipal Separate Storm Sewer System (MS4) discharge permit. The permit requires an assessment of ambient water conditions, but does not specify the methodology. Figure 3-1 displays the locations of the County chemical monitoring sites. The Jones Falls Watershed Association had conducted synoptic surveys within the Northeastern Jones Falls watershed in the past. The locations of these sites are also displayed in Figure 3-1.

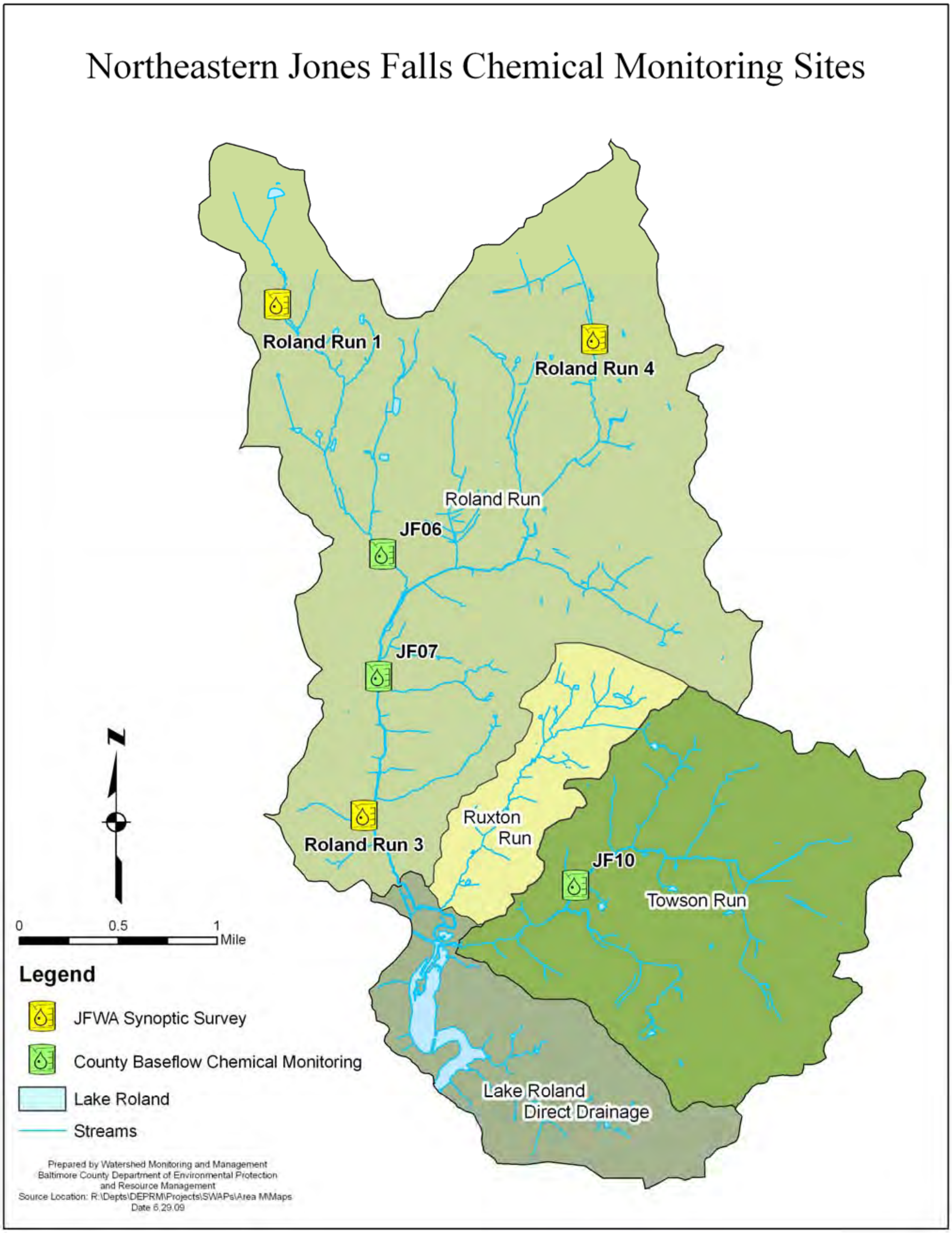

Figure 3-1: Chemical Monitoring in the Northeastern Jones Falls Watershed

This section details water quality sampling data by subwatershed for a number of key parameters from the County's monitoring program. The subwatershed location for each monitoring site is indicated using subwatershed abbreviations provided in Table 3-1. The key parameters were evaluated because of their importance to Total Maximum Daily Loads (TMDLs) and Chesapeake Bay Program Tributary Strategy goals.

Table 3-1: Northeastern Jones Falls Planning Area Subwatershed Abbreviations

Subwatershed	Subwatershed Abbreviation	Monitoring Sites
Roland Run	RR	JF06, JF07
Ruxton Run	XR	none
Towson Run	TR	JF10
Lake Roland Direct Drainage	LR	none

Chloride in particular is reported because it is linked to chronic toxicity in urban streams and the Jones Falls watershed is 303(d) listed for biological impairment. The chronic aquatic life criteria for chloride is 230 mg/l and the acute toxicity limit is 860 mg/l (USEPA, 1988).

Total nitrogen, total phosphorus and sediment were evaluated because the watershed has been issued Total Maximum Daily Loads (TMDLs) for nitrogen and phosphorus and there is a TMDL pending for sediment (submitted 9/28/09). These are key Chesapeake Bay Program parameters as well. Table 3-2 shows stream ratings based on total nitrogen concentration data adapted from the Maryland Department of Natural Resources (2005), and based on loading coefficients reported by Frink (1991). Total phosphorus ratings in Table 3-2 were developed by evaluating non-tidal phosphorus data from the Chesapeake Bay Program (USGS, 1999) (Figure 1). Sediment moves primarily during storm events and thus elevated concentrations of sediment were not found in these baseflow samples.

Table 3-2: Ratings by Nutrient Concentrations

Rating	Total Nitrogen (TN)	Total Phosphorus (TP)
Low	0.0 – 1.0	<0.05
Slightly elevated	1.0 – 2.0	0.05 – 0.075
Moderate	2.0 – 3.0	0.075 – 0.10
High	3.0 – 5.0	0.10 – 0.20
Excessive	>5.0	>0.20

Of the three sites within the planning area, one site in Towson Run (JF10) shows moderate levels of mean total nitrogen at 2.64 mg/l. Two of the sites, JF07 and JF10 in Roland Run and Towson Run, respectively, had slightly elevated mean total phosphorus.

Table 3-3: Northeastern Jones Falls Watershed Data*

Parameter (mg/l)		JF06	JF07	JF10
Subwatershed		RR	RR	TR
Chloride	Max	99.4	152.6	373.2
	Min	36.7	64.0	29.7
	Mean	61.1	100.7	215.4
Total Nitrogen	Max	2.8	2.7	4.3
	Min	1.7	1.1	1.7
	Mean	2.2	1.7	2.6
Total Solids	Max	268	758	836
	Min	20	222	193
	Mean	189	360	561
Total Phosphorus	Max	0.05	0.22	0.13
	Min	0.01	0.01	0.02
	Mean	0.03	0.04	0.05

*at the time if this report, the Jones Falls Watershed Association synoptic sampling data was unavailable

3.2.2 Biological Data

Baltimore County conducts biological monitoring for benthic macroinvertebrates utilizing the Maryland Biological Stream Survey protocols on an annual basis. This program and its results are described below.

The Baltimore County biological sampling program follows the MBSS protocol. Sample sites are randomly selected focusing on the Patapsco/Back River Basin in odd years and the Gunpowder/Deer Creek Basin in even years. The program reports benthic IBI scores for each site (Baltimore County DEPRM, 2005). The BIBI condition ratings are “Very Poor” (1.00 – 1.99), “Poor” (2.00 – 2.99), “Fair” (3.00 – 3.99), and “Good” (4.00 – 5.00). Figure 3-2 shows the locations and years sampled for each site and also shows the average benthic IBI rating for each subwatershed. Table 3-4 summarizes biological rating data for the Northeastern Jones Falls watershed.

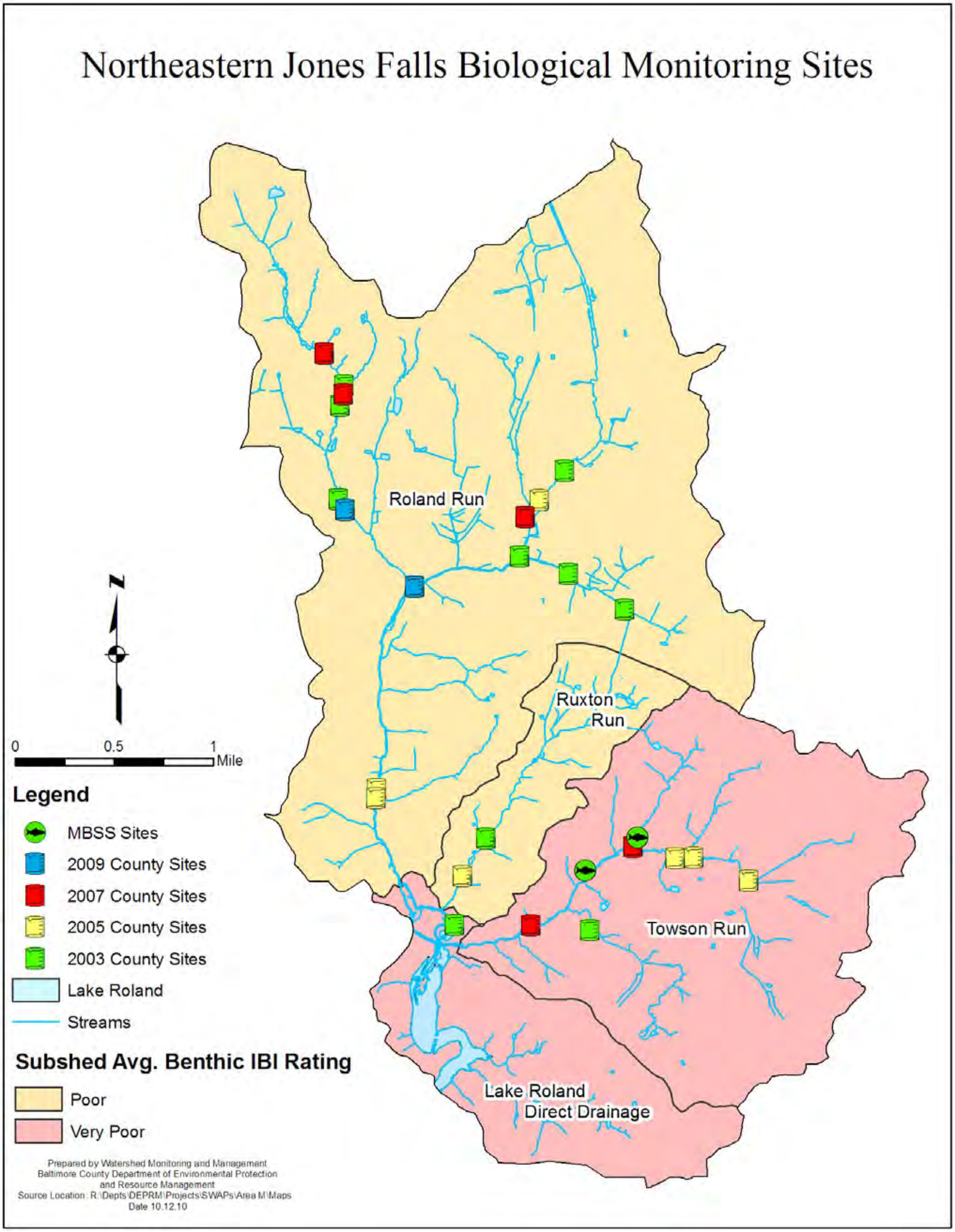

Figure 3-2: Northeastern Jones Falls Biological Monitoring

Table 3-4: Baltimore County Biological Monitoring Results

Station ID	Subwatershed	Longitude	Latitude	Sample Year	Benthic IBI	
					Score	**Rating**
803051	Lake Roland Direct Drainage	-76.6416	39.3907	2003	1.44	Very Poor
803013	Roland Run	-76.6518	39.4303	2003	2.33	Poor
803016	Roland Run	-76.6310	39.4240	2003	2.78	Poor
803018	Roland Run	-76.6254	39.4138	2003	1.89	Very Poor
803015	Roland Run	-76.6524	39.4220	2003	3.00	Fair
803035	Roland Run	-76.6307	39.4165	2003	2.11	Poor
803058	Roland Run	-76.6522	39.4289	2003	2.33	Poor
803059	Roland Run	-76.6353	39.4178	2003	2.33	Poor
805058	Roland Run	-76.6489	39.4007	2005	2.00	Poor
805184	Roland Run	-76.6334	39.4219	2005	1.67	Very Poor
805258*	Roland Run	-76.6490	39.4001	2005	2.33	Poor
807002	Roland Run	-76.6519	39.4297	2007	2.00	Poor
807042	Roland Run	-76.6537	39.4327	2007	2.00	Poor
807045	Roland Run	-76.6347	39.4206	2007	1.67	Very Poor
809046	Roland Run	-76.6452	39.4155	2009	1.00	Very Poor
809056	Roland Run	-76.6517	39.4212	2009	1.67	Very Poor
				Average	**2.07**	**Poor**
803037	Ruxton Run	-76.6386	39.3971	2003	2.78	Poor
805270	Ruxton Run	-76.6408	39.3943	2005	3.00	Fair
				Average	**2.89**	**Poor**
803055	Towson Run	-76.6288	39.3903	2003	2.33	Poor
805036	Towson Run	-76.6190	39.3956	2005	2.00	Poor
805151	Towson Run	-76.6138	39.3939	2005	1.33	Very Poor
805154	Towson Run	-76.6207	39.3955	2005	1.67	Very Poor
807029	Towson Run	-76.6344	39.3906	2007	1.33	Very Poor
807030	Towson Run	-76.6247	39.3964	2007	1.33	Very Poor
				Average	**1.67**	**Very Poor**

*sentinel station

Baltimore County has 22 biological sites within the Northeastern Jones Falls planning area. The benthic IBI ratings include eight very poor sites, 12 poor sites, and two fair sites. There is one sentinel site in the Northeastern Jones Falls planning area.

3.2.3 Illicit Discharge and Elimination Program Data

Baltimore County tracks illicit discharges through a program of routine outfall screening. The program consists of three parts:

(1) A quantitative analysis of the effluent that includes measuring the effluent flow rate, temperature and pH, and field-testing for parts per million (ppm) of chlorine, phenols, copper and ammonia using a specially configured LaMotte NPDES test kit;
(2) A qualitative assessment of the effluent, the outfall structure and the receiving channel, noting such conditions as water color, odor, vegetative condition, sedimentation, erosion, damage, etc.; and
(3) A visual inspection of each outfall that notes any structural damage.

In Baltimore County, there are approximately 3,509 total outfalls; of these approximately 2,800 outfalls are less than 36 inches in diameter. These outfalls are not prioritized. The County has 670 outfalls with pipe diameter of 36 inches or greater of which 593 have been inspected twice and assigned a prioritization rating as of October 2010.

The County has an outfall prioritization system based on data from the outfall screening. The system allows for a more streamlined approach in selecting outfalls to screen and provides a more efficient use of manpower. In addition, the system allows for outfalls screened once or not at all *(Priority 0)* to be screened sufficiently (two or more times) and properly prioritized. A Microsoft Access Query based on the prioritization scheme generates the list of outfalls to be screened.

The outfall prioritization system works as follows: (1) Outfalls not screened twice are not prioritized. (2) Outfalls screened two or more times are assigned one of three priority ratings.

- *Priority 1 (Critical)* rating - Outfalls with major problems that require immediate correction and/or close monitoring, or outfalls with recurrent problems. These outfalls are sampled four times each year.
- *Priority 2 (High)* rating - Outfalls with moderate to minor problems that have the potential to become severe. These outfalls are sampled once a year.
- *Priority 3 (Low)* rating - Outfalls with minor or no problems that do not require close monitoring. These outfalls are sampled on a ten-year cycle.

A second screening is done if nearly a decade has passed since the last screening. If no pollution problems were indicated, then the outfall is considered a low priority. This allows more focus on outfalls with more potential of an illicit connection.

A second screening is also performed at an outfall when prior screening indicates that one or more of the water quality criteria were exceeded. The second screening helps determine whether the pollutant is a persistent constituent of the effluent or simply an anomaly. No remedial action is taken if the second screening indicates that the pollutant is within acceptable levels, however, the outfall is considered to have a potential illicit connection and is automatically queued for re-screening within one year.

If the problem is severe enough to warrant immediate correction, then an investigation begins immediately. Some sites are determined to have problems severe enough to warrant immediate investigation and/or corrective action after only one screening.

The Northeastern Jones Falls planning area within Baltimore County has 33 major outfalls classified as a priority 2 or 3 and zero as priority 1. Table 3-5 displays the results of this prioritization.

Table 3-5: Baltimore County Storm Drain Outfall Prioritization Results

	Roland Run	**Ruxton Run**	**Towson Run**	**Lake Roland Direct Drainage**	**Total**
Priority 1	0	0	0	0	**0**
Priority 2	9	0	1	1	**11**
Priority 3	18	0	3	1	**22**
Total	**27**	**0**	**4**	**2**	**33**

3.2.4 Subwatershed Summary

A summary of monitoring data by subwatershed is provided in Table 3-6. The table provides a summary of water quality, biological, and outfall data for each subwatershed. The average values for each subwatershed are summarized for each monitoring data parameter. The water quality and outfall data values range from low (good) to high (bad). The biological data is reported as very poor, poor, fair and good based on the average value for each subwatershed. This table provides a quick snapshot of the condition of each subwatershed in the Northeastern Jones Falls planning area.

Table 3-6: Summary of Monitoring Data by Subwatershed

Subwatershed	Water Quality (mg/l)		Biological	Outfalls
	TN	TP	IBI	Ammonia
Roland Run	Slightly Elevated	Low	Poor	
Ruxton Run	NA	NA	Poor	
Towson Run	Moderate	Slightly Elevated	Very Poor	
Lake Roland DD	NA	NA	Very Poor	

N/A =no data available

Only Roland Run and Towson Run are monitored for chemicals. Water quality data reported neither subwatershed with high values for total nitrogen or total phosphorus. Averaging the data shows low to moderate levels for these chemicals. Biological IBI scores were reported as very poor in Towson Run and Lake Roland Direct Drainage.

3.3 Stream Assessments

The functions of stream assessments are to identify potential stream problem areas, and identify potential restoration projects.

3.3.1 Stream Corridor Assessment

The Stream Corridor Assessments were conducted in the fall and winter of 2009/2010 by Baltimore County Department of Environmental Protection and Resource Management staff.

3.3.1.1 Assessment Protocol

The Stream Corridor Assessment, or SCA, provides descriptive and positional data for potential environmental problems along a watershed's non-tidal stream network. Developed by DNR's Watershed Services, the survey is a watershed management tool used to identify environmental problems and to help prioritize restoration opportunities on a watershed basis. The assessment follows protocols set forth in *SCA Survey Protocols* (Yetman, 2001). As part of the survey, specially trained personnel walk a watershed's streams and record data for several potential environmental problems that can be easily observed within the stream corridor. Each potential problem site is ranked on a scale of one to five for its severity, correctability, and ease of access for restoration work.

Using a grid system, the areas of interest in the Northeastern Jones Falls were divided into six sections and a GIS map created for each section. Each map contains aerial photography and hydrology data and was laminated for field use. The maps were used as a guide for locating and walking the streams. All potential problems were indicated directly on the map using *Sharpie*® markers showing locations and/or distances.

3.3.1.2 Summary of Sites Investigated

The subwatersheds focused on for the SCAs were Roland Run and Ruxton Run. Towson Run has many institutions that own large tracts of land, including Towson University, which already has a Master Plan developed for managing their campus. The main stem of the Jones Falls was not assessed, as it is more feasible to control pollution sources in headwaters and tributaries. Approximately 49,520 feet or 9.4 miles were assessed in the two subwatersheds, 29,237 feet in Roland Run and 20,284 feet in Ruxton Run. Figure 3-3 shows the stream reaches assessed during the survey.

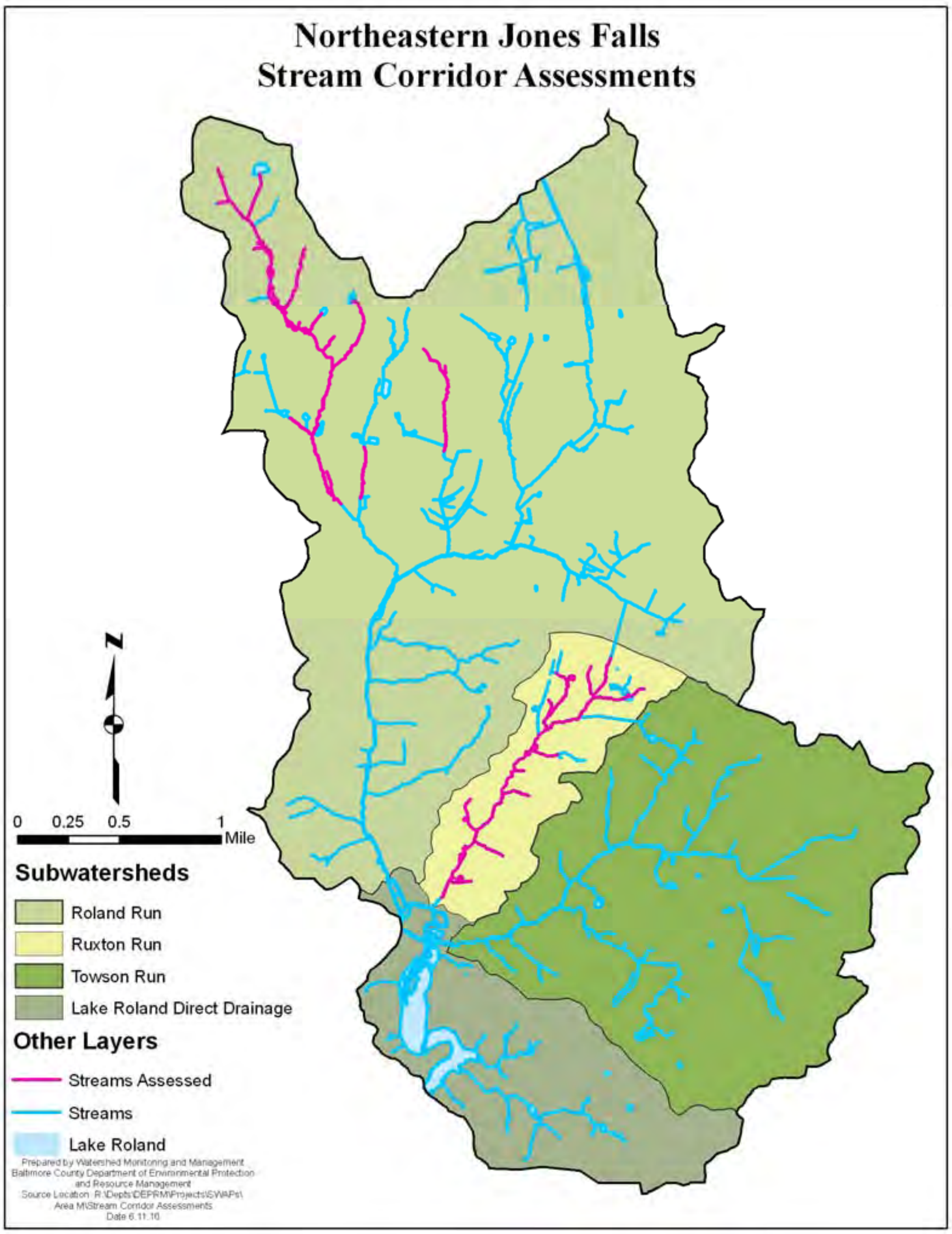

Figure 3-3: Stream Reaches Assessed in the Northeastern Jones Falls

3.3.1.3 General Findings

Table 3-7 summarizes the results of the stream corridor assessment. The most common problem discovered through the stream corridor assessment was pipe outfalls (34), however only one was rated 'very severe' and most were 'minor'. Erosion sites and fish barriers were also numerous. A total of 2.8 miles (30.0%) of the 9.4 miles assessed were found to have an inadequate buffer, with over 95% rated 'very severe' or 'severe'. Erosion was identified as a problem for 2.5 miles (24.0 %) of the streams assessed, with approximately 21% in the 'severe' category. No problems associated with trash dumping or in-stream construction were observed and only three reaches showed evidence of channel alterations. Table 3-8 presents the number of problems for each subwatershed assessed by problem category. Table 3-9 presents the linear feet of inadequate buffer and stream erosion by subwatershed and the percentage of streams assessed with these problems.

Table 3-7: Summary of SCA Results

	#	Estimated Length (ft)	# Very Severe	# Severe	# Moderate	# Low Severity	# Minor
Pipe Outfall	34		1	-	5	11	17
Erosion Site	18	11,879	-	3	8	7	-
Inadequate Buffer	14	14,865	1	12	-	-	1
Fish Barrier	19		1	7	4	6	1
Unusual Condition	7		-	-	4	1	2
Exposed Pipe	6		1	2	2	1	-
Channel Alteration	3	740	-	1	1	1	-
Trash Dumping	-		-	-	-	-	-
In-Stream Construction	-		-	-	-	-	-
TOTAL	101		4	25	24	27	21
Representative Sites	11						

Table 3-8: Baltimore County Stream Corridor Survey Results – Number of Problems

Stream Segment	Channel Alteration	Erosion	Fish Barrier	Inadequate Buffer	Pipe Outfall	Exposed Pipe	In Stream Construction	Trash Dumping	Total
Roland Run	1	11	11	10	19	4	0	0	**56**
Ruxton Run	2	7	8	4	15	2	0	0	**38**
Total	**3**	**17**	**19**	**14**	**34**	**6**	**0**	**0**	**94**

Table 3-9: Baltimore County Stream Corridor Survey Results – Linear Feet of Inadequate Buffer and Stream Bank Erosion

Stream Segment	Erosion (ft.)	Inadequate Buffer (ft.)
Roland Run	8,906	11,637
Ruxton Run	2,973	3,228
Total	**11,879 (24%)**	**14,865 (30%)**

The most impacted of the two subwatersheds based on stream erosion and inadequate buffer is Roland Run.

Stream Bank Erosion

Stream bank erosion is a natural process necessary for maintaining a good aquatic habitat. Very often in human impacted environments, however, the natural erosion process is drastically accelerated resulting in habitat destruction and sediment pollution problems. This often occurs below a specific alteration, such as a pipe outfall or road crossing, or when land use in a watershed changes. For example, as a watershed becomes more urbanized, forest and agricultural fields are converted to impervious surfaces where rainwater cannot seep naturally into the ground. This results in a much greater in-stream flow rate during storm events and leads to eroded streambeds and banks. Although streams in forested areas may have adequate 50 ft. forest buffers, they can also experience erosion problems due to these high flows.

Erosion sites were defined by vertical stream banks with exposed soil and overall instability. Severity ratings were based on height and length of the exposed bank.

There were 18 total sites marked for erosion problems with lengths ranging from 75 ft. up to 1600 ft. in length. As shown in Table 3-9, erosion, as defined by the assessment, exists in 24 percent of the stream reaches assessed. Figure 3-4 shows the erosion problem areas discovered during the SCA in the Northeastern Jones Falls watershed and the rated severity of the problems.

Inadequate Buffers

Forest buffers along streams provide a natural element essential to maintaining stream health and water quality. Tree roots capture and remove excess nutrients and pollutants from shallow flowing water and help stabilize stream banks reducing sedimentation. Shade from tree canopies facilitates the cooler stream temperatures necessary for most stream life, especially cold-water species like trout. Maintaining adequate forest buffers and maintaining healthy streams are important parts of reducing nutrient and sediment loads in the Chesapeake Bay.

While there is no single minimum standard for how wide a stream buffer should be in Maryland, for the purposes of this study, all buffers measuring less than 50 ft. from the edge of the stream were considered inadequate. Severity ratings were based on the lengths and widths of the buffer on each side of the stream.

Survey crews identified 14 inadequate buffer sites with a total length of 14,865 ft (2.8 miles), approximately 30 percent of the stream miles surveyed. Figure 3-5 shows the inadequate buffer locations and severity ratings.

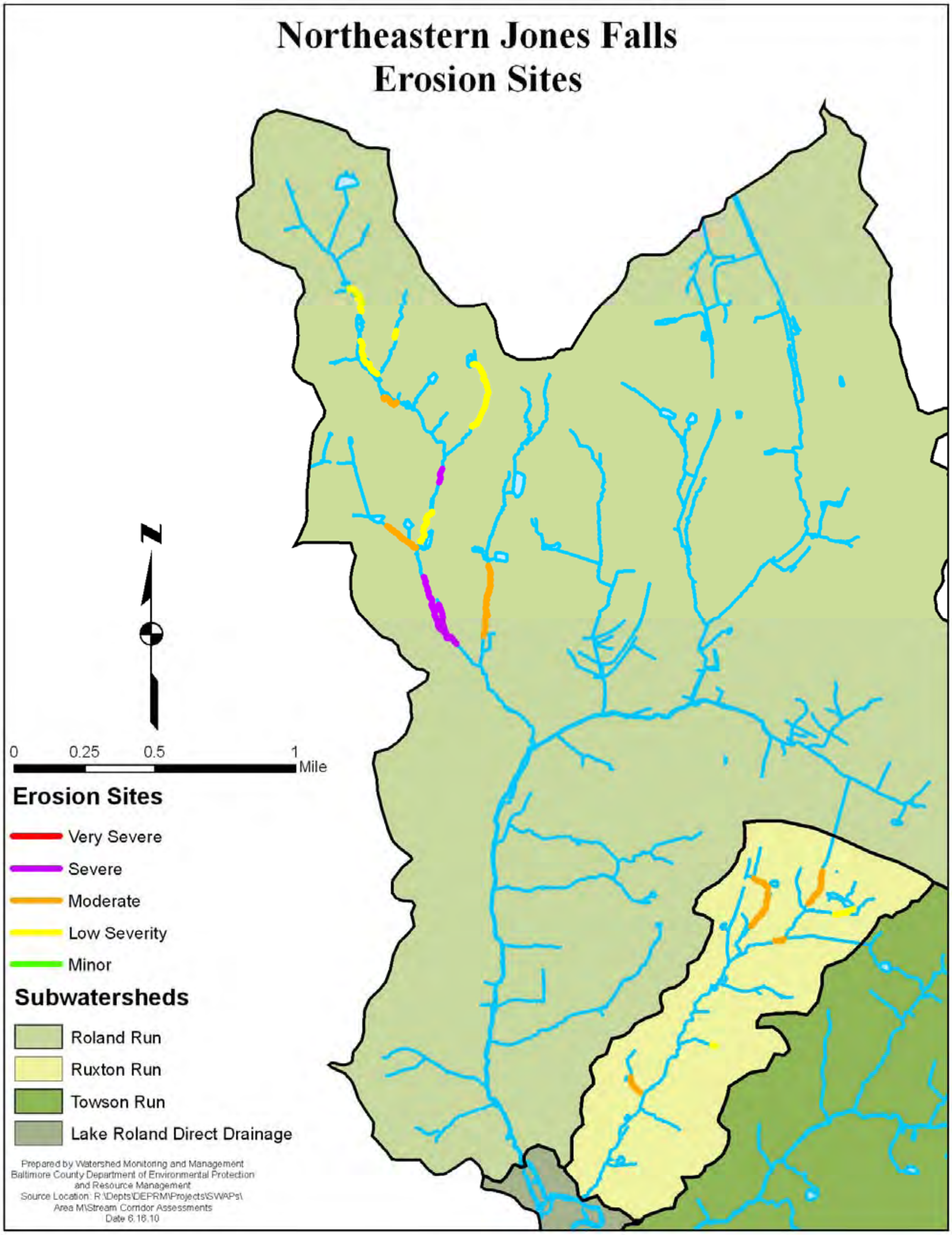

Figure 3-4: Erosion Site Locations and Severities

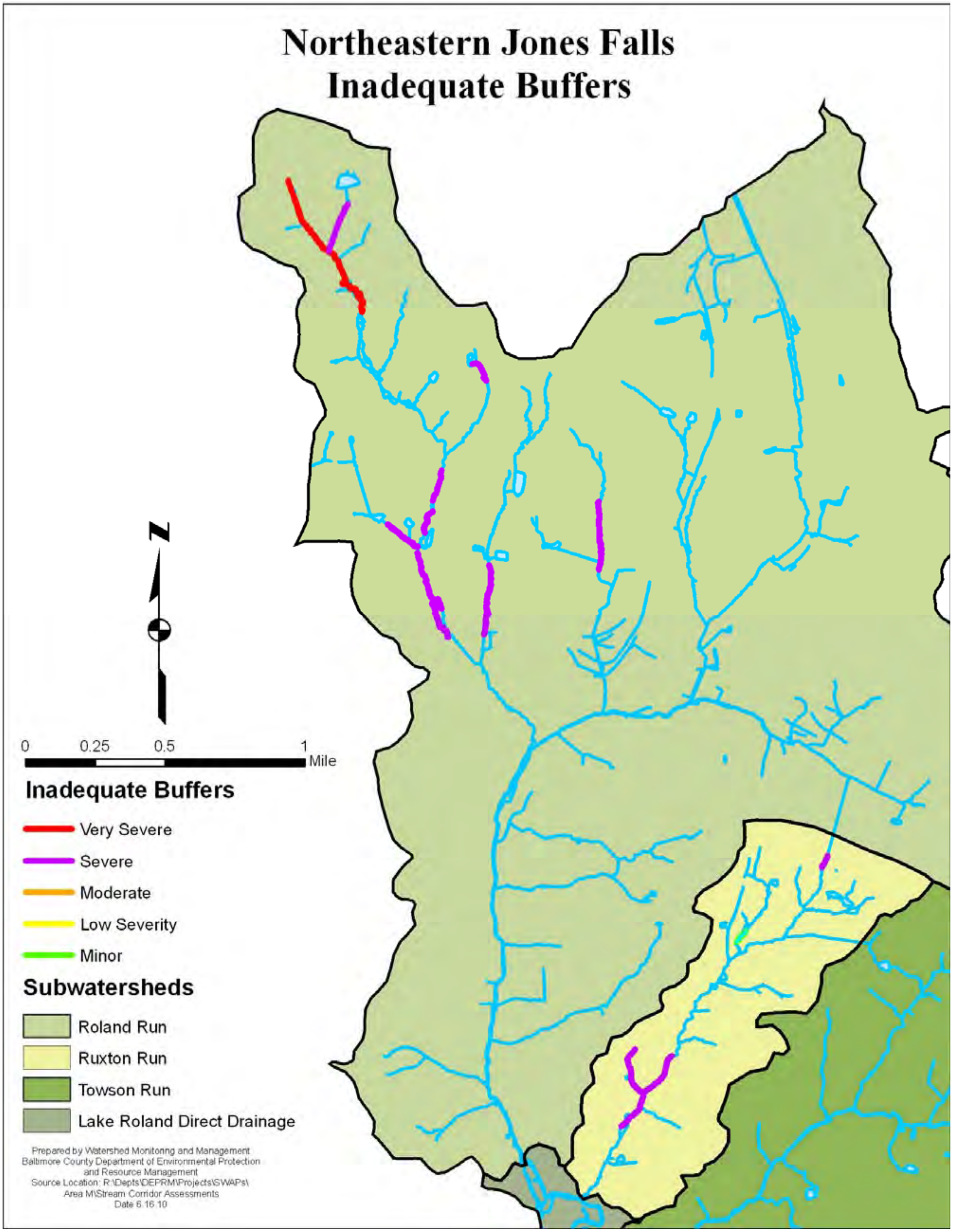

Figure 3-5: Inadequate Buffer Locations and Severities

Trash Dumping

Trash dumping sites are areas where large amounts of trash have either been dumped or have accumulated from wind or storm drainage

No trash dumping sites were observed during the assessment.

Exposed Pipes

Any pipes or sewer stacks that are located in the stream or along the stream's immediate banks that could be damaged by a high flow event are recorded as exposed pipes in the SCA survey. An exposed pipe can be vulnerable to puncture by debris in stream, especially during periods of high flow. A punctured pipe is likely to discharge fluid into the stream causing a serious water quality problem and potential health hazard.

Field crews observed 6 exposed pipes during the survey. Site 60B214 was given the only 'very severe' rating and was referred to Baltimore County Public Works on 6/9/10. Site 69C208, an exposed sewer stack was also reported to Public Works and as of 5/11/10 had been referred to their construction division for repairs. Figure 3-6 shows the locations of all exposed pipes.

Fish Barriers

Fish migration barriers include any condition in the stream that significantly interferes with the free upstream movement of fish. Unimpeded fish passage is especially important for anadromous fish that live most of their lives in tidal waters but must migrate into non-tidal rivers and streams to spawn. In addition, blockages can isolate sections of the stream making it difficult for fish to avoid a pollution disturbance and then harder still to re-populate the area after the disturbance has passed.

Nineteen fish barriers were discovered during the SCA with eight rated as severe or very severe. Figure 3-6 shows the locations of all fish barriers recorded during the survey.

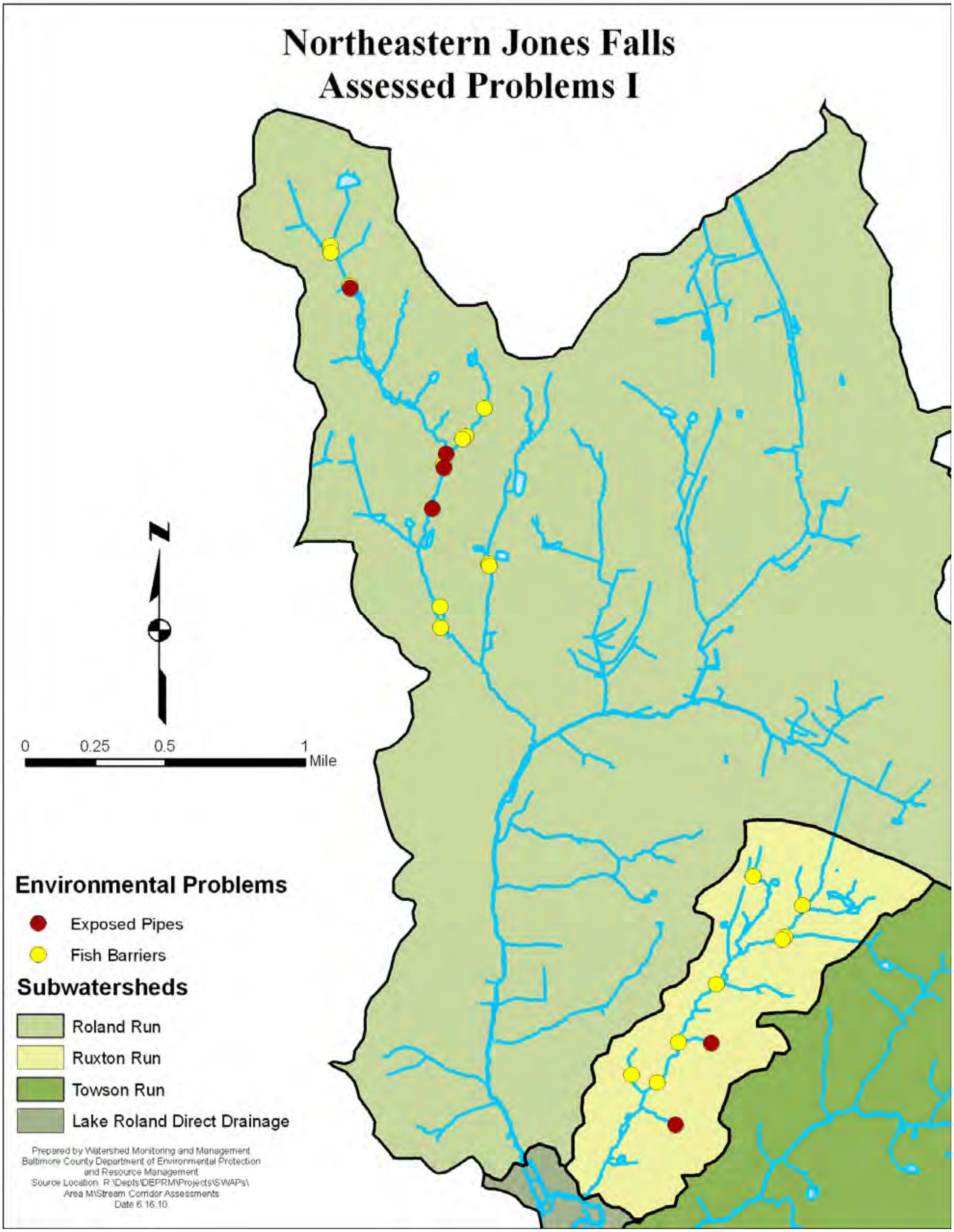

Figure 3-6: Exposed Pipe and Fish Barrier Locations

Pipe Outfalls

Pipe outfalls include any pipe or constructed channel that could potentially discharge into the stream. Pipe outfalls are considered a potential environmental problem in the survey because they can carry uncontrolled runoff and pollutants such as oil, heavy metals, and nutrients to a stream system.

A total of 34 outfalls were identified during the SCA, making it the most common of the problems assessed. Of these 34, however, 28 were classified as having a 'minor' or 'low severity' rating and only one, 60B312, was considered 'very severe'. This rating was due to a natural gas smell coming from the pipe. This was reported to BGE on 11/19/10. Figure 3-7 shows the locations of all pipe outfalls.

In/Near Stream Construction

If in or near stream construction projects cause major disturbances inside or near the stream corridor at the time of the survey, field teams note their location and record any effect on the steam corridor.

No in/near stream construction was observed during the assessment.

Unusual Conditions or Comments

Survey teams record unusual conditions or comments to note the location of anything of environmental interest beyond the scope of the existing parameters of the SCA.

Survey crews identified 7 unusual conditions and 0 comments. None of the seven were rated severe or very severe. Locations of the unusual conditions are shown in Figure 3-7.

Channel Alterations

Stream channel alterations are areas of the stream that have been modified from their naturally occurring structure or condition. Typically this is a concrete channel used to control the flow of the stream near roadways or developments. This increases flow rates and decreases habitat and can decrease nutrient uptake in the waterway. Stream channels can also be straightened by hardening the banks with gabion baskets, concrete or even stone or wooden walls.

Only three sites exhibited characteristics of channel alterations during the course of the survey totaling 740 ft. Only one of the sites qualified as 'severe'. Severity ratings were based on length of the alteration, water depth, and presence of natural sediments.

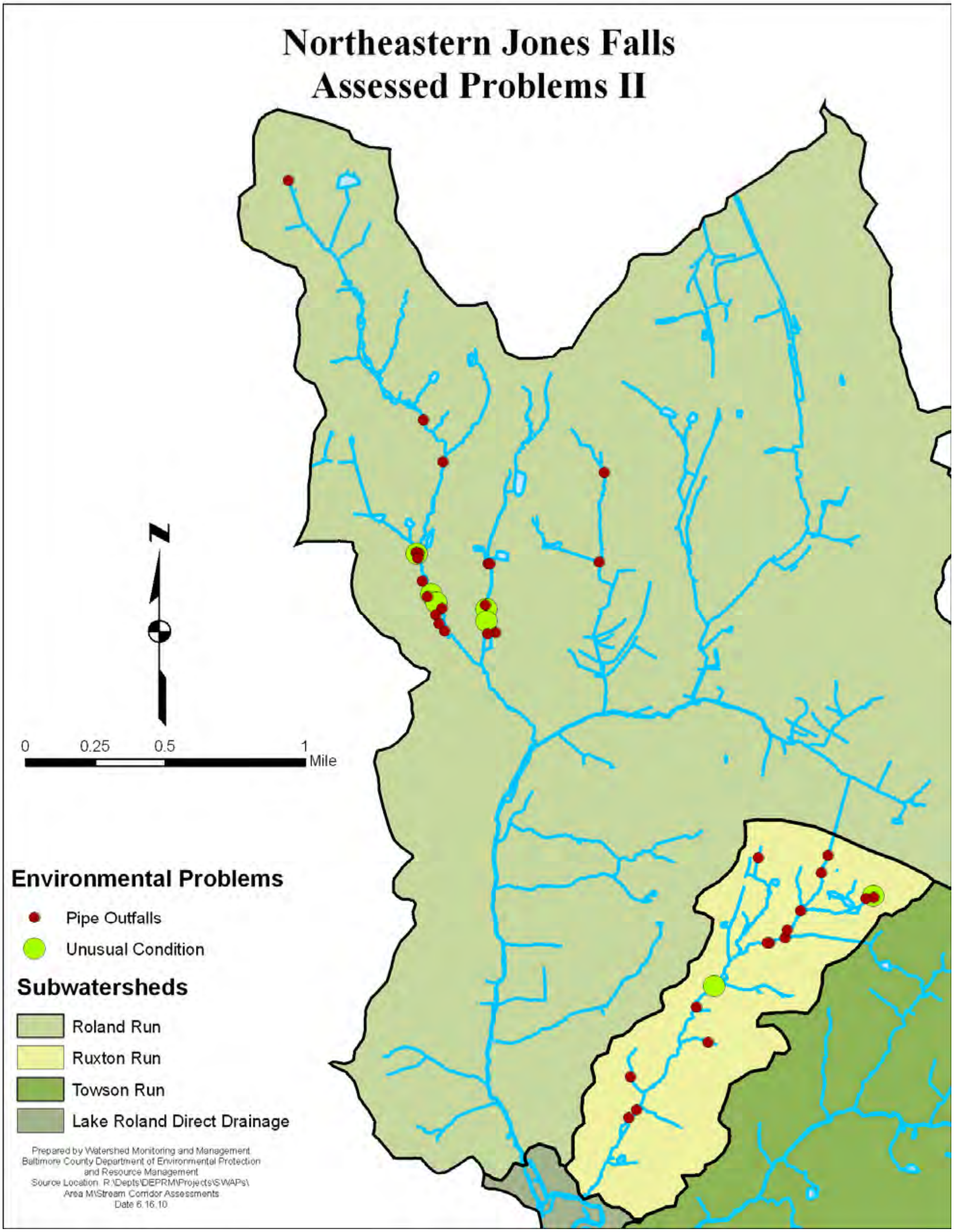

Figure 3-7: Pipe Outfall and Unusual Condition Locations

Representative Sites

Representative sites are used in the SCA to document the general condition of both in-stream habitat and the adjacent riparian corridor. At each representative site, the following 10 categories are evaluated to qualify the health of the stream habitat.

- Attachment Sites for Macroinvertebrates
- Shelter for Fish
- Sediment Deposition
- Channel Flow Status
- Condition of Banks
- Embeddedness
- Channel Alteration
- Velocity and Depth Regime
- Bank Vegetation Protection
- Riparian Vegetative Zone Width

Under each category, field crews base a rating of optimal, suboptimal, marginal or poor on established grading criteria developed to reflect ideal wildlife habitat for rocky bottom streams. In addition to habitat ratings, teams collect data on the stream's wetted width and pool depths at both runs and riffles at each representative site. Depth measurements are taken at the streams thalweg (main flow channel). Field crews also indicate whether the bottom sediments are primarily silt, sand, gravel, cobble, boulder or bedrock. Survey crews evaluated 11 representative sites during the SCA.

3.4 Sewer Overflow Impacts

At present, sanitary sewer overflows (SSOs) and combined sewer overflows (CSOs) are inevitable byproducts of our expanding population and aging sewer systems. Sewer overflows can be caused by, among other things, severe weather, insufficient maintenance and vandalism. When a sanitary sewer system is overwhelmed by volume or the infrastructure fails, raw sewage can enter nearby streams. The EPA reports there are at least 40,000 of these incidents per year in the U.S. The environmental and human health consequences of these overflows can be serious. E. Coli bacteria and other pathogens can be present, posing health risks to individuals who may come in contact with contaminated water. Sewer overflows can also contain high levels of nitrogen and phosphorus that are toxic to aquatic life and feed organisms that deplete oxygen in waterways. High levels of sediment are also present in these overflows, which can clog streams and block sunlight from reaching essential aquatic plants. Table 3-10 shows the volume and number of incidents by year for the Northeastern Jones Falls watershed. Overflow data is obtained from Baltimore County Department of Public Works each year in the form of a GIS shapefile for the purpose of consent decree reporting.

In 2005, the EPA and MDE issued a consent decree that requires Baltimore County to reduce and eventually eliminate sanitary sewer overflows.

Table 3-10: Documented Sewer Overflows in the Northeastern Jones Falls, 2001-2008

Year	Total Volume (gal)
2000	800
2001	4,210
2002	3,330
2003	5,600
2004	31,420
2005	128,600
2006	51,818
2007	5,880
2008	1,400
Total	**233,028**

Table 3-11 shows estimated volumes and pollutant amounts by subwatershed over a seven-year period. Calculations were determined using the following:

Total Nitrogen (TN) – based on a 30mg/L N concentration for raw sewage and a conversion factor of 8.32 x 10^{-6*}, a multiplier of 2.5 x 10^{-4} is achieved for converting gallons of overflow to pounds of pollutant.

Total Phosphorus (TP) – based on 10mg/L phosphorus concentration for raw sewage and a conversion factor of 8.32 x 10^{-6}, a multiplier of 8.32 x 10^{-5} is achieved for converting gallons of overflow to pounds of pollutant.

Total Suspended Solids (TSS) – based on 225mg/L concentration for raw sewage and a conversion factor of 8.32 x 10^{-6}.

Fecal Coliform (FC) – based on 6.4 x 10^{6} MPN** /100mL which converts to 2.4 x 10^{8}MPN/gal.

* using 1 gallon=3.78 liters & 1 mg=2.2x10^{-6} lbs.
** most probable number

Table 3-11: Baltimore Sewer Overflows by Subwatershed, 2001-2008

Subwatershed	Volume (gal)	TN (lbs)	TP (lbs)	TSS (lbs)	FC (MPN)
Roland Run	19,390	4.85	1.61	36.30	4.7 X 10^{12}
Ruxton Run	120	0.03	0.01	0.22	2.9 X 10^{10}
Towson Run	213,298	53.32	17.75	399.29	5.1 X 10^{13}
Lake Roland Direct Drainage	250	0.06	0.02	0.47	6.0 X 10^{10}
Total	**233,058**	**58.26**	**19.39**	**436.28**	**5.6 X 10^{13}**

Figure 3-8 shows the volume and location of sanitary sewer overflows through the years 2000-2008.

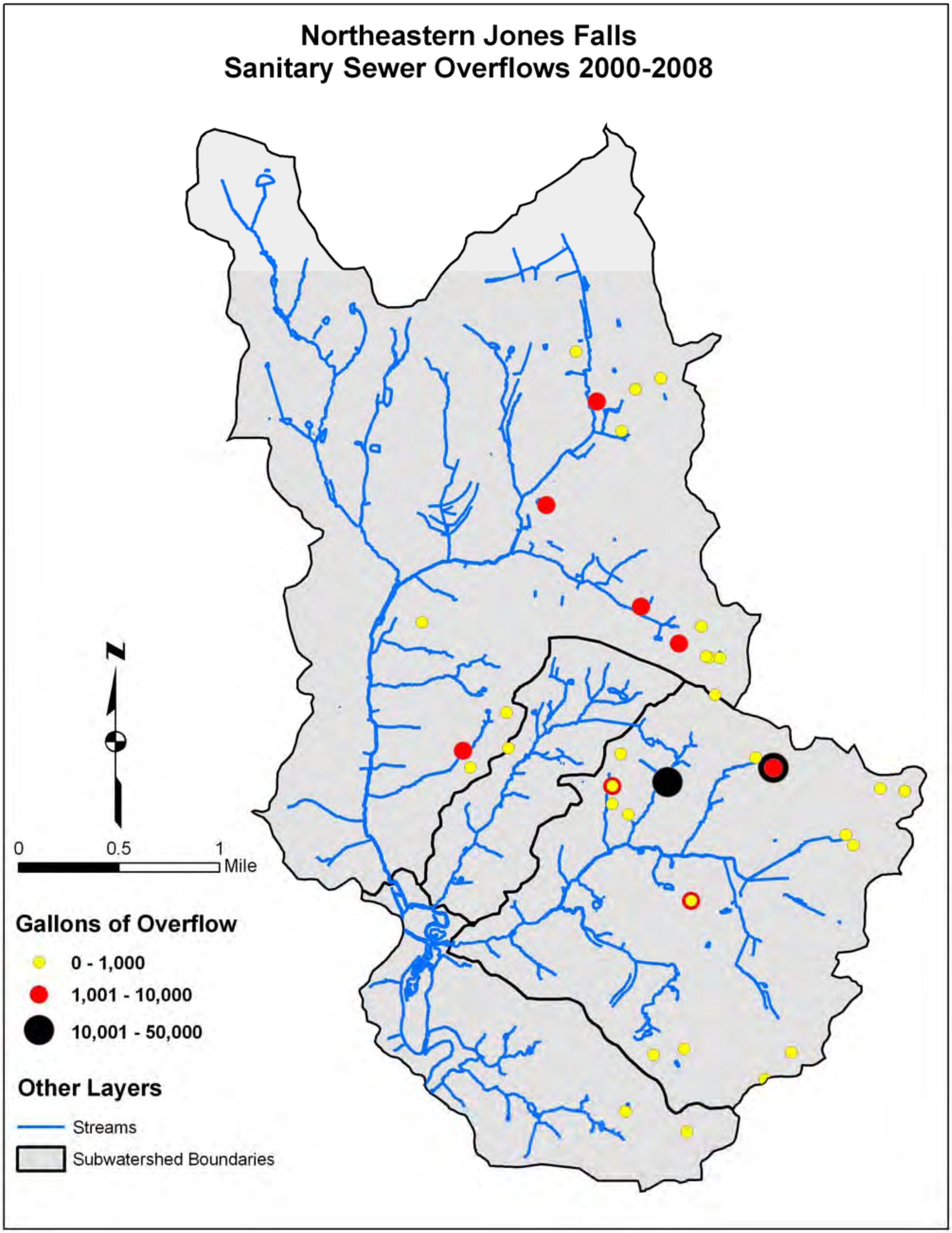

Figure 3-8: Sanitary Sewer Overflows 2000-2008

3.5 303(d) Listings and Total Maximum Daily Loads

The Jones Falls watershed has been listed as being impaired in the Maryland 303(d) list of impaired waters for a variety of substances. The listings include both the streams in the watershed and the tidal receiving waters. Jones Falls drains to the Baltimore Harbor tidal waters. Impairment in the tidal waters is related to the pollutants coming from the watershed, therefore TMDLs developed for the harbor tidal waters will require pollutant loads to be reduced in the watersheds draining to the receiving water (tidal waters in this case). Water Quality Assessments are performed to determine if the substance listed is actually impairing the waters. If it is found that the pollutant is not impairing the receiving waters, than a report documenting the findings is submitted to EPA for concurrence. Table 3-12 displays the status of the impairment listings.

Table 3-12: Water Quality Impairment Listings and Status

Impairment	Applicable Segment	Status	Approval Date
Stream Biological Community	02130904	Impaired	
PCB in Fish Tissue	02130904 – Lake Roland	TMDL development within two years	
Total Suspended Solids - TSS	02130904	TMDL complete	Sept 2011
Phosphorus	02130904	Water Quality Assessment	March 2010
Chlordane	02130904 – Lake Roland	TMDL Complete	March 2001
Nutrients	Baltimore Harbor	TMDL Complete	December 2007
Fecal Coliform	02130904	TMDL Complete	February 2008
Zinc	02130904	Water Quality Assessment	February 2003
Copper and Lead	02130904	Water Quality Assessment	December 2004

The Jones Falls watershed has nine impairment listings (for purposes of this report the separate listings for nitrogen and phosphorus for Baltimore Harbor have been combined as nutrients, but the phosphorus listing for the Jones Falls watershed is kept separate). Four TMDLs and three Water Quality Assessments have been completed. The *Draft 2008 Integrated Report of Surface Water Quality in Maryland* indicated that a TMDL for PCBs would be developed within two years. One additional listing for Stream Biological Impairment, and phosphorus (watershed impairment, not tidal waters), will have TMDLs developed at some point in the future.

The Water Quality Assessment document for zinc can be found at: http://www.mde.maryland.gov/programs/Water/TMDL/ApprovedFinalTMDLs/Documents/www.mde.state.md.us/assets/document/Jones%20Falls%20WQA_final(1).pdf , while the Water Quality Assessment for lead and copper can be found at: http://www.mde.maryland.gov/programs/Water/TMDL/ApprovedFinalTMDLs/Documents/www.mde.state.md.us/assets/document/Jones Falls WQA_final(2).pdf

The three TMDLs that have been approved by EPA are briefly discussed below. Note that although the local sediment TMDL has yet to be approved, reductions suggested in the draft local sediment TMDL document are used for the purposes of this report.

At the time of the writing of this SWAP report, the details of the Chesapeake Bay TMDL for sediments were not yet available so the local draft TMDL reductions are used.

3.5.1 Nutrients

EPA approved the TMDL for nutrients for Baltimore Harbor in December 2007. Based on the analysis, the bulk of the nitrogen and phosphorus reductions needed to meet water quality standards in the tidal segment of the Baltimore Harbor will come from improvements in the Patapsco Waste Water Treatment Plant (WWTP). The Patapsco River WWTP is scheduled for completion of an upgrade to Enhanced Nutrient Removal in 2011, as well as, an expansion from 73 million gallons per day (mgd) to 81 mgd. Upon completion the discharge of nitrogen will be reduced to 3 mg/L and phosphorus will be reduced to 0.2 mg/L.

The Baltimore Harbor receives drainage from the Jones Falls, the Gwynns Falls, and the Patapsco River watersheds. In order to meet water quality standards within Baltimore Harbor a reduction of 15% nitrogen and 15% phosphorus from urban non-point sources will have to achieved in each of the three watersheds draining to Baltimore Harbor.

The document entitled *Total Maximum Daily Loads of Nitrogen and Phosphorus for the Baltimore Harbor in Anne Arundel, Baltimore, Carroll, and Howard Counties and Baltimore City, Maryland* can be found on the Maryland Department of the Environment website at this web address:
http://www.mde.maryland.gov/programs/Water/TMDL/ApprovedFinalTMDLs/Documents/www.mde.state.md.us/assets/document/harbor-main-121406_final.pdf

The document can also be found in Volume 2 - Appendix F of the Northeastern Jones Falls Small Watershed Action Plan.

3.5.2 Bacteria

The entire Jones Falls watershed is listed as impaired by bacteria. Using a combination of monthly samples at five locations and an analysis methodology know as Bacterial Source Tracking (BST), MDE was able to identify the sources of the bacteria. They found that ~52% - 80% of the bacteria could be attributed to human sources, ~14% - 27% to domestic pets, ~1% - 5% to wildlife, and ~5% - 16% to lifestock; depending on the subwatershed. The reductions needed to meet water quality standards range from ~ 92 % - 98% and would require a near total elimination of human and domestic pet waste, as well as, a significant portion of the wildlife source. Much, but not all, of the human source reduction will be achieved through implementation of the requirements documented in the Baltimore City and Baltimore County Consent Decrees.

The document entitled *Total Maximum Daily Loads of Fecal Bacteria for the Non-Tidal Jones Falls Basin in Baltimore City and Baltimore County, Maryland* can be found on the MDE website at:
http://www.mde.maryland.gov/programs/Water/TMDL/ApprovedFinalTMDLs/Documents/www.mde.state.md.us/assets/document/Jones_Falls_TMDL_091906_final.pdf

The document can also be found in Volume 2 - Appendix G of the Northeastern Jones Falls Small Watershed Action Plan.

3.5.3 Chlordane

The impairment listing for chlordane was limited to Lake Roland. Chlordane was used as a pesticide to control termites in building foundations. Its use was restricted in 1975, and its sale was ultimately banned in 1988. With no known existing sources of chlordane (other than what exists in the sediment) and data suggesting that concentrations are decreasing the TMDL identified a strategy of natural recovery as the means of achieving water quality standards.

The document entitled *Total Maximum Daily Load (TMDL) Documentation for Chlordane in lake Roland* can be found on the MDE website at: http://www.mde.maryland.gov/programs/Water/TMDL/ApprovedFinalTMDLs/Documents/www.mde.state.md.us/assets/document/tmdl/roland/roland_tmdl_fin.pdf

The document can also be found in Volume 2 - Appendix H of the Northeastern Jones Falls Small Watershed Action Plan.

3.5.4 Chesapeake Bay TMDL

The United States Environmental Protection Agency (EPA), in coordination with the Bay watershed jurisdictions of Maryland, Virginia, Pennsylvania, Delaware, West Virginia, New York, and the District of Columbia (DC), developed and, on December 29, 2010, established a nutrient and sediment pollution diet for the Bay, consistent with Clean Water Act requirements, to guide and assist Chesapeake Bay restoration efforts.

The Baltimore County Phase II Watershed Implementation Plan (WIP) provides an overall strategy to meet the Chesapeake Bay TMDL reduction allocations for four sectors: agriculture, urban stormwater, septic systems, and point source discharges. This SWAP document, along with other SWAPs, will help address the urban sector allocations, specifically the County Phase I/II MS4 loads. The Bay TMDL requires 29.0% and 45.1% reductions in nitrogen and phosphorus respectively for the County Phase I/II MS4 loads by 2025. Maryland governor Martin O'Malley has asked for Maryland's jurisdictions to meet the Bay TMDL reduction goals by 2020. These reduction percentages will be the targets for this SWAP.

The Bay TMDL can be found on EPAs website here: http://www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/tmdlexec.html

As mentioned above, at the time of the writing of this SWAP report, the details of the Chesapeake Bay TMDL for sediments were not yet available so the local draft TMDL reductions are used.

3.6 Subwatershed Pollutant Loading Analysis

Analyses were conducted to assess the pollutant loads by the 4 subwatersheds within the Northeastern Jones Falls planning area. Using loading rates supplied by the Chesapeake Bay Program's Watershed Model 5.3.2 for land river segment WM0_3650_0001, the nitrogen, phosphorus and sediment loads were calculated for each subwatershed. The land use was derived from the Maryland Department of Planning 2007 land use GIS data layer. This information is presented in Chapter 2 of this Characterization Report. Table 3-13 presents the per-acre loadings for nitrogen, phosphorus and sediment used in this analysis.

Table 3-13: Land Use per Acre Nitrogen, Phosphorus and Sediment Loadings (pounds/acre/year)

Land Use	Nitrogen Load	Phosphorus Load	Sediment Load
Urban Pervious	10.14	0.25	105.21
Urban Impervious	15.92	1.34	771.15
Cropland	21.13	1.27	498.87
Pasture	5.93	0.60	107.58
Forest/Wetlands	2.70	0.04	28.67

The results of the analyses are presented in Tables 3-14, 3-15 and 3-16 for nitrogen, phosphorus and sediment respectively.

Table 3-14: Nitrogen Loads by Subwatershed

Subwatershed	N Load From Urban (lbs/yr)	N Load From Agricultural (lbs/yr)	N Load From Forests/Wetlands (lbs/yr)	N Load From Water (lbs/yr)	N Load Total (lbs/yr)	Per Acre N Load (lbs/acre/year)
Roland Run	41,221.1	208.7	761.5	0.0	42,191.3	11.0
Ruxton Run	3,808.8	0.0	26.9	0.0	3,835.7	8.1
Towson Run	15,980.1	0.0	212.7	0.0	16,192.8	8.8
Lake Roland Direct Drainage	4,544.0	0.0	313.8	99.5	4,957.3	6.5
Total	**65,553.9**	**208.7**	**1,315.0**	**99.5**	**67,177.1**	**9.7**

Table 3-15: Phosphorus Loads by Subwatershed

Subwatershed	P Load From Urban (lbs/yr)	P Load From Agricultural (lbs/yr)	P Load From Forests/Wetlands (lbs/yr)	P Load Total (lbs/yr)	Per Acre P Load (lbs/acre/year)
Roland Run	3,626.0	21.1	11.3	3,658.4	1.0
Ruxton Run	522.6	0.0	0.8	523.3	1.1
Towson Run	1,685.0	0.0	6.0	1,691.1	0.9
Lake Roland Direct Drainage	588.2	0.0	8.9	603.2	0.8
Total	**6,421.8**	**21.1**	**27.0**	**6,475.9**	**0.9**

Table 3-16: Sediment Loads by Subwatershed

Subwatershed	Sed Load From Urban (lbs/yr)	Sed Load From Agricultural (lbs/yr)	Sed Load From Forests/Wetlands (lbs/yr)	Sed Load Total (lbs/yr)	Per Acre Sed Load (lbs/acre/year)
Roland Run	1,023,062.9	3,786.8	8,086.4	1,034,936.1	270.8
Ruxton Run	98,895.4	0.0	574.6	99,443.0	210.7
Towson Run	536,920.4	0.0	4324.9	541,245.3	293.2
Lake Roland Direct Drainage	126,447.1	0.0	6,380.5	132,827.6	175.2
Total	**1,785,325.8**	**3,786.8**	**19,339.4**	**1,808,451.9**	**262.1**

The calculations of the subwatershed pollutant loadings will be used in the prioritization of the subwatersheds for restoration efforts. The total planning pollutant load will be used to determine the necessary reductions needed to meet TMDL and Tributary Strategies reductions.

3.7 Stormwater Management Facility Assessments

3.7.1 Stormwater Management Facility Conversion Assessment

The existing dry detention pond stormwater management facilities located within the Northeastern Jones Falls planning area were investigated for potential conversion to water quality management. The Baltimore County Department of Environmental Protection and Resource Management database on stormwater management facilities indicated that a total of 97 stormwater management facilities have been built in the planning area. Of these facilities, 17 were determined to be of a type that is potentially suitable for conversion to a facility that provides greater water quality benefits. These 17 facilities were originally designed as dry detention facilities to address water quantity only. The facilities were field assessed to determine their suitability for conversion. Data was collected on the pond condition and the potential for conversion. The data was then used in a ranking system to prioritize the ponds that had conversion potential.

The office assessment included:

- A determination of pond design type from the database, with only dry detention ponds being selected for field review.
- The pond drainage area was determined based on information in the database.
- Ownership – Private or Public was determined.
- Location – including ADC map reference and nearest road.

This information was used in conjunction with Geographic Information Systems to produce a set of maps that enhanced efficiency in pond location and routing of the field investigations.

The field assessment included:

- Verification of the facility type based on the configuration of the riser structure.
- The condition of the riser (Good, Damaged, with a description of the damage)
- Embankment condition (No problems, Trees on embankment, Erosion, Holes in the embankment)
- Vegetative condition of the pond bottom (Wetland vegetation, Tree, Bare soil, Mowed grass)
- Condition of the fence/gate
- Conversion potential factors
    - Pond field type conducive to conversion (Yes or No)
    - Pond is on line (Yes or No) – if online generally have greater difficulties with conversion
    - Ease of Access (Easy, Moderate, Difficult)
    - Flow routing (Short Flow Path, Long Flow Path)
    - Comments on conversion potential

The information derived from the field assessment was first used to determine if any conversion potential existed and secondly to develop a ranking score to be used in prioritizing the facilities for conversions. The ranking system is as follows:

- Field pond type – Only the detention pond type is considered as having potential. For those ponds that have a different field pond type (database is incorrect) or it was not possible to determine the pond type in the field no further consideration was given.

- Pond ownership – High priority was given to public ownership with a score of 5, whereas private ownership was given only a score of 1.

- Drainage area (acres) – Ponds with larger drainage areas were given a higher score compared to smaller drainage areas.
    - < 5 acres = 1
    - 5-10 acres = 2
    - 10-20 acres = 3
    - 20-50 acres = 4
    - >50 acres = 5

- Pond online – a negative 10 points were given to ponds that were online (had a stream flowing through them) and 5 points were given if the pond was off line.

- Accessibility – Easy access to the site was given 5 points, whereas moderate and difficult accessibility were given 3 and 1 point, respectively.
- Flow routing (distance between the inflow into the pond and outflow from the pond) – 5 points were given for short flow paths and 1 point was given for long flow paths.
- Vegetation on the pond bottom – The point system is based on whether the existing vegetation is already providing some water quality improvement
    - Grass/bare soil = 5
    - Wetland vegetation = -2
    - Trees = -1
- Riser – If the riser was damaged or there are holes in the embankment requiring repairs a higher score of 5 was given. No damage was scored as 1
- Land Use (based on the GIS maps) – These types generally followed a decrease impervious cover factor:
    - Commercial/Industrial = 5
    - High Density Residential = 3
    - Medium or Low Density Residential = 1
- Notes Factor – If the notes indicated a high potential by the field reviewer it was scored 5 points, whereas low potential received a –5 points.

Of the 17 stormwater management facilities assessed, only eight were found to have conversion potential and ranked for conversion.

Eight of the 17 facilities were not functioning as detention ponds and one was never built. Six of these eight facilities showed they had 'self-converted' to either a wet pond or shallow marsh type BMP. Pollution reductions for these self-converted ponds were calculated based on the BMP type that was observed in the field.

The results of the application of the ranking methodology described above are presented in Table 3-17. The table presents the ownership, drainage area to the facility, the total score and the subwatershed that the pond is in.

Table 3-17: Potential Conversions of Dry Ponds to Improve Water Quality

Pond Number	Ownership	Acres	Total Score	Rank	Subwatershed
112	Public	36.2	-4	Medium	Roland Run
113	Public	17.5	18	High	Roland Run
124	Private	2.2	16	High	Roland Run
126	Private	3.2	16	High	Roland Run
630	Private	10.0	21	High	Roland Run
771	Private	91.2	7	Medium	Roland Run
966	Private	3.1	16	High	Roland Run
1797	Public	113.2	4	Medium	Roland Run

3.7.2 Stormwater Management Facility Pollutant Load Reductions Calculations

3.7.2.1 Existing Facility Pollutant Removal

The drainage areas for the 97 built stormwater management facilities in the Northeastern Jones Falls have been digitized into a Geographic Information System (GIS) data layer. This along with the land use data layer permits the calculation of pollutant loads delivered to the facility based on the per acre loading rates in Table 3-13. The amount of reduction is dependant on the type of facility that receives the stormwater. Table 3-18 presents the pollutant removal efficiencies of various types of urban stormwater management BMPs. These efficiencies are derived from the Chesapeake Bay Program BMP efficiency table located at: http://archive.chesapeakebay.net/pubs/NPS_BMP_Table1.8.pdf . These efficiencies may be changed in the future as a result of a current effort to assess the literature and factors that affect the efficiencies.

Table 3-18: Percent Removal Efficiency of BMPs

BMP	Pollutants		
	TN	TP	TSS
Detention Facilities	5	10	10
Extended Detention Facilities	20	20	60
Wet Ponds & Wetlands	20	45	60
Infiltration Practices	80	85	95
Filtering Practices	40	60	80

Detention Facilities = Detention Pond and Hydrodynamic Devices (DP, OGS, and UGS)
Extended Detention Facilities = Extended Detention Ponds (EDSD, EDSW, ED)
Wet Ponds and Wetlands = Wet Pond and Shallow Marsh (WP and SM)
Infiltration Practices = Infiltration Trench and Infiltration Basins (IB, IT and ITWQC), Porous Paving (PP), and Dry Wells (DW)
Filtration Practices = Sand filters and Bioretention Facilities (SF, BIO)

The analysis was done on a subwatershed basis and is presented in Tables 3-19 and 3-20. Note that when a discrepancy existed between the facility database and what was observed in the field, the observed field pond type was used for the nutrient reduction analysis.

Table 3-19: Removal of Nitrogen and Phosphorus Due To Existing Stormwater Management Facilities by Facility Type (pounds)

Subshed	Facility Type	Acres	# Facilities	Nitrogen #s		Phosphorus #s	
				Load	Reduction	Load	Reduction
Roland Run	Detention	351.9	24	3,510.2	175.5	175.8	17.6
	Wet Pond/Wetland	80.3	4	1,006.6	201.3	51.9	23.4
	Filtration	53.7	10	663.1	265.2	32.0	19.2
	Ext Detention	120.9	12	1,442.8	288.6	76.0	15.2
	Infiltration	4.1	4	50.6	43.0	2.5	2.2
	Subwatershed Total	**610.9**	**54**	**6,673.2**	**973.6**	**338.3**	**77.5**
Towson Run	Detention	45.3	13	589.7	29.5	35.9	3.6
	Ext Detention	92.2	10	1,063.1	212.6	57.3	11.5
	Filtration	10.2	7	135.7	54.3	9.4	5.6
	Infiltration	1.3	1	18.2	15.5	1.2	1.0
	Subwatershed Total	**149.0**	**31**	**1,806.7**	**311.9**	**103.8**	**21.7**
Ruxton Run	Detention	10.6	1	127.2	6.4	6.3	0.6
	Wet Pond/Wetland	13.0	1	158.3	3.7	8.3	3.7
	Ext Detention	11.4	2	136.0	27.2	6.6	1.3
	Infiltration	4.7	2	57.8	49.2	3.0	2.6
	Subwatershed Total	**39.8**	**6**	**479.3**	**114.4**	**24.3**	**8.3**
Lake Roland Direct Drainage	Ext Detention	14.6	1	165.7	33.1	7.0	1.4
	Filtration	7.4	4	82.5	33.0	3.2	1.9
	Infiltration	1.4	1	20.4	17.3	1.4	1.2

Subshed	Facility Type	Acres	# Facilities	Nitrogen #s		Phosphorus #s	
				Load	Reduction	Load	Reduction
	Subwatershed Total	**23.5**	**6**	**268.5**	**83.4**	**11.6**	**4.5**
All Subsheds	***Grand Total***	***823.2***	***97***	***9,227.71***	***1,483.3***	***478.0***	***112.0***

Table 3-20: Removal of Sediment Due To Existing Stormwater Management Facilities by Facility Type (pounds)

Subshed	Facility Type	Acres	# Facilities	Sediment #s	
				Load	Reduction
Roland Run	Detention	351.9	24	94,986.4	9,498.6
	Wet Pond/Wetland	80.3	4	26,361.4	15,816.8
	Filtration	53.7	10	16,148.4	12,918.7
	Ext Detention	120.9	12	40,925.2	24,555.1
	Infiltration	4.1	4	1,326.6	1,260.3
	Subwatershed Total	**688.0**	**54**	**179,748.0**	**64,049.6**
Towson Run	Detention	45.3	13	19,774.3	1,977.4
	Ext Detention	92.2	10	31,068.9	18,641.4
	Filtration	10.2	7	5,269.3	4,215.4
	Infiltration	1.3	1	674.7	641.0
	Subwatershed Total	**149.0**	**31**	**56,787.3**	**25,475.2**
Ruxton Run	Detention	10.6	1	3,353.9	335.4
	Wet Pond/Wetland	13.0	1	4,459.2	2,675.5
	Ext Detention	11.4	2	3,510.5	2,106.3
	Infiltration	4.7	2	1,638.5	1,556.6
	Subwatershed Total	**39.9**	**6**	**12,962.1**	**6,673.8**
Lake Roland Direct Drainage	Ext Detention	14.6	1	3,560.4	2,136.2
	Filtration	7.4	4	1,612.8	1,290.2
	Infiltration	1.5	1	811.3	770.8
	Subwatershed Total	**23.5**	**6**	**5,984.6**	**4,197.3**
All Subsheds	***Grand Total***	***900.4***	***97***	***255,482.0***	***100,395.9***

3.7.2.2 Additional Pollutant Removal Based on Conversions of Detention Ponds

The increased load reductions due to conversion of existing dry detention ponds to water quality facilities is predicated on the assumption that the facility will be able to be converted to shallow marsh with at least partial extended detention. This results in improved pollutant removal efficiencies based on the efficiencies in Table 3-17 above. Nitrogen removal would improve from 5% to 20%, phosphorus removal from 10% to 45% and sediment removal from 10% to 60% . Table 3-21 presents the summary results by subwatershed.

Table 3-21: Conversion of Dry Detention Ponds – Nutrient Removal Calculations

Subshed	# of Facilities	Acres	Nitrogen (pounds)			Phosphorus (pounds)		
			Load to Facilities	Current Removal	Converted Removal	Load to Facility	Current Removal	Converted Removal
Roland Run	8	276.3	2,598.1	129.0	519.6	122.5	12.3	55.1
Total								

Table 3-22: Conversion of Dry Detention Ponds – Sediment Removal Calculations

Subshed	# of Facilities	Acres	Load to Facilities	Current Removal	Converted Removal
Roland Run	8	276.3	65,707.0	6,570.7	39,424.2
Total					

The conversion of all 8 dry ponds would result in an increase in the removal of nitrogen from 129.0 pounds/yr to 515.9 pounds/yr, and of phosphorus from 12.3 pounds/yr to 55.6 pounds/yr. This represents a nutrient reduction increase of 386.9 pounds/year and 43.3 pounds/year for nitrogen and phosphorus respectively.

Note that the detention facilities listed in Table 3-18 total more than the 17 considered for conversion as some are oil and grit separators, stormceptors and underground storage facilities.

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CHAPTER 4

UPLAND ASSESSMENTS

4.1 Introduction

The Unified Subwatershed and Site Reconnaissance or USSR is a field survey used to evaluate potential water pollution sources and restoration opportunities within the upland portion of an urban watershed. The USSR manual detailing the specific investigations used to conduct the survey is one in a series developed by the Center for Watershed Protection (Wright *et. al.* 2004). The concept behind the USSR is to provide a quick but thorough characterization of upland areas to identify major sources of stormwater pollutants and the restoration opportunities for source controls, pervious area management, and improved municipal maintenance (i.e., retrofits, street sweeping, open space management, etc.)

This chapter outlines the four procedures used to accomplish data collection for the USSR in the Northeastern Jones Falls watershed: the Neighborhood Source Assessment, Hot Spot Investigation, Institutional Site Investigation and Pervious Area Assessment. Results from these upland assessments are also presented.

4.2 Neighborhood Source Assessments (NSA)

4.2.1 Assessment Protocol

The Neighborhood Source Assessment primarily followed the protocols outlined in the Unified Subwatershed and Site Reconnaissance (USSR) manual (Wright *et. al.* 2004).

Prior to the fieldwork, neighborhood units were designated through aerial photograph interpretation and neighborhood GIS maps. The neighborhoods were differentiated using factors such as age, housing density, physically defined communities and apartment or town home complexes.

The NSA form serves to quantify potential pollution sources and identify potential restoration opportunities. The assessment looks specifically at yards and lawns, rooftops and downspouts, driveways and sidewalks, curbs and common areas.

Specific actions can than be recommended. Recommended actions are a product of the assessment that will guide volunteer groups and local government. This results in a better use of volunteer resources to target specific actions where they are most needed. The following is a list of the recommended actions included on the field form. If a different action was identified during the field visit, than it was noted as a separate comment.

- Downspout retrofit
- Better lawn/ nutrient management practice

- Better landscaping/ Bayscaping practice
- Better management of common space
- Storm drain stenciling
- Tree planting
- SWM pond maintenance or retrofit
- Multifamily parking lot retrofit

The final step in the NSA is to assign indexes, using benchmarks based on all the data collected through the NSA form. Each neighborhood was given a Pollution Severity Index (PSI) of "severe", "high", "moderate" or "low". PSI rates the degree of non-point source pollution a neighborhood is likely generating based on the NSA. A Restoration Opportunity Index (ROI) was also assigned to each neighborhood as "high", "moderate" or "low". ROI is a measure of the feasibility of onsite retrofits or behavior changes based on the assessment.

4.2.2 Summary of Sites Investigated

A total of 49 neighborhoods were identified and assessed. Of these 49, 17 were considered to have a "high" Pollution Severity Index (PSI) and/or a "high" Restoration Opportunity Index (ROI). Note that of these 17, only one, NSA-M-08, had a "high" rank for both PSI & ROI. See Appendix 4-4 for a map of neighborhoods assessed.

4.2.3 General Findings

Below is a description of the methodologies associated with evaluating recommended actions along with the respective results of the inquiry. The tables list the neighborhoods that are identified for specific actions. Note that some neighborhoods exist in two subwatersheds, hence the 'total unique' row at the bottom of the tables. Maps are also included showing the locations of the neighborhoods that were identified from the associated assessment.

4.2.3.1 Downspout Disconnection

Downspout disconnection decreases flow to local streams during storm events, helping to ease stream bank erosion and reduce pollutants entering the stream during storm events. Downspout disconnection can usually be achieved through downspout redirection. This method involves redirecting rooftop runoff from impervious areas or from a direct connection to a nearby lawn or garden area. This allows the rain gutter discharge to infiltrate through the pervious area and enter the stream through the groundwater system in a slower and more natural fashion. There must be at least 15 feet of pervious area available for infiltration to occur.

Rain barrels and rain gardens are other disconnection options that were sometimes recommended instead of redirection based on specific conditions. When there is limited space or limited impervious surface available, a rain barrel may be the only feasible method of disconnection. If the average neighborhood lot has several hundred square feet down gradient from the downspout, there is potential for a rain garden, the most desirable disconnection method.

A neighborhood in which 25% or more of the downspouts are either directly connected to the system or drain to an impervious surface that feeds into a storm drain inlet, will be recommended for downspout redirection, given there is at least 15 feet of usable pervious area to redirect the flow. Table 4-1 lists by subwatershed the neighborhoods that meet these criteria. A GIS data layer of building footprints was used to calculate the amount of impervious surfaces that could have runoff treated if a downspout disconnection program was initiated. This data is also included in Table 4-1. Figure 4-1 shows the locations of these neighborhoods recommended for downspout redirection.

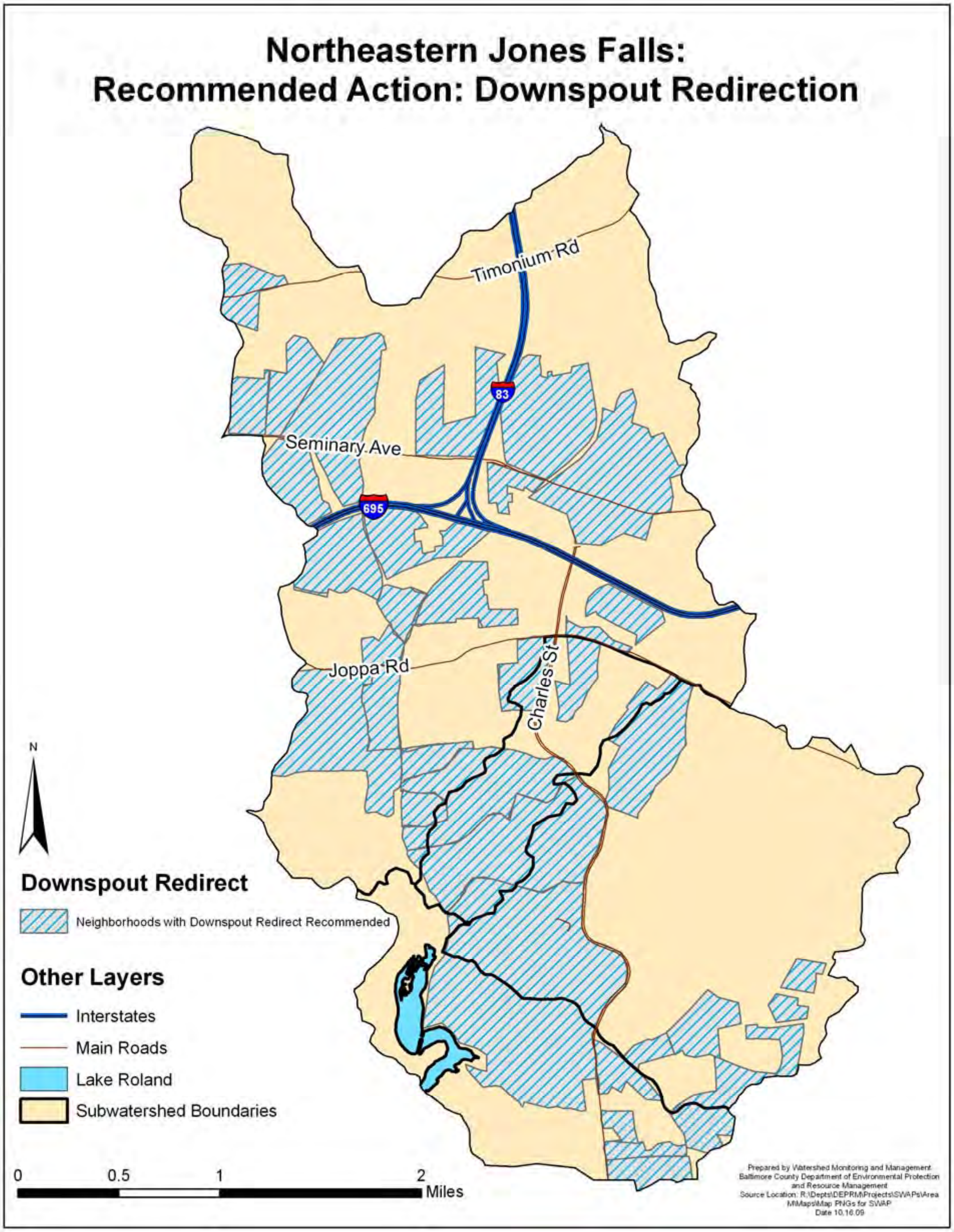


Figure 4-1: Neighborhoods with Downspout Redirection Recommended

Table 4-1: Acres Addressed by Downspout Redirection

Subwatershed	Number of Neighborhoods with Downspout Redirection Recommended	Impervious Rooftop Acres Addressed by Downspout Disconnection
Roland Run	24	133.1
Ruxton Run	7	19.3
Towson Run	9	51.0
Lake Roland Direct Drainage	6	27.0
Total	**46**	**230.3**
Total Unique	**36**	

4.2.3.2 Street Sweeping

Street sweeping removes trash, sediment and organic matter such as leaves and twigs from the curb and gutter system preventing their entry into nearby streams. This helps reduce the clogging of the stream with excess material and the decay of excess organic matter that can rob a stream of essential oxygen.

Neighborhoods exhibiting 20% or more of their curbs/gutters with excessive trash, sediment and/or organic matter were recommended for street sweeping. A GIS data layer of roads was used to tally the miles of roads for the neighborhoods that have street sweeping as a recommended action. Figure 4-2 shows the locations of neighborhoods recommended for street sweeping. Table 4-2 lists these neighborhoods and miles of roads by subwatershed. This information can help Baltimore County agencies better target street sweeping efforts.

Table 4-2: Neighborhoods and Miles of Road Addressed by Street Sweeping

Subwatershed	Number of Neighborhoods with Street Sweeping Recommended	Miles Addressed by Street Sweeping
Roland Run	12	16.9
Ruxton Run	5	2.9
Towson Run	9	17.1
Lake Roland Direct	5	5.2
Total	**31**	**42.0**
Total Unique	**19**	

4.2.3.3 High Lawn Maintenance

A well-manicured and responsibly maintained lawn can be an asset to the watershed. Too often however, over fertilization and irresponsible pest management result in pollutant charged runoff to local streams.

Neighborhoods where 20% or more of the homes were considered to employ intensive lawn maintenance practices were recommended for fertilizer reduction/education. Table 4-3 shows the number of neighborhoods and the acreage of these neighborhoods by subwatershed. Figure 4-3 shows their location. Typically, apartment complexes and town home developments employ the same lawn maintenance practice throughout their "neighborhood" so these usually assessed at 100% high or 100% medium lawn maintenance.

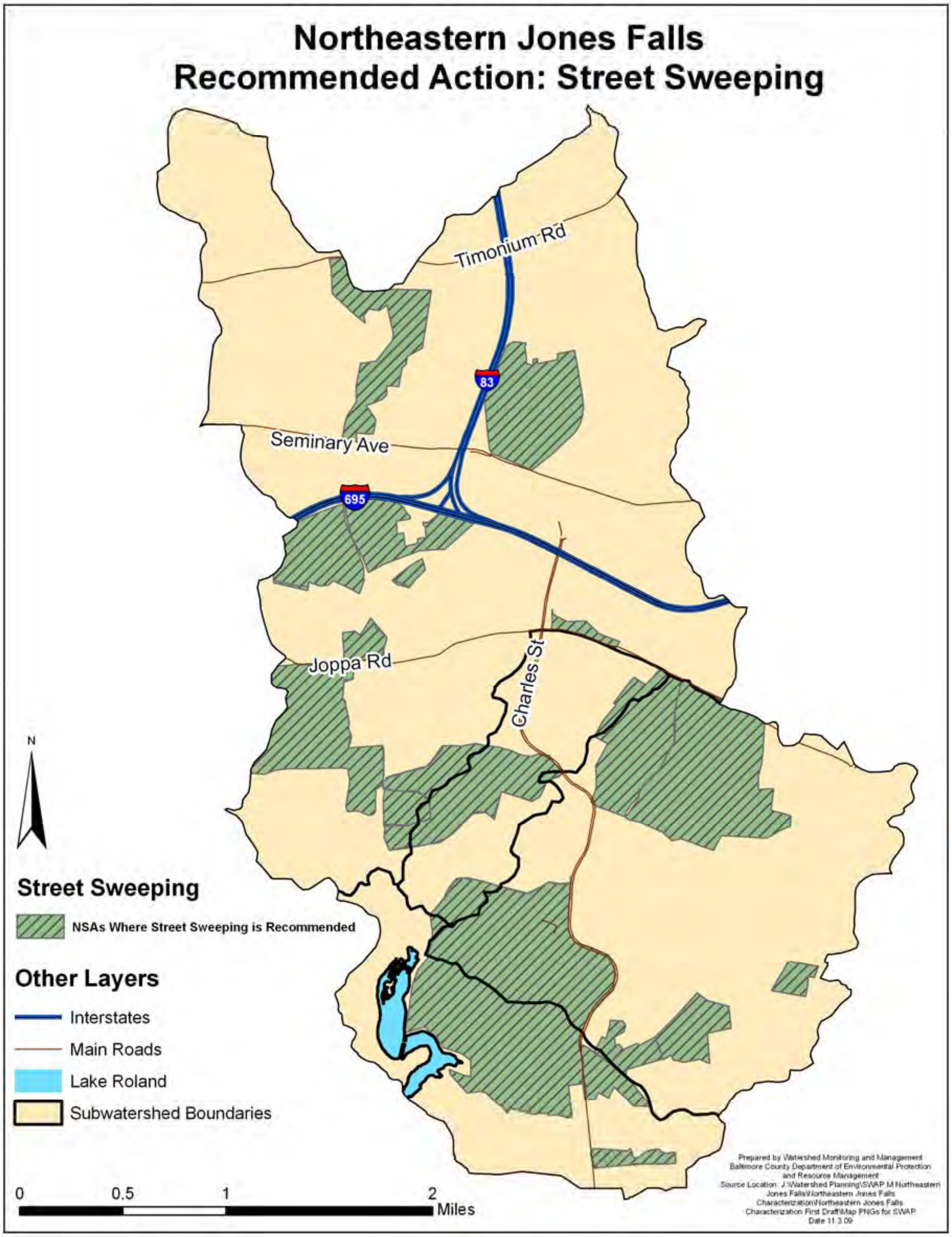


Figure 4-2: Neighborhoods with Street Sweeping Recommended

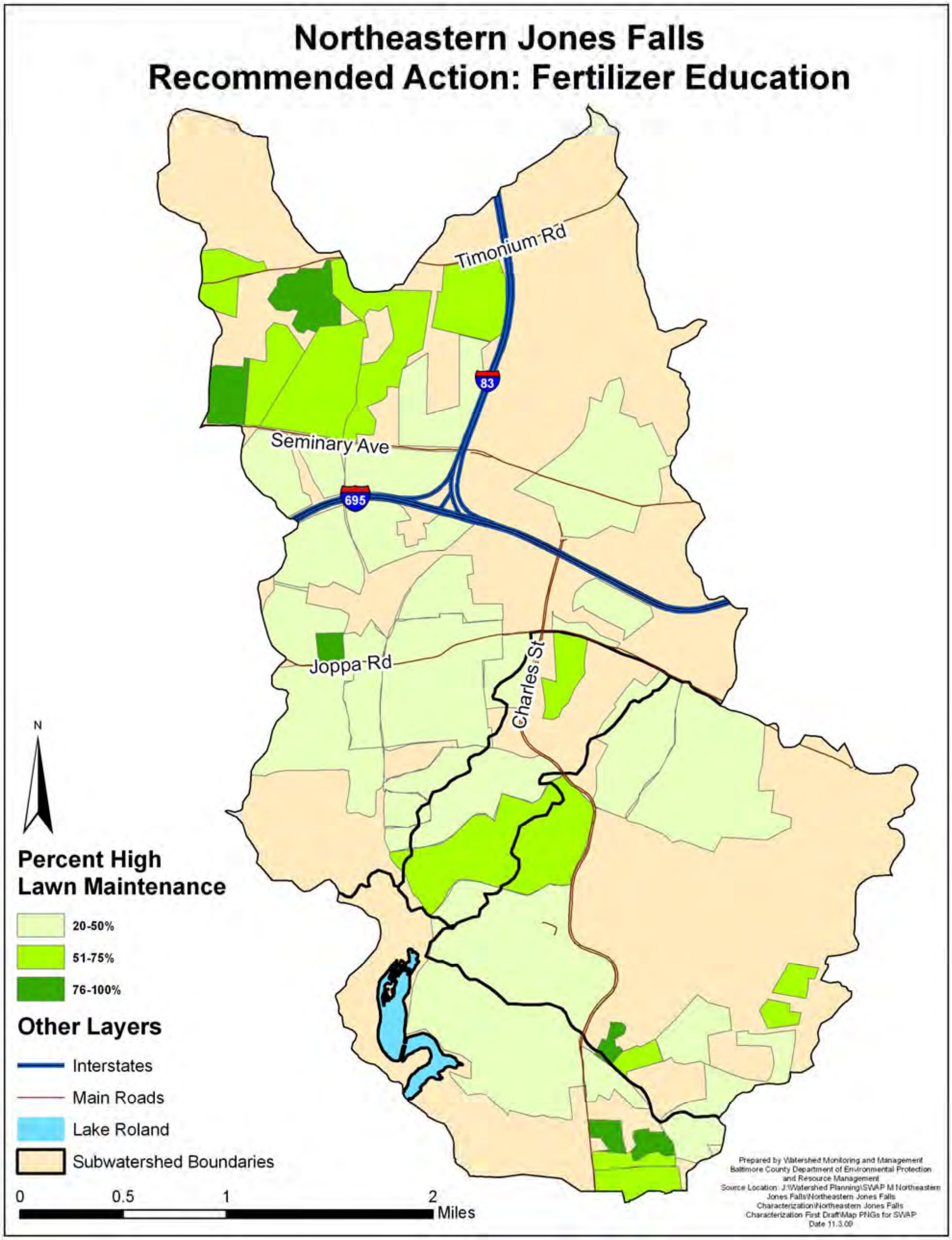


Figure 4-3: Neighborhoods with 20-100% High Maintenance Lawns

Table 4-3: Acres of Lawn Addressed by Fertilizer Reduction

Subwatershed	Number of Neighborhoods with Fertilizer Reduction Recommended	Acres of Lawn To Be Addressed by Fertilizer Reduction	% of Subwatershed To Be Addressed by Fertilizer Reduction
Roland Run	27	601.5	15.7
Ruxton Run	9	120.8	25.6
Towson Run	12	269.4	14.6
Lake Roland Direct	10	159.6	19.5
Total	**58**	**1,230.2**	**17.8***
Total Unique	**40**		

*this percentage excludes water acreage of Lake Roland

4.2.3.4 Bayscaping

Bayscaping employs the use of plants native to the Chesapeake Bay watershed for landscaping. These plants require less watering, fertilizers and pesticides to maintain, and can enhance wildlife benefits. Implementing new bayscaped areas on a property also reduces lawn maintenance requirements, which reduces fuel consumption and exhaust from mowing equipment and also reduces the need for lawn chemicals.

Every neighborhood could use more bayscaping. In this case, however, bayscaping education and implementation was recommended in neighborhoods where the typical lot was less then 25% landscaped and impervious area on the lot would not inhibit improvement of this percentage. Table 4-4 shows the number of these neighborhoods and the acreage of land addressed by subwatershed. Acreages represent pervious lands within the neighborhoods with the recommendation. Figure 4-4 shows their location.

Table 4-4: Neighborhoods and Acres of Land Addressed by Bayscaping

Subwatershed	Number of Neighborhoods with Bayscaping Recommended	Acres of Land Addressed with Bayscaping
Roland Run	30	1,456.2
Ruxton Run	5	61.1
Towson Run	4	100.0
Lake Roland Direct	3	25.0
Total	**42**	**1,642.2**
Total Unique	**35**	

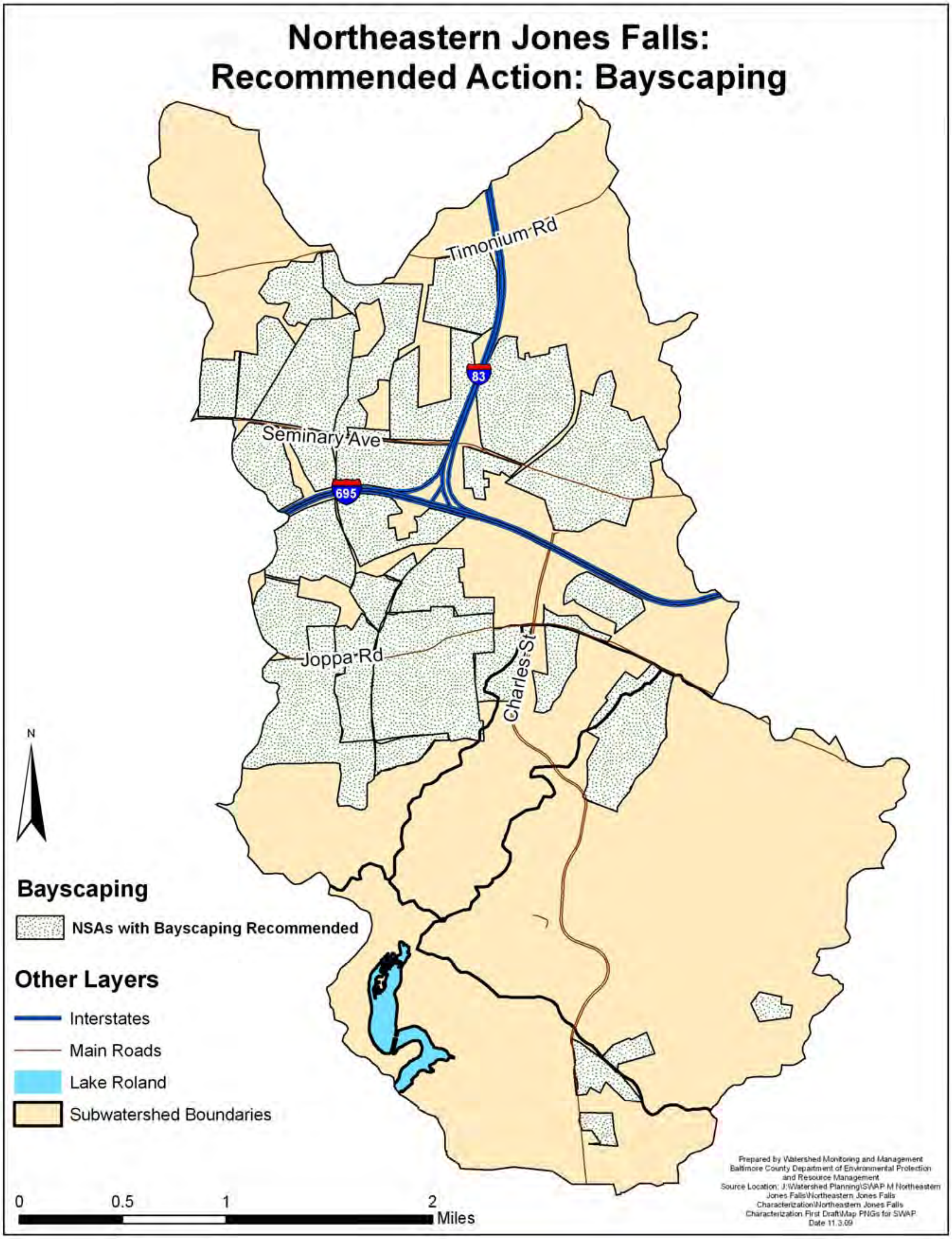


Figure 4-4:Neighborhoods with Bayscaping recommended

4.2.3.5 Street Trees

Note-this analysis will need to be redone as 6 ft is now required for street trees (-NCF 1/13).

Street trees improve air quality, catch precipitation with their leaves and absorb nutrients through their root systems.

Street trees were recommended for neighborhoods where at least 25% of the streets had four (4) feet or more of plantable space between the curb and sidewalk and less than 75% of these areas had trees planted. The number of trees was estimated based on a spacing of one tree per 15-20 feet. Table 4-5 shows the number of neighborhoods and the number of street trees that could be planted. Figure 4-5 shows the locations of the neighborhoods.

Table 4-5: Number of Street Trees to be Planted

Subwatershed	Number of Neighborhoods with Street Trees Recommended	Number of Trees That Could be Planted
Roland Run	10	690
Ruxton Run	0	0
Towson Run	5	215
Lake Roland Direct	1	40
Total	**16**	**945**
Total Unique	**13**	

See appendix 4-1 for a comprehensive summary of NSA results

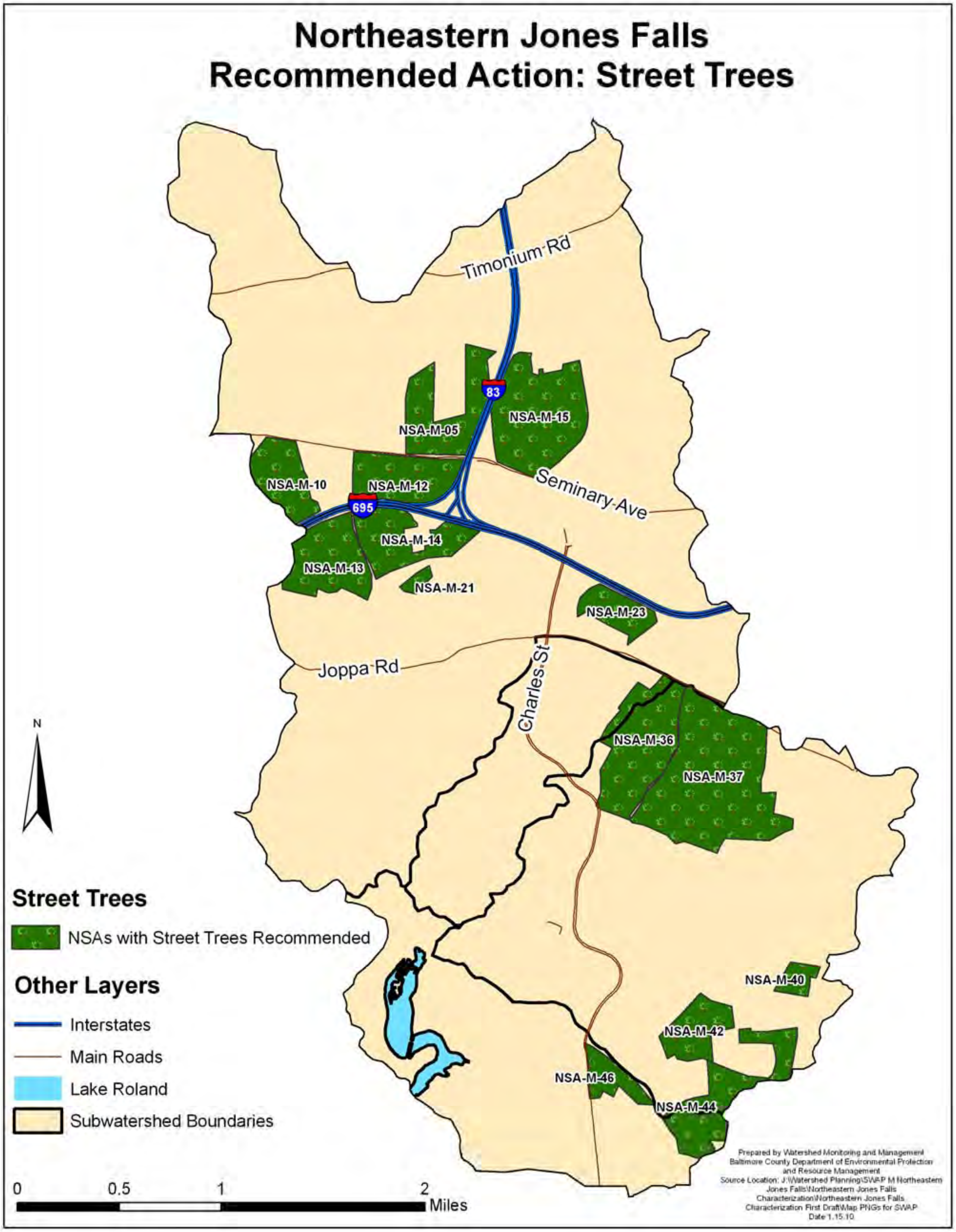


Figure 4-5: Neighborhoods with Street Tree Planting Recommended

4.3 Hotspot Site Investigations (HSI)

Stormwater "hot spots" are commercial or industrial operations that produce higher levels of storm water pollutants, and/or present a higher potential risk for spills, leaks or illicit discharges into the storm water system. Identifying potential hotspots using the HSI can help the appropriate local government agencies target follow-up investigations and enforcement efforts.

4.3.1 Assessment Protocol

The Hot Spot Investigation primarily followed the protocols outlined in the Unified Subwatershed and Site Reconnaissance (USSR) (Wright *et. al.* 2004). This manual is one in a series developed by the Center for Watershed Protection. Stormwater hotspots are classified into four types of operations: commercial, industrial, municipal and transport-related. The Hot Spot Investigation is used to evaluate the potential of these types of facilities to contribute contaminated runoff to the storm drain system or directly to receiving waters.

At hotspot sites, field crews looked specifically at vehicle operations, outdoor materials storage, waste management, building conditions, turf and landscaping, and stormwater infrastructure to evaluate potential pollution sources. Based on observations at the site, the field crew may recommend enforcement measures, follow-up inspections, illicit discharge investigations, retrofits, or pollution prevention planning and awareness. The HSI data sheet was used to complete the investigation, the contents of which are outlined below:

A. Vehicle Operations: If there are vehicles stored, maintained, washed or fueled on the premises it must be noted here. Any and all vehicle activity from long-term parking to commercial fueling stations should be investigated. Staining and proximity of operations to storm drains are of particular interest here.

B. Outdoor Materials: Many sites will require the storage of outdoor materials. Uncovered loading docks, rusting storage barrels and any exposed storage areas could be contributing to stormwater pollution. Again, stains leading from these areas to storm drains are of particular concern and provide visual documentation of an observed pollution source.

C. Waste Management: All sites exhibit some form of waste management, at a minimum trash disposal. Each site is noted for the type of waste generated, dumpster conditions and possible stains leading to storm drains.

D. Physical Plant: Basic good housekeeping procedures can be observed by the condition of the building(s) and parking lot(s). Downspout discharge is noted here and a check for stains leading to storm drains indicating poor erosion/sediment control or cleaning & material storage practices.

E. Turf/Landscaping: Intensively treated lawns and landscaped areas may be a pollution source if they drain to the storm drain system.

F. Storm Water Infrastructure: Any on-site storm water management practices were indicated here along with gutter conditions if there were private storm drains on the property. Some commercial and industrial sites have underground treatment facilities which may be overlooked during the field investigation.

The overall pollution potential for each hotspot site was tallied based on observed sources of pollution and the potential of the site to generate pollutants that would likely enter the storm drain network. The hotspot designation criteria as set forth in *Wright et al*. (2004) was used to determine the status of each site based on field crew observations. Sites were classified into four initial hotspot status categories:

- Not a hotspot – no observed pollutant: few to no potential sources
- Potential hotspot – no observed pollution; some potential sources present
- Confirmed hotspot – pollution observed; many potential sources
- Severe hotspot – multiple polluting activities directly observed

Prior to going out in the field, potential hotspot locations were identified using GIS data from NAICS or North American Industry Classification System. Most of the potential hotspots were located along main roads where commercial and industrial zoning districts are planned. These road corridors tend to run as radials out from Baltimore City's core.

4.3.2 Summary of Sites Investigated

The investigation into potential hotspots in the Northeastern Jones Falls yielded one potential, one confirmed and one severe hotspot, all located in the Roland Run subwatershed. Tables 4-6 through 4-8 show some of the details of the investigation. Figure 4-6 shows the locations and rated severity of these hot spots.

Table 4-6: Hotspot Site Status

Subwatershed	# Severe Hotspots	# Confirmed Hotspots	# Potential Hotspots	# Not Hotspots
Roland Run	1	1	1	0

Table 4-7: Hotspot Site Type of Facility

Subwatershed	# Commercial	# Industrial	# Municipal	# Transportation Related
Roland Run	2	0	1	0

Table 4-8: Hotspot Site Source of Pollution

Subwatershed	Outdoor Storage	Waste Management	Physical Plant	Turf/ Landscaping	Vehicle Operations
Roland Run	3	3	0	0	1

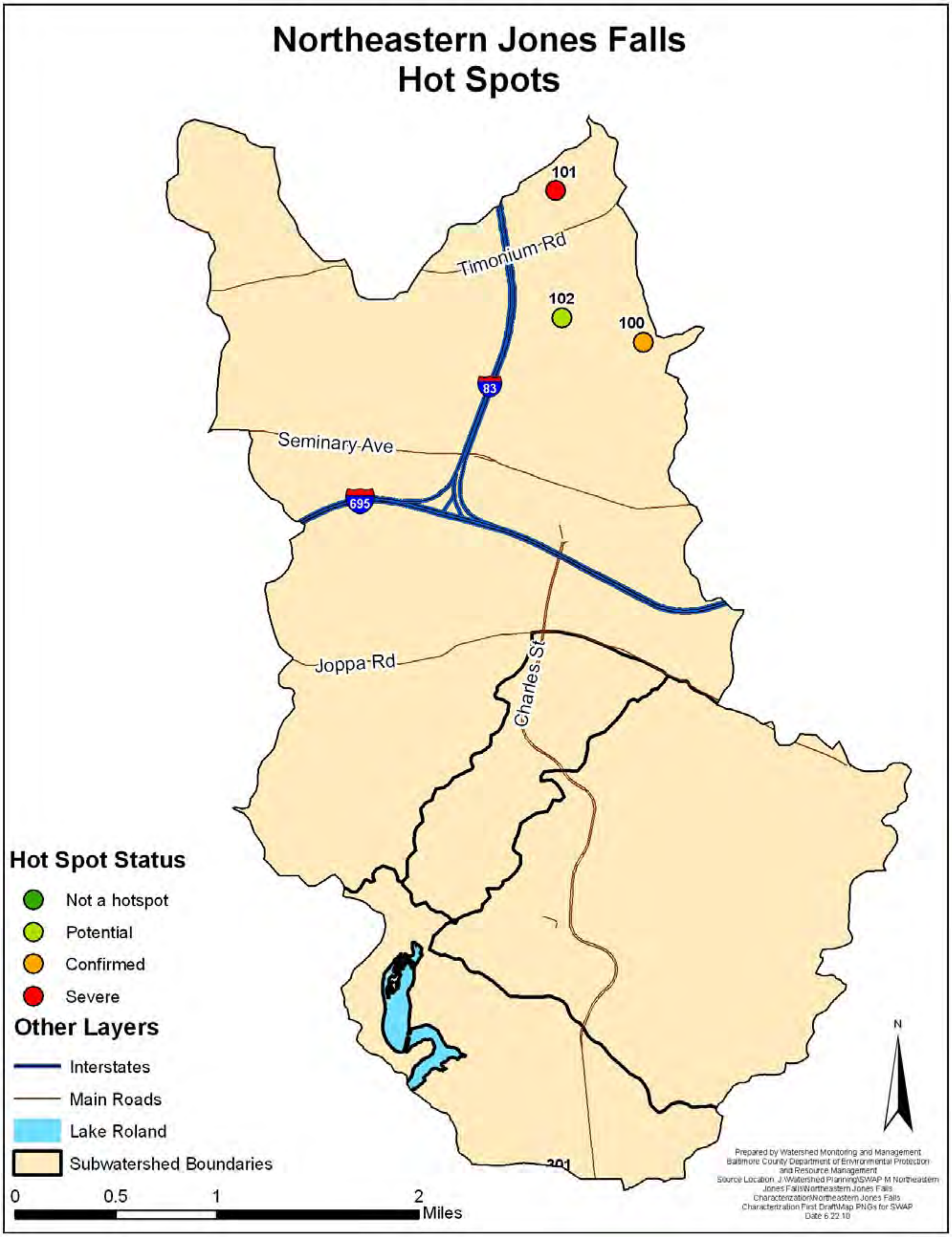


Figure 4-6: Hot Spot Investigation Locations

4.3.3 General Findings

The hot spot investigation in the Northeastern Jones Falls yielded only three facilities, all located in the Roland Run subwatershed.

At site M_100 a drum containing used cooking grease was observed actively spilling over the top during a rain event. The field team reported this to Baltimore County Environmental Health on 9/14/09. A follow up visit on 1/19/09 confirmed that the barrel had been removed and therefore no longer posing a problem.

Site M_101 is the Timonium Fairgrounds and was rated as a severe hot spot. The field team visited this site on 9/11/09 during a rain event, just after the State Fair. Large piles of uncovered manure, hay and mulch were observed draining directly to the storm drain inlets that were clogged with debris. There were also large amounts of sediment running off from a large gravel lot and from the racetrack.

Site M_102 is an auto repair shop that has been using an area behind the facility as a junkyard for old vehicles and metal storage drums. This facility was reported to Baltimore County Office of Permits and Development Management on 1/20/10.

4.4 Institutional Site Investigations (ISI)

The Northeastern Jones Falls watershed has an abundance of Institutional facilities that occupy more than 8% of the land surface.

4.4.1 Assessment Protocol

Prior to conducting the fieldwork, a list was generated to determine sites of interest and a GIS map generated showing identified ISI sites within the subwatershed. In the field, ADC maps and indexes were used, along with the GIS maps to locate the targeted institution. Most institutions are listed in the ADC index.

Field investigations consist of observing the site as thoroughly as possible either from a vehicle or walking the site. The ISI data sheet is used to complete the investigation, the contents of which are outlined here:

The ISI form indicates the type of facility from the following categories:

- Hospital
- Municipal facility
- School:
  - College
  - High school
  - Middle school
  - Elementary

The ownership, if known, is also indicated. This is important because different approaches may be used to contact private versus public institutions. Sometimes different partners may be making the contacts. A message may be received differently coming from government as opposed to a non-profit group. Strategies for individual institutions will incorporate these different approaches.

Also included is the likelihood of the site to need a nutrient management plan. The Maryland Department of Agriculture (MDA) implements an Urban Nutrient Management Program based on the Maryland Water Quality Act of 1988. This program regulates all facilities or companies that apply fertilizer to land that is either state-owned or 10 acres of land or more. Several of the Institutions in the study area potentially qualify and these will be forwarded to staff at the MDA for follow up.

The field form incorporates many of the pollution source investigation categories that are used on the Hot Spot Investigation form. Some of the restoration opportunities and recommended actions from the Pervious Area Assessment and the Neighborhood Source Assessment are also incorporated. Below is a description of these categories.

A. Tree Planting: Potential tree planting locations are sought and estimates are noted on the field sheet. More accurate numbers can be determined during the post-fieldwork desktop analysis.

B. Exterior: Condition of the building(s) and parking lot(s) are noted and potential for excess impervious cover removal is determined. Although churches often seem to have potential for impervious removal, in most cases, it must be considered that on Sundays empty lots will most likely fill.

Storm drains in close proximity to the building must be examined for possible maintenance/mop water dumping. Downspout discharge is also noted here, keeping in mind the 15 ft minimum pervious area necessary for infiltration to be considered for disconnection. Also, a check for stains leading to storm drains indicating poor erosion/sediment control, cleaning & material storage practices is necessary.

C. Waste Management: In most cases, garbage is the only waste type evident at institutions. Dumpster condition and proximity to storm drains is noted here.

D. (vehicle operations) and **E. (outdoor materials)** were not applicable in any institutions during these investigations.

F. Turf/Landscaping Areas: Turf/landscaping/forest canopy/bare soil percentages are estimated here and confirmed in the post-fieldwork desktop analysis. Turf management status is determined based on guidelines set up in Manual 11 of the Urban Subwatershed Restoration Series. Landscaped areas are checked for possibility of mulch and other organic matter washing to the storm drain system and adjacent impervious surfaces.

G. Storm Water Infrastructure: Check for storm drain stenciling and SWM practices.

Recommended actions for ISIs include:

- storm drain stenciling
- tree planting
- downspout disconnection
- stormwater retrofit
- education
- follow-up on-site inspection
- impervious cover removal
- pervious area restoration
- consider a water pollution prevention plan

Using GIS, a total acreage for the institution's property is determined using tax boundaries. Tree planting sites identified in the field are accurately measured using GIS and tree-planting estimates are determined based on 15-20 foot spacing. These are preliminary estimates that will be more accurately estimated through follow up on-site investigations, if in fact the institution is chosen for restoration. Turf/landscaping/forest canopy/bare soil percentages are confirmed and latitude/longitude coordinates are noted using GIS.

4.4.2 Summary of Sites Investigated

A total of 13 ISI sites were investigated in the SWAP area. Table 4-9 summarizes the institution types assessed by subwatershed. Figure 4-7 shows locations, types and ownerships of all ISI sites. No ISIs were performed in the Lake Roland Direct Drainage subwatershed.

Table 4-9: Institutional Types by Subwatershed

Subwatershed	Faith Based	Private Schools	Colleges	Hospitals	Public Schools	Municipal	Total
Roland Run	3	0	0	0	2	0	**5**
Ruxton Run	0	1	0	0	1	1	**3**
Towson Run	0	0	0	3	2	0	**5**
Lake Roland	-	-	-	-	-	-	**0**
Total	**3**	**1**	**0**	**3**	**5**	**1**	**13**

Note that although Towson University lies within the SWAP boundary, there was no ISI assessment performed. TU has their own Master Plan, which includes environmental restoration and stewardship so an assessment here was not deemed necessary.

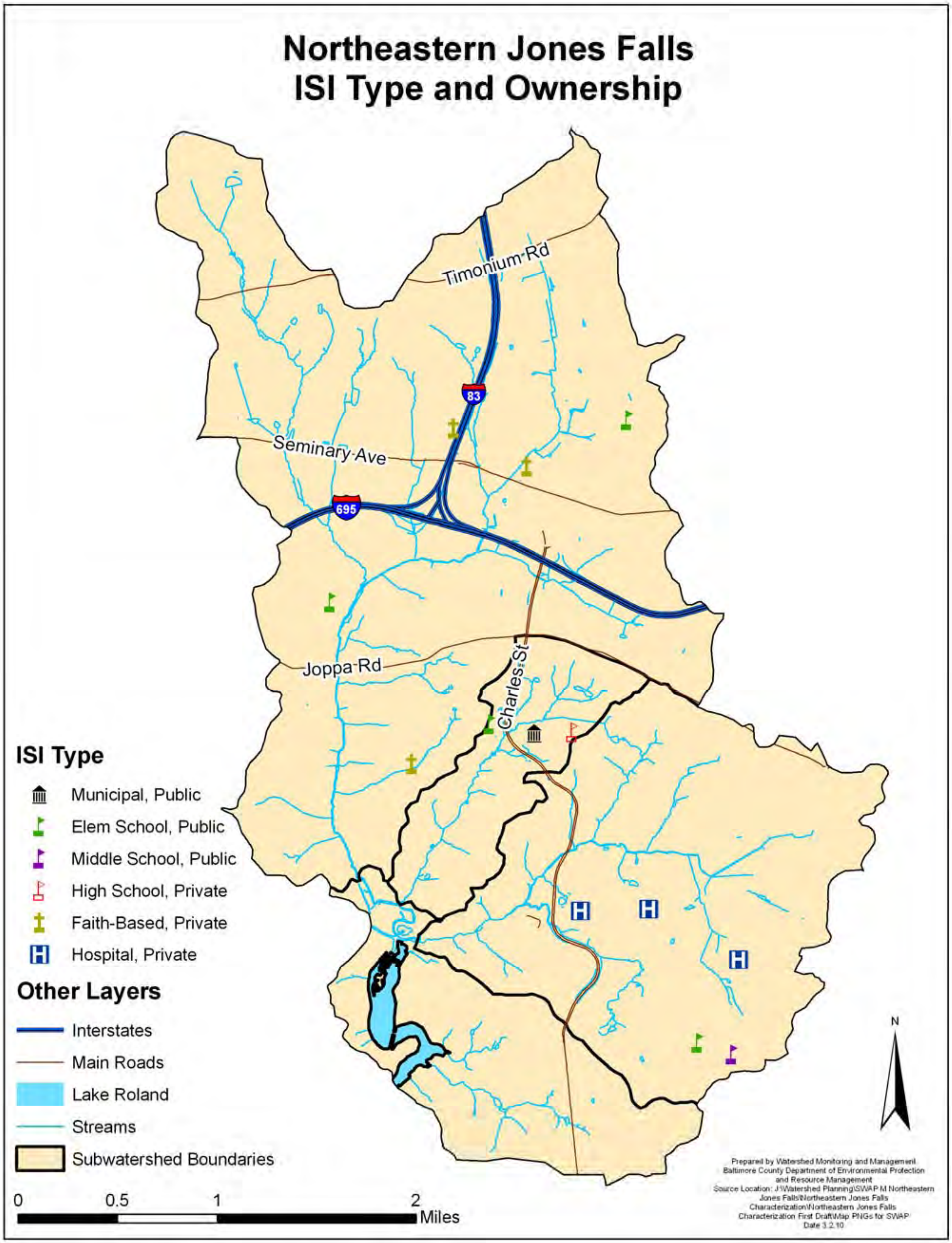


Figure 4-7: Institutional Site Investigation Locations

4.4.3 General Findings

See Appendix 4-3

Waste management proved to be the most frequent area in need of improvement with over 50% of the sites exhibiting this as a potential pollution source. 4 sites showed downspout disconnection possibilities and 4 sites had storm water retrofit potential.

It was estimated that 602 total trees could be on 10 of the 13 institution sites surveyed. Table 4-10 summarizes the recommended actions by subwatershed.

Table 4-10: ISI Actions by Subwatershed

Subwatershed	Est. Trees	SW Retrofit	Downspout Disconn.	I. C. Removal	Trash Mgmt.
Roland Run	252	3	2	0	0
Ruxton Run	200	1	2	0	0
Towson Run	150	0	0	0	3
Lake Roland Direct	-	-	-	-	-

4.5 Pervious Area Assessments (PAA)

4.5.1 Assessment Protocol

The Pervious Area Assessment or PAA is used as a component of the USSR to identify and evaluate sites within the study area with potential for land reclamation, reforestation, or revegetation. The PAA primarily followed the protocols outlined in the Unified Subwatershed and Site Reconnaissance (USSR) (Wright *et. al.* 2004) Although the manual recommends remnants 2 acres or larger, in the Northeastern Jones Falls area all sites at least .5 acres were considered. Each site was evaluated based on the quality of any vegetation present and any conditions that may prevent the site from being considered a good candidate for restoration.

The overall recommendation for each site was determined based on existing conditions at the sites including parcel size, ownership, invasive species, etc. The initial recommendation criteria as set forth in Wright *et al.* (2004) was used to determine the status of each site based on field crew observations. Sites were classified into four initial recommendation categories:

- Good candidate for natural regeneration
- May be reforested with minimal site preparation
- May be reforested with extensive site preparation
- Poor reforestation site requiring excessive preparation

4.5.2 Summary of Sites Investigated

A total of 13 pervious areas were assessed within the study area totaling 80 acres. Parcel sizes ranged from .5 acres to 15 acres and averaged 6 acres. All sites exhibited the “open pervious” cover type. Table 4-11 shows some data on the sites. Figure 4-8 shows locations of the PAAs, and their respective sizes.

4.5.3 General Findings

Table 4-11. Pervious Area Assessments

Site ID	Acres	Subwatershed	Ownership	Site Prep	% Turf
PAA-M-100	3.0	Roland Run	Public	Minimal	85
PAA-M-101	1.5	Roland Run	Public	Minimal	100
PAA-M-102	13.0	Roland Run	Public	Minimal	80
PAA-M-103	2.5	Roland Run	Private	Minimal	70
PAA-M-104	13.0	Roland Run	Public	Minimal	85
PAA-M-105	10.0	Roland Run	Public	Minimal	90
PAA-M-106	10.0	Roland Run	Public	Minimal	70
PAA-M-107	4.0	Roland Run	Public	Extensive	5
PAA-M-108	4.5	Roland Run	Private	Minimal	95
PAA-M-300	15.0	Towson Run	Private	Minimal	85
PAA-M-400	0.5	Lake Roland	Private	Minimal	100
PAA-M-401	1.5	Lake Roland	Public	Extensive	65
PAA-M-402	1.5	Lake Roland	Private	Minimal	85
Total	**80**				

The most likely candidates for a successful pervious area restoration effort are those on public lands with minimal site preparation required. There were 6 such sites identified in the Northeastern Jones Falls watershed, with areas ranging from 1.5 to 13 acres and totaling 50.5 acres. Sites 102 and 104 were the largest of these sites, both on public property and good starting points for pervious area restoration efforts. Each of these sites is a public park so the entiresite is not available to plant.

Site 300 is a 15-acre open pervious area at the entrance to the GBMC Hospice. According to tax parcel data, this land is the property of Towson University. Considering the size, topography and apparent lack of usage, it is worthy of further investigation.

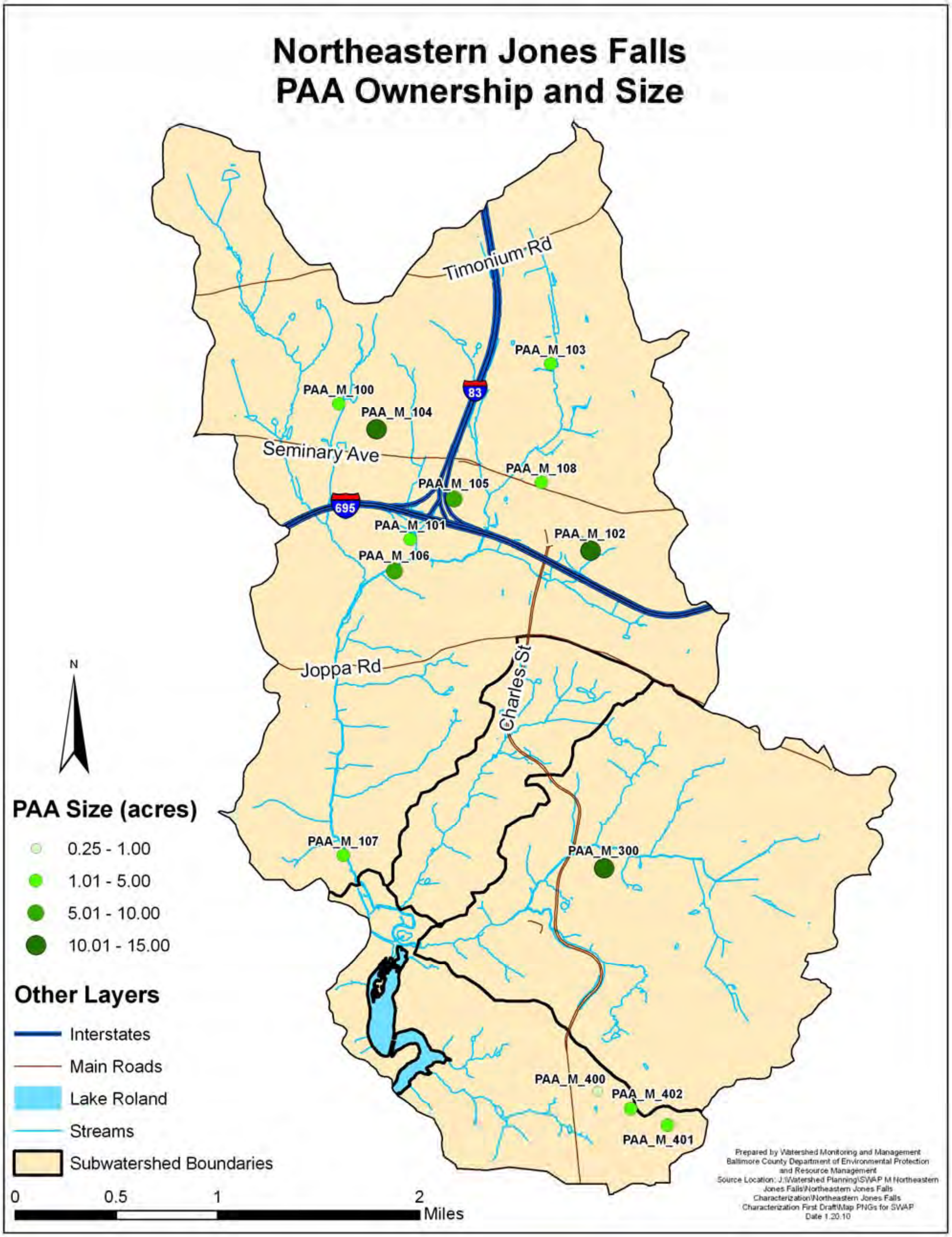


Figure 4-8: Pervious Area Assessment Locations

Appendices

Appendix 4-1a: NSA Data

Neighborhood ID	PSI	ROI	Downspout Redirect	Rain Barrel	Rain Garden	Storm Drain Stenciling	Bayscaping	Lot Canopy	Fertilizer Reduction	% High Maintanance Lawns
NSA-M-01	High	Low	X		X	X			X	60
NSA-M-02	Moderate	Moderate			X	X	X	X	X	85
NSA-M-03	Moderate	Moderate		X		X	X		X	70
NSA-M-04	None	High		X	X	X	X	X	X	70
NSA-M-05	Moderate	Moderate	X		X		X	X		25
NSA-M-06	Moderate	Moderate		X		X	X			10
NSA-M-07	Moderate	High	X		X	X	X	X	X	75
NSA-M-08	High	High	X		X	X	X	X	X	75
NSA-M-09	Moderate	High	X		X	X	X	X	X	95
NSA-M-10	Moderate	High	X	X		X	X	X	X	40
NSA-M-11	Moderate	Moderate	X			X	X	X	X	50
NSA-M-12	Moderate	Moderate				X	X	X	X	40
NSA-M-13	Moderate	Moderate	X				X	X	X	35
NSA-M-14	Moderate	Moderate	X		X		X		X	30
NSA-M-15	Moderate	High	X	X		X	X	X		10
NSA-M-16	Moderate	Moderate	X	X			X	X		10
NSA-M-17	Moderate	Moderate	X		X	X	X	X	X	25
NSA-M-18	Moderate	Moderate	X		X	X	X	X		20
NSA-M-19	Moderate	Low		X		X	X		X	100
NSA-M-20	Moderate	Moderate	X	X		X	X	X	X	35
NSA-M-21	Moderate	High		X		X	X	X		15
NSA-M-22	Moderate	High	X	X		X	X	X		15
NSA-M-23	Moderate	Moderate	X	X		X	X	X	X	30
NSA-M-24	Moderate	Moderate	X		X	X	X		X	40
NSA-M-25	Moderate	Moderate	X		X	X	X	X	X	60
NSA-M-26	Moderate	Moderate	X		X	X	X	X	X	50
NSA-M-27	Moderate	Moderate			X	X	X		X	50
NSA-M-28	Moderate	Moderate	X		X	X	X			10
NSA-M-29	Moderate	Moderate	X		X	X			X	20
NSA-M-30	Moderate	Moderate	X		X	X			X	60
NSA-M-31	None	Low			X	X				0
NSA-M-32	Moderate	Moderate	X	X		X			X	25
NSA-M-34	Moderate	Moderate	X		X	X	X		X	35
NSA-M-35	Moderate	Moderate	X	X			X	X	X	20
NSA-M-36	Moderate	High	X	X		X	X	X	X	35
NSA-M-37	High	Moderate		X		X			X	30
NSA-M-38	Moderate	High	X	X	X	X		X	X	50
NSA-M-39	Moderate	High		X		X		X	X	100

Neighborhood ID	PSI	ROI	Downspout Redirect	Rain Barrel	Rain Garden	Storm Drain Stenciling	Bayscaping	Lot Canopy	Fertilizer Reduction	% High Maintanance Lawns
NSA-M-40	Moderate	Moderate	X			X		X	X	75
NSA-M-41	Moderate	Moderate	X	X		X	X	X	X	75
NSA-M-42	High	Moderate	X	X				X	X	25
NSA-M-44	Moderate	Moderate	X	X					X	25
NSA-M-45	High	Moderate	X	X		X	X	X	X	60
NSA-M-46	Moderate	Moderate	X	X		X	X	X	X	25
NSA-M-47	Moderate	Moderate	X		X	X	X	X	X	80
NSA-M-48	Moderate	Moderate		X		X			X	100
NSA-M-49	Moderate	Moderate	X		X	X		X	X	60
NSA-M-54	Moderate	Moderate			X	X	X	X	X	40
NSA-M-55	High	Moderate	X		X	X			X	65

Appendix 4-1b: NSA Data cont.

Neighborhood ID	Buffer Impact	# Street Trees	# Open Space Trees	Parking Lot Retrofit	AlleyRetro	Street Sweeping	Total Neighborhood Acres	Sum Impervious Acres
NSA-M-01		0	0				41.9	4.7
NSA-M-02		0	10				49.1	10.2
NSA-M-03		0	0	X		X	104.6	29.3
NSA-M-04		0	0				74.1	18.3
NSA-M-05		100	0				82.1	17.6
NSA-M-06		0	0				5.0	1.2
NSA-M-07		0	0				112.0	21.3
NSA-M-08		0	0				49.2	9.2
NSA-M-09		0	0				34.2	6.3
NSA-M-10	X	100	100				104.6	9.5
NSA-M-11	X	0	100				30.5	7.8
NSA-M-12	X	100	0				70.4	30.6
NSA-M-13	X	100	0			X	85.0	17.5
NSA-M-14	X	100	0			X	68.8	16.3
NSA-M-15	X	50	0			X	137.3	48.8
NSA-M-16		0	0				22.2	3.7
NSA-M-17		0	0				189.4	39.5
NSA-M-18		0	0				61.2	9.0
NSA-M-19		0	15	X			12.8	3.4
NSA-M-20	X	0	0			X	19.7	2.8

Neighborhood ID	Buffer Impact	# Street Trees	# Open Space Trees	Parking Lot Retrofit	AlleyRetro	Street Sweeping	Total Neighborhood Acres	Sum Impervious Acres
NSA-M-21		40	0			X	6.7	1.4
NSA-M-22		0	0				26.7	4.5
NSA-M-23	X	60	0				36.9	9.5
NSA-M-24		0	0			X	12.0	2.8
NSA-M-25		0	0				35.1	4.4
NSA-M-26		0	0				45.6	7.8
NSA-M-27	X	0	0				205.8	26.1
NSA-M-28		0	0				25.2	6.4
NSA-M-29	X	0	0			X	146.0	44.8
NSA-M-30	X	0	0				213.4	28.5
NSA-M-31		0	0				20.4	5.8
NSA-M-32		0	0			X	22.6	6.8
NSA-M-34	X	0	0			X	250.9	22.7
NSA-M-35	X	0	0				42.9	8.1
NSA-M-36	X	30	0			X	120.0	25.1
NSA-M-37		10	0			X	233.4	50.6
NSA-M-38		0	0			X	500.9	53.9
NSA-M-39		0	0			X	10.1	4.2
NSA-M-40		25	0			X	14.9	6.2
NSA-M-41		0	0				12.4	3.1
NSA-M-42		100	0		X	X	46.1	17.3
NSA-M-44		50	0				128.9	34.8
NSA-M-45		0	0		X	X	15.1	4.7
NSA-M-46		40	0			X	28.6	8.6
NSA-M-47		0	0				13.0	8.0
NSA-M-48		0	100				13.7	5.3
NSA-M-49		0	0				46.0	6.5
NSA-M-54		0	0				65.7	7.3
NSA-M-55		0	0			X	17.5	4.4

Appendix 4-2: Hot Spot Category and Status

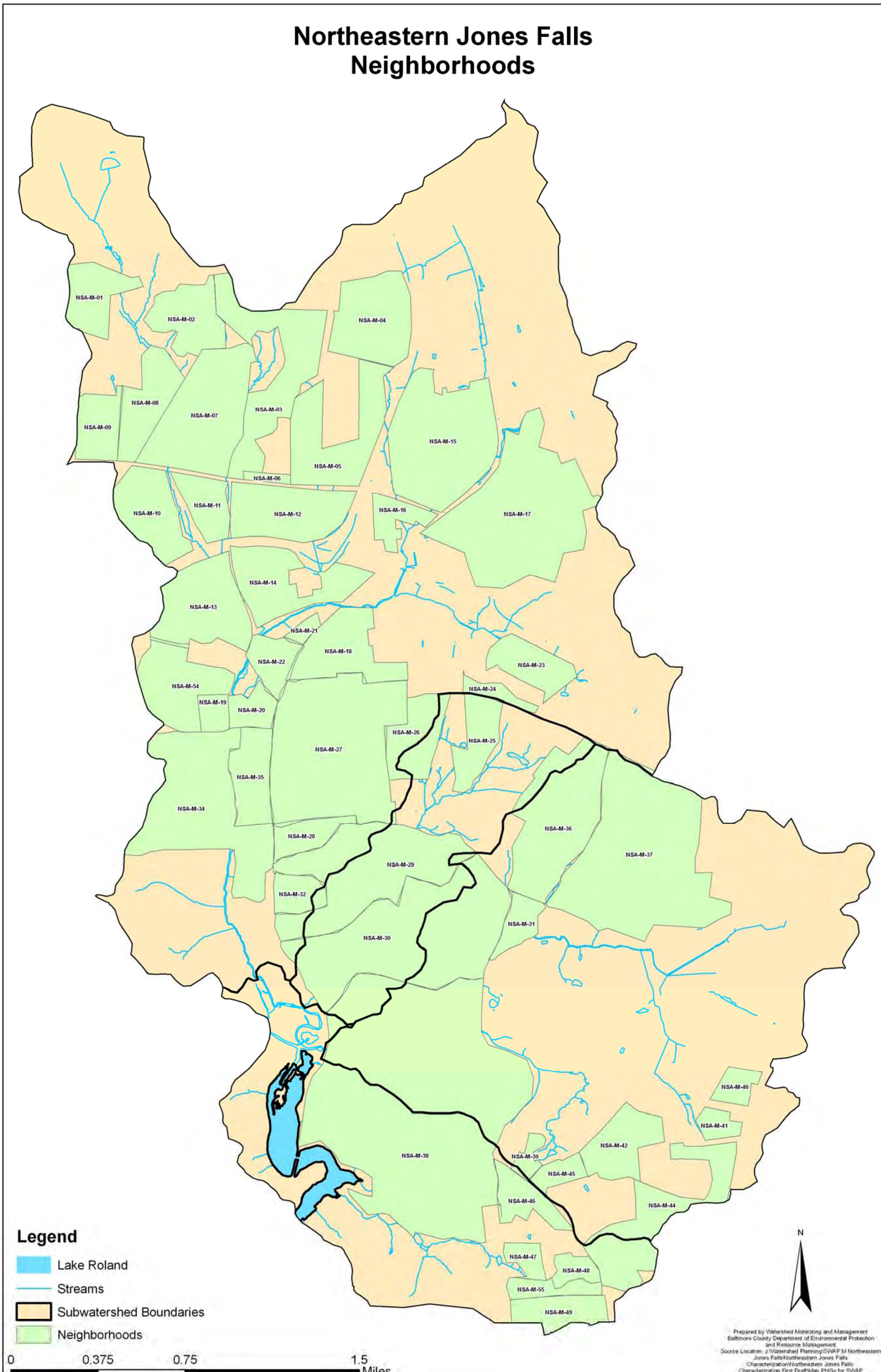
Hotspot ID	HSI Category			HSI Status			
	Commercial	Municipal	Transport-Related	Not a Hotspot	Potential	Confirmed	Severe
HSI_H_100	X					X	
HSI_H_101		X					X
HSI_H_102	X				X		
Total	**2**	**1**	**0**	**0**	**1**	**1**	**1**

Appendix 4-3: Institutional Site Investigations

Institution ID	Type	Public or Private?	Nutrient Mgmt. Plan Req?	Tree Planting (#)	Downspout Disconnect	SW Retrofit	Trash Mgmt.
ISI_M_100	Elem School	Public	Y	75			
ISI_M_101	Elem School	Public	Y	50		X	
ISI_M_102	Faith-Based	Private	N	100	X	X	
ISI_M_103	Faith-Based	Private	N	7			
ISI_M_104	Faith-Based	Private	N	20	X	X	
				252	**2**	**3**	
ISI_M_200	Elem School	Public	Y	0			
ISI_M_201	Municipal	Public	N	100	X		
ISI_M_202	High School	Private	Y	100	X	X	
				200	**2**	**1**	
ISI_M_300	Hospital	Private	N	0			
ISI_M_301	Hospital	Private	N	0			X
ISI_M_302	Elem School	Public	N	50			
ISI_M_303	Middle School	Public	Y	50			X
ISI_M_304	Hospital	Private	Y	50			X
				150			**3**

Appendix 4-3b Institutional Site Investigations Notes

Institution ID	Description	Notes
ISI_M_100	Riderwood Elementary	clogged storm drain and erosion
ISI_M_104	Parkville Kingdon Hall Jehovah's Witnesses	rain garden E corner/buffer planting/great opportunities
ISI_M_200	Ridge Ruxton School	need to revisit, extensive construction here
ISI_M_201	Balto Co Board of Ed	invasive removal, inlet repair
ISI_M_202	Loyola High School	invasive removal, cleat washer drains to storm drain
ISI_M_300	St. Joseph's Hospital	stream naturalization/buffer improvement
ISI_M_301	GBMC	soil spoil and brush disposal
ISI_M_304	Sheppard Pratt	stream buffer improvement



Appendix 4-4: Neighborhoods assessed in the Northeastern Jones Falls

CHAPTER 5

RESTORATION OPTIONS

5.1 Introduction

This chapter presents an overview of the key management practice recommendations for the Northeastern Jones Falls watershed. These practices are geared toward restoring degraded resources in urban/suburban watersheds. The chapter is divided into five sections: Municipal Capital Programs, Municipal Management Programs, Volunteer Restoration Programs, Business and Institutional Initiatives, and Citizen Awareness Activities. These groups were separated based on the scale for implementation and the controlling organization. The municipal programs are county wide and implemented individually or collaboratively by multiple county agencies. Comparatively, the volunteer and many of the awareness programs are at a community or neighborhood scale and oversight is by a non-government organization. Business and institutional efforts are at a site-specific scale and implementation is most effective when oversight is with the property owner.

5.2 Municipal Capital Programs

5.2.1 Stormwater Management

The application of stormwater management practices varies according to the impervious cover and land use makeup of the site or subwatershed. The most efficient method to augment stormwater treatment is to convert existing dry detention ponds to a design with greater pollutant removal capability. This is referred to as a stormwater pond conversion. If enough land is available, the greatest benefit would be to construct a new facility, designed with current state of the art technology, to reduce pollutants to the maximum extent practicable. However, a developed subwatershed seldom has sufficient open space. Instead there are options available to put treatment systems directly in the storm drain system. Many packaged systems are available through the retail market and are explained further below. Additional sites in alleys and adjacent to parking lots can offer treatment of large amounts of impervious surface. Also, new research in porous concrete and asphalt may offer the potential for additional reductions in impervious cover on public and private properties.

5.2.1.1 Detention Pond Conversion

Dry detention ponds are typically designed for flood control and have little pollutant removal capacity. These facilities have the greatest potential for conversion to a facility type with greater pollutant removal efficiency. Current stormwater facilities are designed to capture and retain stormwater runoff and allow enough detention time for sediments and pollutants to settle out, while also providing flood control if necessary.

5.2.1.2 Stormwater Retrofits

The developed nature of the watershed provides limited potential for implementing new stormwater storage projects other than converting existing stormwater ponds. Where space exists between an outfall and the stream channel, retrofits such as floodplain wetlands and energy dissipation devices are considered. Floodplain wetlands can provide treatment of storm flows prior to entering the stream channel. Energy dissipation devices can reduce stream power, and thus erosive forces of storm flows, prior to entering the stream channel.

Curb and gutter systems consist of numerous inlets, pipes, and outfalls. While the curb and gutter system removes stormwater quickly from roadways, it delivers increased runoff volumes and untreated pollutants to receiving water bodies. One way to address these potential water quality issues is to install proprietary Best Management Practices (BMPs) at selected storm drain inlets. Various structural BMPs are commercially available and include catch basin inserts, water quality inlets, oil/grit separators, filtering devices and hydrodynamic devices. Proprietary BMPs are designed to address specific pollutants such as floatables and solid waste, nutrients, metals, sediment and oil/grease. Most are helpful for removing a portion of pollutants for pretreatment when used in conjunction with another BMP type such as an infiltration trench or a grassed swale for filtering pollutants upstream of an inlet. While proprietary devices can be costly, they are water improvement alternatives for areas where there is inadequate space for other stormwater management options. Selection of inlets for proprietary devices is based on the county's outfall screening program and stream corridor assessments.

5.2.1.3 Parking Lot/Alley Retrofits

Parking lots and alleyways can sometimes present opportunities. Pavement in alleys can be replaced with modern, absorbent materials that soak up the rain and whatever pollution it picked up when it hit the ground. Alleys can also be retrofitted with pervious grass strips down the middle or perpendicular filter strips. Parking lots sloping towards an adjacent pervious area can be retrofitted to have their runoff directed to an engineered bioretention area rather than flowing directly to the storm drain system.

5.2.2 Stream Corridor Restoration

Stream corridor restoration practices are used to enhance the appearance, stability, and aquatic function of urban stream corridors. The practices range from simple stream repairs such as vegetative bank stabilization and localized grade control, to comprehensive repair applications such as full channel redesign and re-alignment. Stream repair practices are often combined with stormwater retrofits and riparian management practices to meet subwatershed restoration objectives.

Channel redesign follows natural channel design techniques and is utilized to stabilize eroded, degraded stream banks and to protect infrastructure such as private property, buildings and utilities. Stabilizing the stream channel improves water quality by preventing eroded soils, and the pollutants contained in them, from entering the stream. In addition, protecting infrastructure such as sewer and storm drain pipes reduces and/or eliminates water quality impacts associated with leaking sewer pipes and manholes. Where conditions allow, reconnecting the stream channel to its floodplain provides additional water quality benefits.

5.2.3 Reforestation - Buffers & Open Space

The Community Reforestation Program (CRP) was established by Baltimore County's Department of Environmental Protection and Sustainability (EPS) to provide a dedicated workforce for planting, monitoring, and maintaining forest mitigation projects. The program is funded through fees-in-lieu of mitigation for forests removed as a result of public and private land development, as required by the implementation of the county's Forest Conservation Act and Chesapeake Bay Critical Area Regulations. The CRP is the only full-time county-wide reforestation mitigation program among Maryland's counties.

The CRP includes a four-person reforestation crew that carries out year-round reforestation operations. The crew is based at a one-acre site in eastern Baltimore County that is provided by the Department of Recreation and Parks. This home base houses a growing out nursery for 10,000 tree seedlings; equipment and machinery needed for planting, monitoring, and maintaining the reforestation projects; and office space for the reforestation team. Occasionally, the CRP will undertake special grant-funded projects to improve water quality and groundwater recharge, as well as wildlife habitat. The most recent example is the expansion of forest buffers and the reforestation of fields on private rural properties.

5.3 Municipal Management Programs

5.3.1 Street Sweeping

Baltimore County has an active street sweeping program to remove debris, dirt and pollutants from the roads before they enter the storm drain system. Effective street sweeping usually involves using a vacuum assisted sweeper, and a schedule that coincides with things like trash pickup days or seasonal changes such as leaf litter in the fall and more frequent lawn care activities by residents in spring and summer.

5.3.2 Inlet Cleaning

The Baltimore County storm drain system consists of approximately 388 miles of storm drainpipe, 14,400 inlets, and 3,460 outfalls. In order to keep the entire system clean of trash, debris, and sediment, the Department of Public Works maintains three storm drain cleaning vehicles and employs three crews of two men each on a daily basis to clean the storm drains and pipes. Removing the material from the storm drain system reduces street flooding, a potential safety hazard, and aids in the detection of illicit connections.

5.3.3 Illicit Discharge Detection and Elimination Program

The County's Illicit Connection program ensures that all discharges to and from the municipal separate storm sewer system that are not composed entirely of stormwater are either permitted by MDE or eliminated. The County is required to screen a minimum of 150 storm drain outfalls annually for the purposes of detecting and removing these unpermitted discharges. The Illicit Connection program is responsible for performing outfall screenings, reporting screening data, and coordinating remedial actions. The Illicit Connection program also investigates illicit connection complaints from other agencies, citizens or volunteers in the Stream Watch Program. This program allows citizens to adopt a stream, which includes tracking the health of the stream and reporting problems or potential problems they observe.

Routine outfall screenings for detection of illicit connections compliment citizen complaints of problems they observe. The routine outfall screenings catch the chronic problems that may be missed by the public, such as chlorine leaks from the municipal water supply. Citizens provide surveillance at a level beyond that of the monitoring staff. A majority of the time citizens call while they are actually observing a problem and often can provide immediate local information that increases the chance of eliminating illicit connections.

5.3.4 Land Development Review

New development and redevelopment projects undergo a rigorous review for impacts to natural resources. Regulations are in place for the protection of stream buffers, forests, tidal shorelines, groundwater, and stormwater runoff. In addition, on-site inspections take place during the construction process for erosion and sediment control. Post construction follow-up inspections review the stream buffers, forests, tidal shoreline and stormwater facilities before a development project is released for occupancy. The following are the current regulatory programs used during the development and redevelopment plan review process and follow-up inspections.

5.3.4.1 Riparian Forest Buffers:

Baltimore County enacted the Regulations for the Protection of Water Quality, Streams, Wetlands and Floodplains in 1991. These regulations require development designs to include a 75 or 100 foot stream buffer and provisions for expansion of the riparian buffer for steep slopes, wetlands and floodplains. Development plans must minimize road crossings, have stormwater management facilities and outfall outside of the riparian buffer, and place utilities outside the buffer to the maximum extent possible. In cases where fish passage is an issue, stream crossings should be either open bottom bridges or provide for low flow fish passage. All of these design considerations are an attempt to maintain the integrity of the riparian buffer.

5.3.4.2 Forest Conservation

The main purpose of the Maryland Forest Conservation Act, enacted in 1991, is to minimize the loss of Maryland's forest resources during land development by making the identification and protection of forests and other sensitive areas an integral part of the site planning process. EPS oversees local implementation of these regulations during the development review process and conducts inspections during the construction and post-construction closeout process. Of primary interest are areas adjacent to streams or wetlands, those on steep or erodible soils or those within or adjacent to large contiguous blocks of forest or wildlife corridors. Identification of priority areas is completed prior to design of the development plan. Any activity requiring an application for a subdivision, grading permit or sediment control permit on areas 40,000 square feet (approximately one acre) or greater is subject to the Forest Conservation Act and requires a Forest Conservation Plan prepared by a licensed forester, licensed landscape architect, or other qualified professional.

5.3.4.3 Chesapeake Bay Critical Area

The Chesapeake Bay Critical Area law and criteria were designed to foster more sensitive land use and development activity along the tidal shorelines and to ensure the implementation of appropriate long-term conservation measures to protect important habitats. The law identified the "Critical Area" as all land within 1,000 feet of the mean high water line of tidal waters or the landward edge of tidal wetlands. The Critical Area Act, passed in 1984, was significant and farreaching, and marked the first time that the State and local governments jointly addressed the impacts of land development on habitat and aquatic resources.

5.3.4.4 Groundwater Management

The Groundwater Management Section within EPS is charged with the responsibility of managing and protecting the groundwater resources of Baltimore County. The Groundwater Management section handles issues related to drinking water wells, septic systems, and removal of residential underground storage tanks. These systems are regulated during the development review process and property title transfers to protect residents and groundwater resources.

5.3.4.5 Stormwater Management

Stormwater management in the State of Maryland has evolved over time, with the initial emphasis on quantity control in the mid to late 1980s, to quantity and quality control in the 1990s, to the more recent emphasis on channel protection (one year storm management) and diffusing stormwater over the site (Low Impact Development). Baltimore County implements stormwater management as a critical companion to riparian buffers. The control of erosive flows through stormwater management augments the riparian forest buffer in the protection of natural resources.

5.3.4.6 Erosion and Sediment Control

Baltimore County has delegated authority from the Maryland Department of the Environment to enforce the State Erosion and Sediment Control Program. The main function of the Erosion and Sediment Control Program is to monitor best management practices (BMPs) for sediment from new development and redevelopment during the construction phase. These practices prevent sediment and other pollutant inputs into the storm drain system and stream network. The sediment control BMPs are specified in the sediment and erosion control plan for each development site. Sediment control plans are required for any construction activity disturbing an area greater than 5,000 square feet. The standard plan for erosion and sediment control is used for residential construction activity disturbing less than 30,000 square feet and for all other construction activity disturbing less than 20,000 square feet.

5.3.5 Trash and Recycling

5.3.5.1 Single Stream Recycling

Baltimore County began Single Stream Recycling in 2010. All recyclables (plastics, glass, metals, paper, and cardboard) are collected co-mingled by the curbside each week. Under this program, recycling rates increased as a result of a greater number of accepted materials, convenience of only needing one bin, and weekly pickup. Recycling saves energy, helps protect natural resources, and reduces air and water pollution.

5.3.5.2 Household Hazardous Waste Collection

In response to numerous requests from citizens and elected officials concerned with disposal of hazardous wastes from their own homes, Baltimore County citizens can drop off household hazardous waste materials for recycling or proper disposal at a permanent processing facility located at the Eastern Sanitary Landfill Solid Waste Management Facility. Materials dropped off for processing include unwanted household chemicals, such as paints, flammable cleaning solvents, automotive fluids, pesticides, pool chemicals, acids, mercury thermometers, gasoline, corrosive material, etc. In addition, EPS holds two one-day collection events annually, in the spring and fall, at different locations around Baltimore County.

5.3.6 Pollution Prevention: Public Lands Management

Certain county owned facilities require an NPDES Industrial Stormwater Discharge General Permit. EPS assists other county agencies in fulfilling the requirements of this permit. EPS reviews with the agency the information needed to complete a Notice of Intent form. If required, a Pollution Prevention Plan is prepared by the agency and maintained on file at the building site. EPS provides the agency with a template for the preparation of the pollution prevention plan and assists with the preparation of maps and geographic and monitoring data.

Certain county facilities also prepare spill prevention and response plans, which describe operational procedures to reduce spill risks and ensure that proper controls are in place when they do occur. Spill prevention plans standardize everyday procedures and rely heavily on employee training and education. The investment is a good one for most operations, since spill prevention plans reduce potential liability, fines and costs associated with spill cleanup.

Baltimore County agencies continue to reduce the amount of fertilizers, pesticides and deicing materials used on county properties. Agencies collect statistics for usage of these materials and report them in the county's annual NPDES report. Golf courses are consistently the biggest users of fertilize and pesticides. Logically, because of its responsibility to clear roads, the Department of Public Works – Bureau of Highways remains the biggest user of deicing materials.

5.4 Volunteer Restoration Programs

5.4.1 Stream Watch Program

The Stream Watch Program is intended to develop citizen stewardship through participation of citizen volunteers in the program who actively assume the role of caring for segments of the stream network by observing changes in the system, leading stream clean-ups, and participating in planting activities. The Stream Watch Program also includes identification of potential restoration projects for possible inclusion in the Waterway Capital Improvement Program and provides a valuable addition to the County's Illicit Connection Program through reports by Stream Watch participants.

5.4.2 Stream Clean Ups

Stream cleanups are a simple practice used to enhance the appearance of the stream corridor by removing unsightly trash, litter, and debris. Cleanups are commonly conducted by volunteers and continue to be one of the most effective outlets for generating community awareness and involvement in watershed activities.

5.4.3 Downspout Disconnection

In addition to road runoff, rooftops also contribute stormwater directly into streams. Many downspouts are connected directly to the stormdrain system through underground pipes, others are funneled toward driveways and sidewalks, which then are connected to the street. By redirecting downspouts to a pervious area, this additional runoff is allowed to filter across pervious areas such as gardens and lawns. The use of rain barrels for the collection and reuse of the runoff is a highly sustainable practice, and is effective even if there is limited space on the property. Additional treatment can be achieved by directing the runoff into a raingarden instead of lawn. Raingardens are simply gardens that are comprised of native perennials and shrubs that are compatible with wet soils. A downhill area that naturally collects rain is an ideal location for a rain garden.

5.4.4 Street Trees

Street trees improve air quality, catch precipitation with their leaves and absorb precipitation and nutrients through their root systems. Street trees can be planted where there is suitable distance between the sidewalk and road. Real estate values frequently are higher when a neighborhood is beautified with trees.

5.4.5 Reforestation - Buffers & Open Space

Pervious areas and natural area remnants provide important natural groundwater recharge functions within a subwatershed, and should be optimized to promote natural infiltration. These areas also present an opportunity for reforestation in the watershed. Reforestation is generally the highest priority in terms of improving the infiltration and recharge functions, however other techniques such as establishing native plantings or meadows also serve a higher function than turf grass. Priority sites have little evidence of soil compaction, invasive plants, and trash/dumping, and can be reforested with minimal site preparation.

5.4.6 Storm Drain Marking

Most of the developed areas in urban/ suburban watersheds have curb and gutter systems, including storm drain inlets that convey stormwater runoff quickly to the stream system, and ultimately to the Chesapeake Bay. Since there is little or no infiltration of stormwater in a curb and gutter system, there is a direct discharge of pollutants to the stream system. Citizens can walk through their neighborhood and adhere markers directly on top of the storm drain inlets. This may help remind their neighbors of the direct connection with their local streams.

5.4.7 Parking Lot/Alley Retrofits

Parking lots and alleyways can sometimes present opportunities. Pavement in alleys can be replaced with modern, absorbent materials that soak up the rain and whatever pollution it picked up when it hit the ground. Alleys can also be retrofitted with pervious grass strips down the middle or perpendicular filter strips. Parking lots sloping towards an adjacent pervious area can be retrofitted to have their runoff directed to an engineered bioretention area rather than flowing directly to the storm drain system.

5.5 Business and Institutional Initiatives

5.5.1 Impervious Cover Removal

Unused or unmaintained impervious surfaces with the potential for removal were identified at several institutions, mostly on school properties. At sites where parking lots may be larger than necessary, portions of the impervious cover could be removed and reforested or converted to bio-retention areas for treating stormwater runoff from the remaining impervious surfaces.

5.5.2 Parking Lot Retrofits

Often large parking surfaces are included in commercial and institutional development projects for events that occur very infrequently. If reducing the impervious cover is not an option, then filtering practices can provide a substantial benefit when applied over large areas. Onsite commercial and institutional retrofit practices often include the use of sand filters, bioretention, and grass swales adjacent to parking lots. Larger redevelopment projects often include underground storage or filtering systems. Several research groups are exploring innovative parking surfaces to develop a surface that is both durable and porous. These surfaces are another option for providing better filtering of runoff, while still allowing for the same amount of parking spaces.

5.5.3 Open Space Planting

An increasing number of public and private schools show interest in adopting conservation landscaping principles. This begins primarily by removing unused turf areas on their schoolyard campuses. These areas are then replaced by an assortment of more sustainable and environmentally friendly practices. Options include: planting trees, restoring wildlife habitat, introducing no-mow zones, and creating meadows, all of which also improve stormwater runoff and can increase energy efficiency.

5.5.4 Pollution Prevention: Private Lands Management

Most commercial and industrial facilities require an NPDES Industrial Stormwater Discharge General Permit. This permit requires the business to inform the Maryland Department of the Environment (MDE) about activities on their property that may adversely affect stormwater runoff. The property owner is required to submit to MDE a Notice of Intent which provides general information about the location of the site and the pollution generating activities at the property. It may be required that a Pollution Prevention Plan (PPP) be prepared and maintained on file at the building site. A PPP outlines staff responsibilities in the event of an emergency resulting in potential toxic discharge to stormwater. There is also an outline of good house keeping and best management practices to prevent contaminants from leaving the site.

5.6 Citizen Awareness Activities

Residents and businesses engage in behaviors and activities that can negatively influence water quality, including over-fertilizing lawns (Figure 4-3), using excessive amounts of pesticides, poor housekeeping practices such as inappropriate disposal of paints, household cleaners or automotive fluids, and dumping into storm drains. Alternatively, positive behaviors such as tree planting, disconnecting downspouts, and picking up pet waste can help improve water quality. Whether a pollution prevention program is designed to discourage negative behaviors or encourage positive ones, targeted education is needed to deliver a specific message that promotes behavior changes. Local watershed organizations, and other civic groups such as the Master Gardeners, are in a position to influence these changes using pollution prevention education and outreach to teach citizens how to properly care for the watershed.

5.6.1 Stormwater Runoff

A survey was conducted in 2004 regarding people's knowledge about stormwater. It concluded that even people who want to improve stormwater runoff, don't realize how they adversely impact it. Storm drain marking *(5.4.6)* is a way to educate residents about the connection between the street inlets and the streams. Neighbors that read the message will understand that trash and lawn clippings that build up along the curbs and gutters will be washed away after a storm event and end up in their local stream and the bay.

5.6.2 Pet Waste/ Bacteria Awareness

Pet waste contributes bacteria to streams. A pet waste station is a sign reminding pet owners of the importance of proper disposal of pet waste and it usually includes a supply of bags for pet waste cleanup. Often it is located next to an existing trashcan or it includes one. Pet waste stations can help neighborhoods to reduce bacteria flowing into their local streams and help to keep their neighborhood park or school site clean. Citizens can participate by monitoring the supply of bags to make sure they are continually available.

EPS, in collaboration with other county agencies, is developing an awareness campaign for better pet waste management. Additional sites for installation of pet waste stations are to be identified.

5.6.3 Fertilizer Reduction

A well-manicured and responsibly maintained lawn can be an asset to the watershed. Too often however, over fertilization and irresponsible pest management result in pollutant charged runoff to local streams. Significant reductions on total nitrogen to stormwater can be achieved through careful fertilizer management, or better yet, by going organic. Homeowners should be reminded to follow the application instructions so that it is applied in the correct amount, during the right season, and does not wash away in a rainstorm. Citizens can be more cognizant about fertilizer placement so that it doesn’t land on driveways and sidewalks where it may wash directly into the street and storm drain system.

5.6.4 Trash and Recycling

5.6.4.1 Compost Bins

Baltimore County holds a one-day compost bin/rain barrel sale for residents to purchase bins for composting yard waste in their backyards. By composting leaves and weeds in backyard bins, the amount of material handled by the municipal yard waste collection is reduced. Use of compost is an environmentally friendly way of improving soil and avoids chemical application of fertilizer.

5.6.4.2 Stewardship Projects

EPS provides assistance in planning and advertising local stewardship projects such as Project Clean Stream, hosted by the Alliance for the Chesapeake Bay.

5.6.4.3 Reuse Directory

Online and in print, this is a directory of reuse organizations for Baltimore County residents and businesses. It lists all the places that you can take unwanted items for reuse, including construction materials, appliances, office supplies, clothing, household items, automobiles, food, medical equipment, and more. By donating reusable items, you will: help other people and organizations, reduce disposal costs, reduce air and water pollution, and conserve space in the landfill. Published by the Baltimore County Bureau of Solid Waste Management.

5.6.4.4 The Re-Source Newsletter

Baltimore County's solid waste reduction, reuse, recycling, and refuse disposal newsletter with information pertaining to recycling, waste prevention, special events, and more. Published quarterly on the web.

5.6.5 Conservation Landscaping

Numerous water quality benefits are achieved from converting turf into landscaping and through increasing the urban tree canopy. EPS promotes the Tree-Mendous MD tree program and offers no-cost delivery of the trees to communities that make a request.

EPS promotes invasive removal, turf reduction and conservation landscaping. When planning a landscape, homeowners are encouraged to use native plants, which reduce the need for watering, are adapted to this climatic region and are more resistant to pests. Incorporating these sustainable landscaping practices into a garden's design can increase wildlife habitat and create a healthier home site.

5.6.6 MD Green School Award

Baltimore County uses *The Maryland Green School Awards Program* to provide a framework for integrating environmental learning and community involvement in local schools. EPS supports workshops and site-based meetings for teachers and provides local and regional resources to enhance staff development opportunities and increase the environmental awareness and interest of local school principals, teachers, and facilities managers. A requirement of each Green School is to demonstrate Best Management Practices at their site. These may include: water conservation, energy conservation, solid waste reduction, and habitat restoration using the school grounds.

APPENDIX E

TOTAL MAXIMUM DAILY LOADS

APPENDIX E

TOTAL MAXIMUM DAILY LOADS

This appendix provides links to all TMDLs applicable to the Northeastern Jones Falls SWAP Area.

Chesapeake Bay TMDL

http://www.epa.gov/reg3wapd/pdf/pdf_chesbay/FinalBayTMDL/BayTMDLExecutiveSummaryFINAL122910_final.pdf

http://www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/tmdlexec.html

Baltimore Harbor Nitrogen and Phosphorus TMDL

http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Documents/www.mde.state.md.us/assets/document/harbor-main-121406_final.pdf

Jones Falls Bacteria TMDL

http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Documents/www.mde.state.md.us/assets/document/Jones_Falls_TMDL_091906_final.pdf

Jones Falls Sediment TMDL

http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Documents/www.mde.state.md.us/assets/document/Jones_Sed_TMDL_092911_Final.pdf

Lake Roland Chlordane TMDL

http://www.mde.state.md.us/programs/Water/TMDL/ApprovedFinalTMDLs/Documents/www.mde.state.md.us/assets/document/tmdl/roland/roland_tmdl_fin.pdf