# Existing Environmental Conditions

The following description of the natural resources of Olney and vicinity are organized in two sections. The first part of the chapter provides an overview of the study area geology, soils, terrain, vegetation, sensitive areas and habitats of rare, threatened and endangered species, wildlife and fish, air quality, noise conditions and the availability of sewer and water service. The second part of the chapter examines the character, water quality and management of the component watersheds in the study area.

The subsection covering wetland resources of the study area provide analysis at two levels of detail. A general overview of the major wetland resources is provided for the study area. More detailed information based upon field inventory is provided for the Olney policy area. In-depth field study of wetland resources was focused on the policy area because of limited staff resources and the expectation that most land use decisions would be focused in this area.

## Parkland and Agriculture

Approximately eighteen percent of the study area is within public parkland and WSSC-owned land, and 21% is in agriculture (see Table 1 and Figure 3). The agricultural land is concentrated in the northern headwaters of the North Branch of Rock Creek, and in the Hawlings and Patuxent watersheds. The lower levels of imperviousness associated with agricultural land uses contribute toward the high water quality in these areas. Parkland includes 1,023 acres, or 12 percent, of the agricultural land. Approximately 17% (5,318 acres) of the planning area and 8% (907 acres) of the policy area are in parkland. Parks contain many of the sensitive areas in the watershed. Whenever practical, this inventory distinguishes between resources in parkland and resources outside parkland.

### Study Area Existing Parkland(1) and Agriculture Distribution

**Table 1**

| Watershed | Total Acres | Acres in Parkland | % of Watershed(2) in Parkland | Acres in Agriculture | % of Watershed(2) in Agriculture |
|---|---|---|---|---|---|
| Great Seneca Creek | 98 | 0 | 0 | 84 | 86 |
| Hawlings River | 18,069 | 1,885 | 10 | 4,869 | 27 |
| Northwest Branch | 6,502 | 566 | 9 | 15 | .2 |
| Patuxent | 7,011 | 2,966 | 42 | 2,783 | 40 |
| North Branch Rock Creek | 8,014 | 1,653 | 21 | 731 | 9 |
| **TOTALS** | 39,694 | 7,070(3) | 18 | 8,482 | 21 |

(1) GIS coverage of existing parkland, M-NCPPC 1997. For parkland ownership, see Appendix, Table A-1.
(2) Includes only the portions of the Great Seneca Creek, Northwest Branch, Patuxent, and North Branch Rock Creek watersheds which fall within the study area boundary.
(3) Includes both existing and proposed parkland based upon the most recent version of the park-acquisition map.

## Geology and Soils

The Hawlings River, upper Northwest Branch, North Branch of Rock Creek, and the lower portion of the upper Patuxent River lie entirely within the Piedmont physiographic province, where bedrock is composed of metamorphic and igneous rocks of Pre-Cambrian to early Paleozoic age. The study area is predominantly underlain by schist and gneiss crystalline rocks of the Wissahickon and Sykesville formations (see Figure 4). A small portion of the southern part of the Hawlings River watershed and the western portion of the upper Northwest Branch watershed are underlain by mafic and ultramafic rock. The Hawlings River and upper Patuxent River watersheds also have minor amounts of mafic and ultramafic rock in the areas underlain by schist. A mantle of loose unconsolidated material, the regolith, generally overlies solid rock. It comprises saprolite, soils and alluvium. The saprolite is gradational material overlying bedrock. Saprolite is rocky and barely weathered just above the bedrock and clay-rich at the surface.

Soils in the study area are generally deep to very deep. The depth of soils to bedrock ranges from 0 to 75 ft., and is greater than 5 feet for more than 85 percent of the watershed area. Well-drained soils, mostly Glenelg, Wheaton and Gaila, dominate the uplands. Poorly drained hydric soils, including Baile and Hatboro, are more common in the floodplain and low-lying areas of the stream valleys.

Upland soils on ridge tops and side slopes are generally well drained and deep, with slight to moderate restrictions to development. In low lying areas, and in the proximity of streams in general, hydric and poorly drained soils present severe limitations to on-site sewage disposal. In those areas, development using individual on-site sewage disposal systems may be constrained due to slow percolation, wetness, flooding or depth to bedrock (see Figure 5). Approximately 23 percent of the study area outside the sewer service area and parkland, contains soils which present severe limitations to on-site sewage disposal.

## Topography and Slopes

The terrain of the study area exhibits gentle to steep slopes (see Figure 6). The majority of the area has slopes less than 8 percent (see Table 2). Steep slopes (25 percent or greater) occur along the mainstem of the North Branch of Rock Creek, along the Patuxent River and some of its major tributaries, and along the mainstem and major tributaries of the Hawlings River. The majority of steep slopes are contained within parkland.

### Study Area Slopes

**Table 2**

| Slope | Approximate % of Total Area |
|---|---|
| Less than 8% | 68 |
| 8-14% | 22 |
| 15-24 | 7.5 |
| 25 or greater | 2.5 |

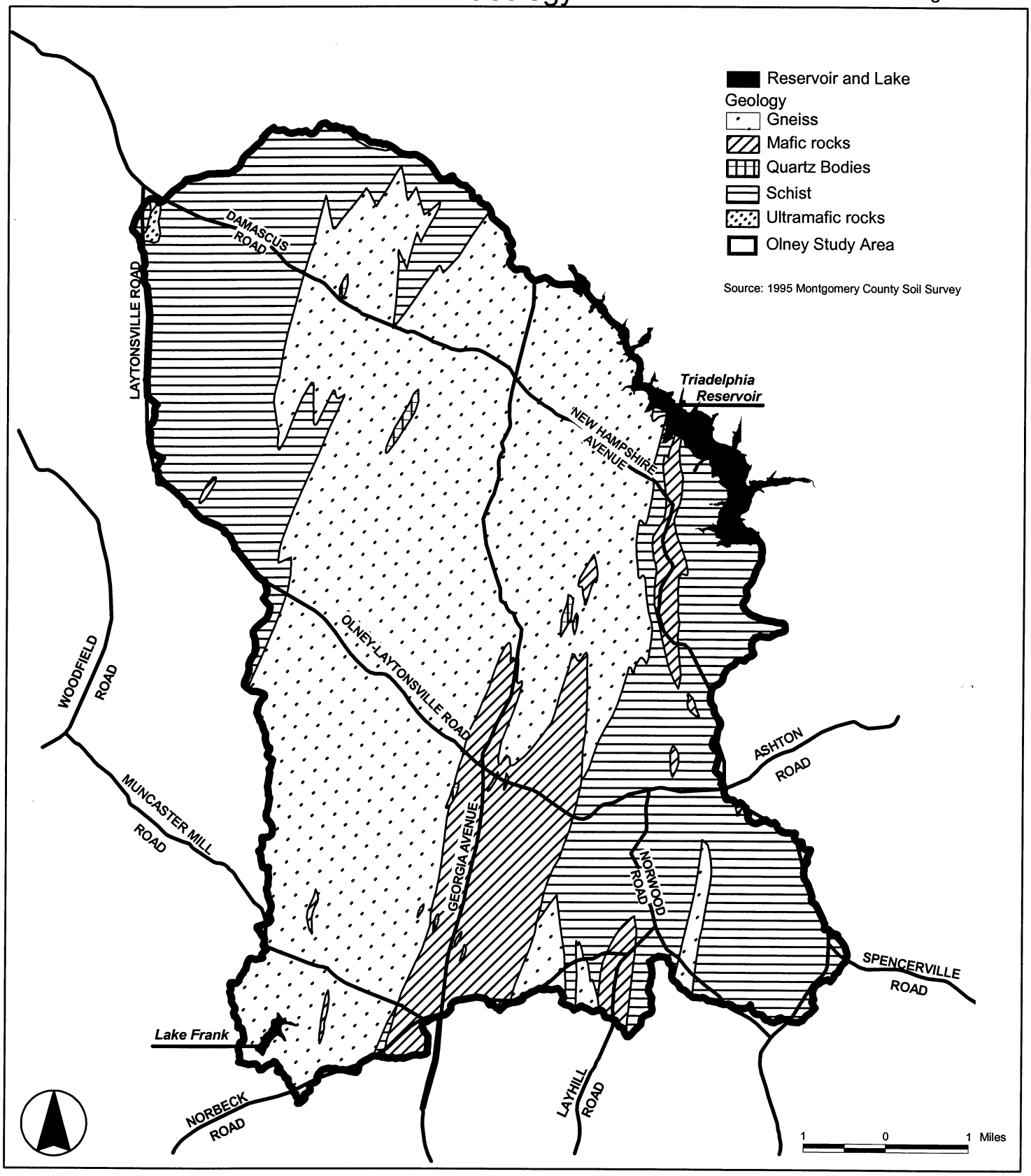
## Groundwater

The Olney master plan study area lies entirely within the upland section of the Piedmont physiographic province in Montgomery County. The hydrogeologic setting of the watersheds within the study area is typical of the Maryland Piedmont – precipitation that infiltrates the ground recharges ground water, which discharges to streams. Precipitation is the primary source of aquifer recharge in Montgomery County. The average annual rainfall is about 42 inches, of which an estimated 9 to 10 inches is available as recharge. Most precipitation either runs off or is intercepted or taken up by plants and other organisms and returned to the atmosphere as evapotranspiration.

Groundwater flow systems in the Maryland Piedmont are generally unconfined and local. By unconfined we mean that the top of the aquifer is not bounded by an impermeable layer; rather, the top of the aquifer is simply the top of the zone of saturation, otherwise known as the water table. The water table surface generally reflects the overlying topography. As a result, groundwater watersheds and divides generally mimic surface watersheds and drainage divides. There is little or no groundwater flow between drainage basins in the Maryland Piedmont; therefore, processes acting within the individual basins determine water quality. This is a fundamental difference between crystalline rock aquifers of the Piedmont and the sedimentary aquifers of the Coastal Plain, where recharge water travels long distances in confined aquifers and water quality may not bear any relation to land use near the well. During dry weather stream flow is maintained predominantly by

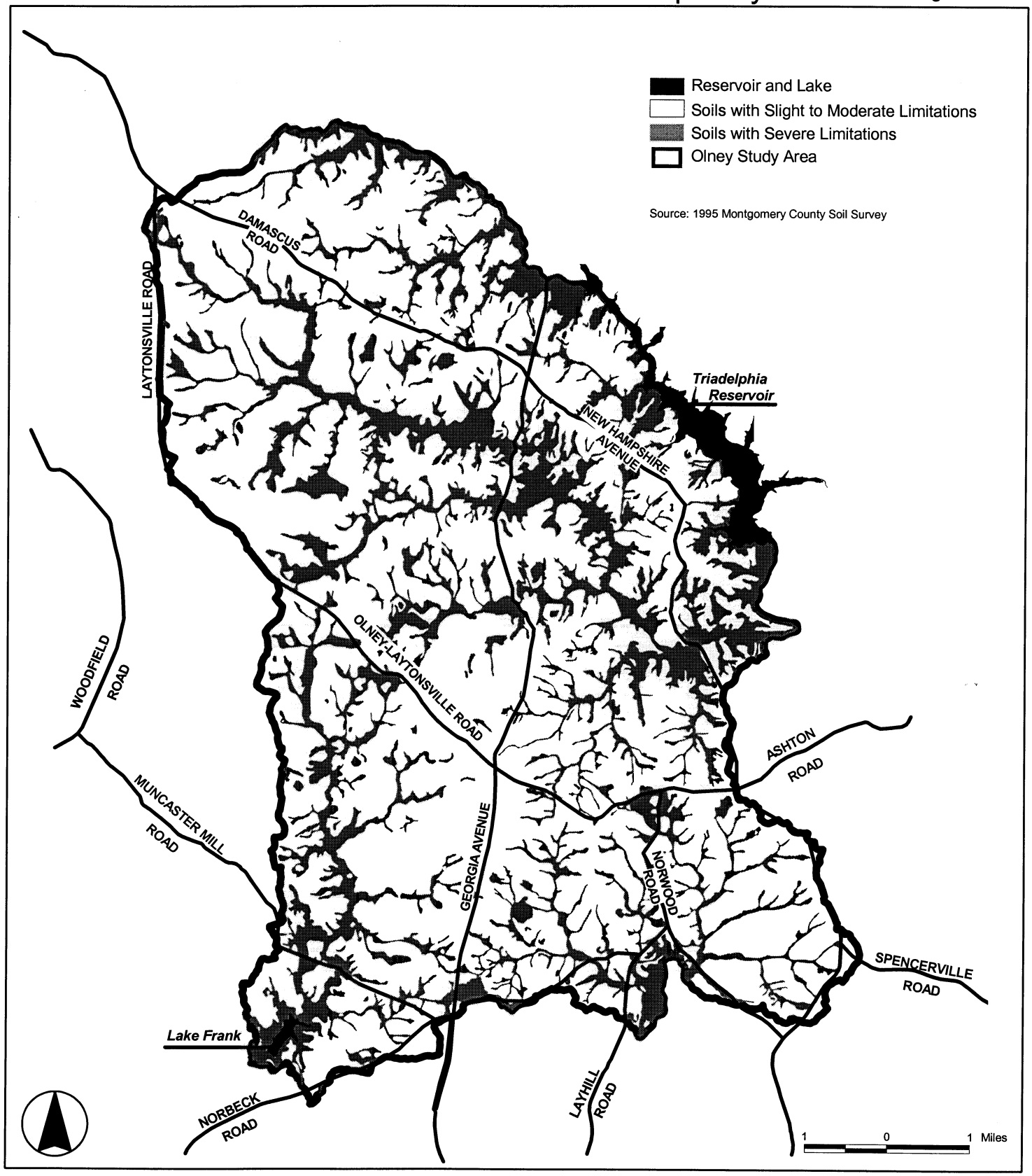
# Geology

Figure 4



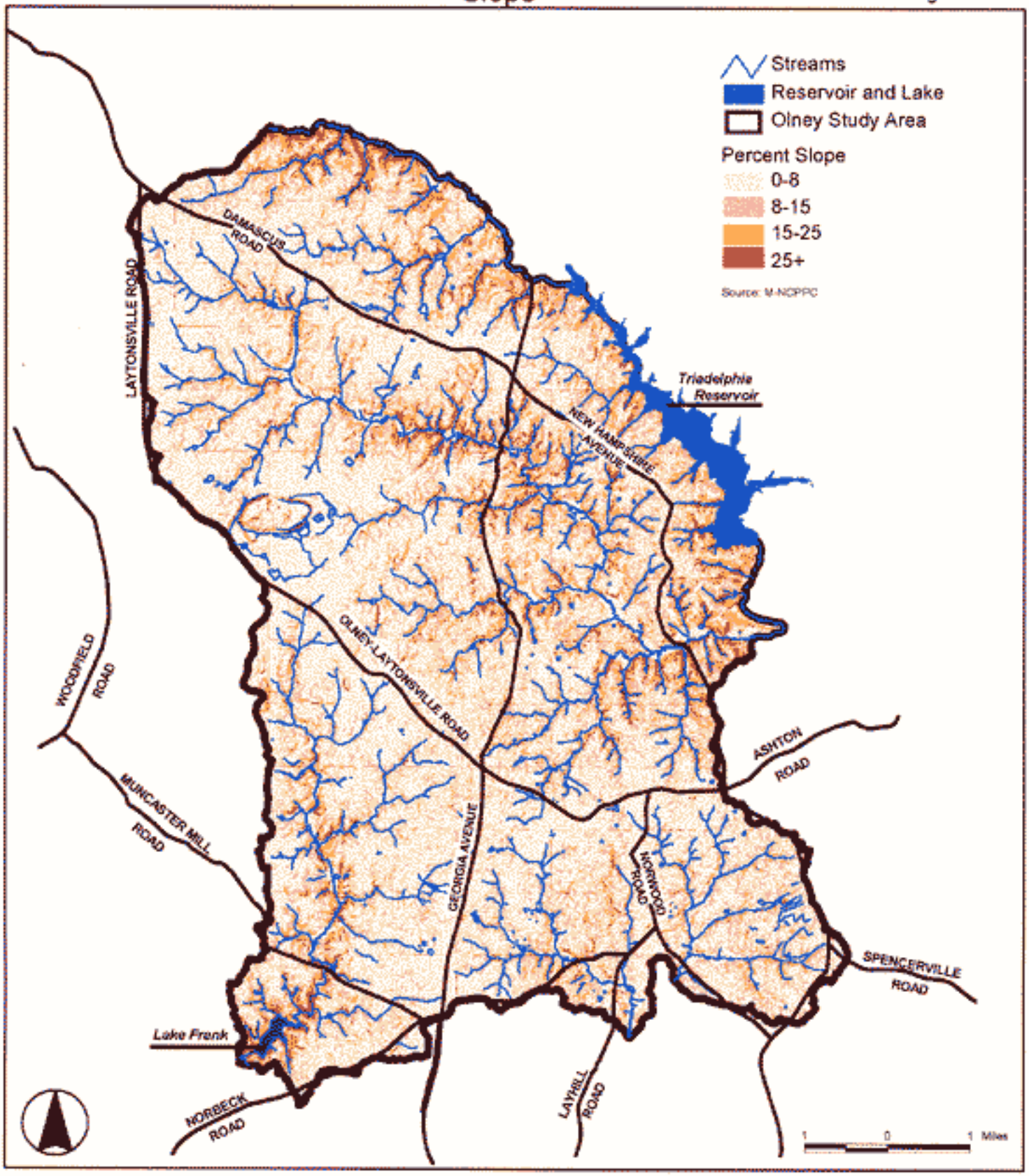
# Soils with Severe Limitations to Septic Systems

Figure 5



# Slope

Figure 6



groundwater discharge. As a result, under low flow conditions groundwater and surface water quality are closely linked.

In areas of Montgomery County that depend on individual well systems, protection of groundwater quality is essential. Ironically, those same areas usually depend on individual on-site sewage disposal systems (septic systems) that may contribute to groundwater pollution. Regulations are in place to require separation of wells and septic systems, and proper design to avoid contamination from failing systems. Use of such systems, however, requires large lots especially where soils have septic limitations due to shallow bedrock or wet conditions. Other sources of groundwater pollution include animal waste, excessive application of fertilizers and pesticides, improper land disposal of hazardous substances, and recharge from heavily contaminated surface sources such as stormwater management infiltration trenches.

From a water quantity standpoint, the disturbance or replacement of natural water recharge and discharge areas interferes with the hydrologic cycle of groundwater. Streams in heavily urbanized areas experience a decrease in stream base flow and lower groundwater yields. The impacts can be serious for areas that depend on public or private wells. Also, low baseflow in streams adversely impacts the natural aquatic environment.

As discussed in the previous section, the four watersheds that occur in the Olney master plan study area are all characterized by very similar geology and soils (see Figure 4). Well yields in the gneiss crystalline rock aquifer range from less than 1 gallon per minute (gpm) to 183 gpm, but yields are generally low, averaging 11 gpm in schist bedrock. The relatively low yield from wells in this aquifer has been attributed to the poorly developed network of points and fractures in the rock. Movement of groundwater is slow, with transmissivities of 2100 to 6500 gpd/ft.

Variability in well yields has been associated with area topography and geology. A greater percentage of wells in the valleys have high yields than wells located on hilltops. This is a typical occurrence in gneiss crystalline rock where valleys tend to develop along zones of structural weakness, where fracturing is greater. Also, a slightly larger percentage of wells in Montgomery County drilled in gneiss have produced high (25 gpm or greater) and intermediate (6-25 gpm) yields than wells drilled in schist or mafic rock.

In general, the crystalline rock aquifer is considered suitable for providing limited quantities of high quality water, such as for individual homes in rural areas. A trend among municipalities in the area has been to shift from initially using groundwater to using treated surface water, as population growth results in the need for larger water supplies.

## General Characteristics of Vegetation and Natural Resources

### Forest Resources

The forest areas of Olney and vicinity provide various environmental functions, including enhancing air quality, filtering particulates, absorbing nitrogen oxides, and reducing energy needs by reducing the need for cooling and heating. They also provide habitat for a range of plants and animals and recreation opportunities and resources for people. Along streams and waterways, forests play a vital role in maintaining water quality by filtering and reducing surface runoff, helping to alleviate flooding, and moderating stream temperature fluctuations. The quality of life in communities is also improved by forests and trees which provide recreation, aesthetics, and beautification.

A forest resources inventory was conducted in the Olney study area to aid in identifying priority forest stands and locating forest enhancement and reforestation areas in the master plan. The existing forests were analyzed to determine their distribution and amount, and to classify them by forest type. The approach and methodology used are described in the Appendix.

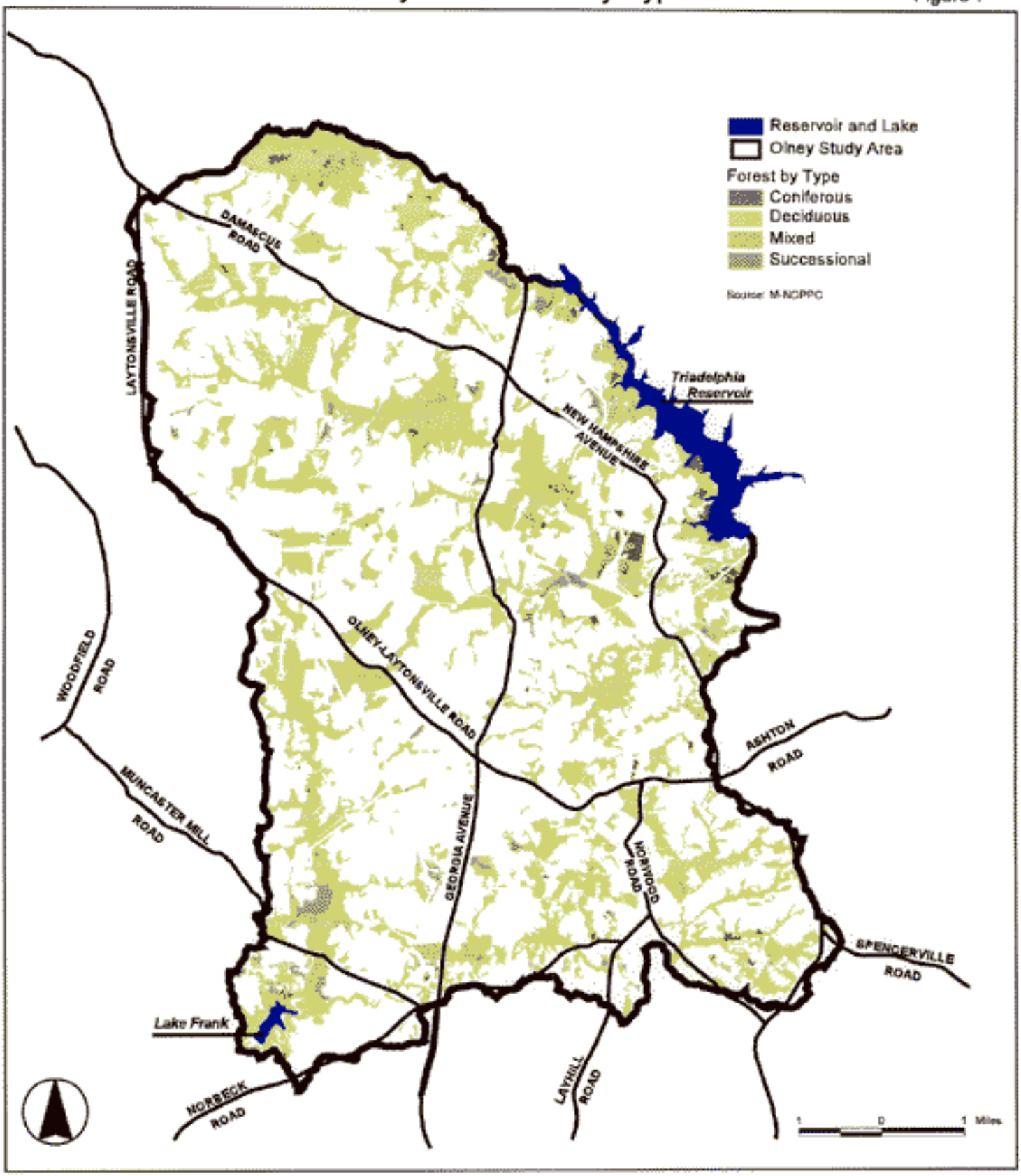
#### Inventory Results

The forests of the study area were categorized into deciduous, mixed deciduous/coniferous, coniferous, and successional forest types (see Figure 7). Definitions of these types are included in the Appendix.

Forest dominated by deciduous species are the predominant type within the study area. In the North Branch of Rock Creek, and some areas of the Hawlings and Patuxent, successional forest is also an important component. Mixed deciduous/coniferous forests are a relatively small component of the overall study area forest, but are more predominant in the Hawlings and

# Study Area Forest by Type

Figure 7



Patuxent River areas. Coniferous forests are rare in the North Branch of Rock Creek and Northwest Branch, but large coniferous forest stands are present in the Hawlings and Patuxent River areas.

Several significant coniferous stands exist along land bordering the Triadelphia Reservoir. Table 3 provides a summary of forest types by acreage in the study area. Approximately forty percent of the forest resources of the study area are within existing parkland.

### Study Area Forest by Type[1]

**Table 3**

| Forest Type | Acreage[2] | % of Total Forest |
|---|---|---|
| Deciduous | 11,235 | 90 |
| Mixed Deciduous/ Coniferous | 490 | 4 |
| Coniferous | 260 | 2 |
| Successional | 460 | 4 |
| TOTAL | 12,445 | 100 |

(1) The forest categories used represent generalized forest types recognized by the Maryland state forest inventory.

(2) A total of 4,391 acres (or 35 percent) of the study area forest is within parkland.

As is typical throughout the county, the deciduous forests in the study area are comprised of various forest stands which differ in age, species, and quality throughout their extent. Many of the stands contain mature woodland with specimen size trees. Non-native, invasive vegetation is a problem in many of the deciduous forests. Although the amount of invasive species varies widely within the different stands, in some cases they are a major inhibitor to overall forest development. Several instances were observed in the Northwest Branch and Hawlings River watershed areas of old fields completely covered with multiflora rose bushes that were inhibiting development of the areas as forest. In many instances, the deciduous forest stands have also been affected by excessive deer browsing and, as a result, contain little to none of the typical forest understory tree, shrub and herbaceous plants.

Dominant tree species in the deciduous forest areas vary across the topography. The more mature upland forest areas are representative of the oak/hickory forest association (Brush et al., 1980). Dominant tree species include white oak (*Quercus alba*), northern red oak (*Q. rubra*), chestnut oak (*Q. prinus*), scarlet oak (*Q. coccinea*), mockernut hickory (*Carya tomentosa*), and pignut hickory (*C. glabra*) with tulip poplar (*Liriodendron tulipifiera*) as an important secondary component. Many unusual features within deciduous forest stands were noted. They included occurrences of healthy stands of Amercian chestnut (*Castanea dentata*) containing unusually large trees; stands dominated by exceptionally large specimen trees; and stands where not only are existing trees specimen size, but also they are made up of an unusual variety of tree species for one location. This exceptional level of diversity and health make several of the existing deciduous forest stands important candidates for preservation.

Slopes and lowland areas are typically dominated by tulip poplar in association with red maple (*Acer rubrum*) and sycamore (*Platanus occidentalis*). Black cherry (*Prunus serotina*) is an important associated species along with green ash (*Fraxinus pennsylvanica*), black walnut (*Juglans nigra*), black gum (*Nyssa sylvatica*), American elm (*Ulmus americana*) and beech (*Fagus grandifolia*). In many locations, exceptionally large tulip poplars and sycamore are present within the stands.

Typical woody understory vegetation in the deciduous forests includes dogwood (*Cornus florida*), spicebush (*Lindera benzoin*), mountain laurel (*Kalmia latifolia*), ironwood (*Carpinus caroliniana*), blueberries (*Vaccinium spp.*), and viburnums (*Viburnum spp.*) with occurrences of more unusual species such as hornbeam (*Ostrya virginiana*). Alien and invasive plants include multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), Asiatic bittersweet (*Celastrus orbiculatus*), porcelain berry (*Ampelopsis brevipedunculata*) garlic mustard (*Alliaria petiolata*), and Vietnamese stilt grass (*Microstegium vimineum*).

The mixed deciduous/coniferous forests contain many of the same species of trees as the deciduous forest in association with Virginia or scrub pine (*Pinus virginiana*), eastern hemlock (*Tsuga* Canadensis) and white pine (*Pinus strobus*). In the younger mixed forest stands eastern red cedar (*Juniperus virginiana*) replace the pines as the dominant associated coniferous tree. The coniferous forest stands include planted stands of white pine and a combination of planted and natural occurrences of eastern hemlock. The hemlocks occur primarily on the rocky, north-facing slopes within the forest along the Triadelphia Reservoir. Unlike some areas of

occurrence in the county, most of these hemlock stands appear to be healthy and in some cases the individual trees are quite large.

The successional forest areas are dominated by tulip poplar, red maple, and black cherry in association with eastern red cedar. They also contain the alien invasive species mentioned above in various quantities. Successional forest areas and old fields offer opportunities for expansion of existing forest resources in the watershed. One significant area exists north of Muncaster Mill Road in the North Branch Stream Valley Park. Another location is the area north of Lake Frank in Rock Creek Regional Park. Large areas of successional forest also exist along the Reddy Branch Stream Valley Park east of Brookeville and within public land east and west of Georgia Avenue along the Patuxent River.

## Important Forest Resource Areas

In Montgomery County where urbanization and agriculture have removed much of the existing forest, conservation of all remaining forest resources is important. High quality forest stands may warrant preservation. Quality of a forest stand is a reflection of such characteristics as acreage of the stand, tree species and age, stand structure, percent of non-native or invasive vegetation within the stand, and overall health. High quality forest stands are large enough to provide a variety of habitats including forest interior. They may contain tree species which are rare or the trees may be significant because of their maturity and size. High quality stands have more diverse forest structure including varying layers of tree canopy with associated understory trees, shrubs and herbaceous plants. Forest stands which are in good health and have a small percentage of non-native or invasive vegetation are also high quality.

As a first cut to identifying high quality forest stands, significant forest areas based upon stand size and proximity to existing streams were identified (see Figure 8). Using this coverage, more detailed analysis for stand quality was carried out. Several forest areas exhibiting one or more of the characteristics of high quality forest are present in Olney and vicinity.

Within existing park and WSSC land, important forest areas include (see Figure 8):

1. The forest south of Olney-Laytonsville Road midway between its intersection with Georgia Avenue and the western study area boundary in the North Branch of Rock Creek Stream Valley Park
2. The forest within the stream valley north of Lake Frank, including the stand north of Muncaster Mill Road
3. Rachel Carson Conservation Park south of Damascus Road just west of Georgia Avenue
4. Hawlings River Stream Valley Park east of Georgia Avenue
5. Patuxent River State Park along the river on the northern boundary of the study area
6. Reddy Branch Stream Valley Park west of the town of Brookeville; and
7. Most of the forest along the Triadelphia Reservoir within WSSC property

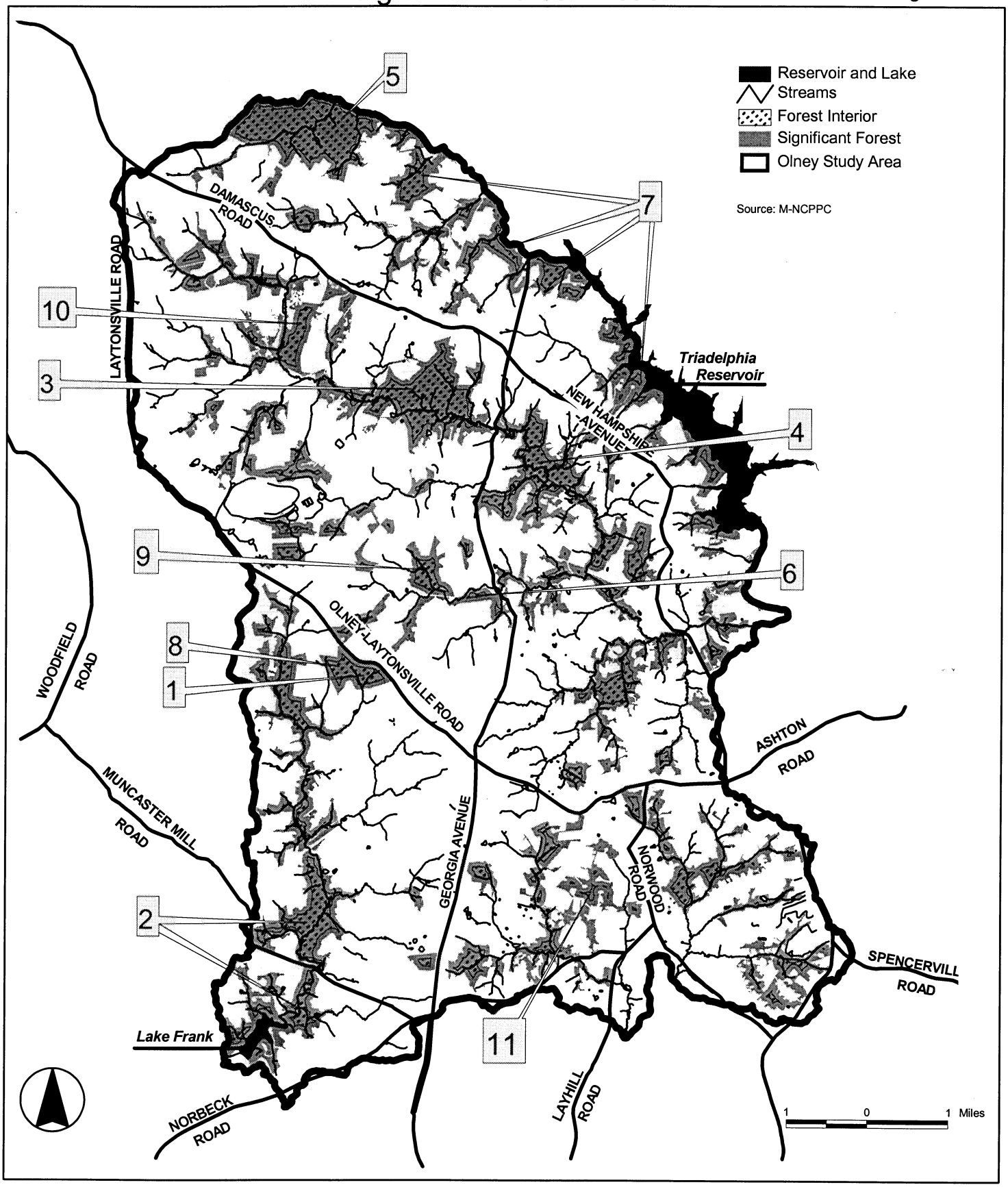
Outside parkland, important forest areas include:

8. The forest between the North Branch of Rock Creek Stream Valley Park area south of Olney-Laytonsville Road and west of the policy area boundary
9. The forest in the headwaters of Reddy Branch west of Brookeville
10. The forest north and west of Rachel Carson park in the Hawlings River area; and
11. The forest along the Bachelors Forest tributaries of Northwest Branch east of Georgia Avenue and south of Norwood Road

Table 4 summarizes the location and significance of forest within the study area.

# Significant Forest Areas

Figure 8



## Study Area Forest by Location and Significance

**Table 4**

| Watershed | Watershed Area | Total Forest Area | | Forest in Parkland | | Significant Forest[1] | | | | Forest Interior Habitat[2] |
|---|---|---|---|---|---|---|---|---|---|---|
| | Acres | Acres | % of watershed area | Acres | % of total forest acreage | Acres | % of total forest acreage | Acres in parkland | % of significant forest in parkland | Acres |
| North Branch of Rock Creek | 8,014 | 2,255 | 28 | 1,210 | 54 | 1,670 | 74 | 1,109 | 66 | 455 |
| Hawlings River | 18,069 | 5,709 | 32 | 1,402 | 24 | 4,336 | 76 | 1,330 | 31 | 1,085 |
| Upper Northwest Branch | 6,502 | 1,970 | 30 | 162 | 8 | 1,517 | 77 | 89 | 6 | 198 |
| Upper Patuxent River | 7,011 | 2,511 | 36 | 1,616 | 64 | 2,216 | 88 | 1,540 | 69 | 675 |
| **TOTAL** | 39,694[3] | 12,445 | 31 | 4,391 | 35 | 9,739 | 78 | 4,068 | 42 | 2,413 |

[1] Consists of forest areas that contain forest interior (300 feet) and riparian corridors (600 feet). For a discussion of Significant Forest Areas, see the Appendix.
[2] Included under significant forest
[3] Total includes the study area acreage within the Great Seneca Creek watershed which has no forest.

### Wetlands

According to the definition listed in both federal and state wetlands statutes, a wetland is an area that is inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Wetlands have soils which are saturated or flooded for a significant portion of the growing season each year. The wet soil conditions smother the root systems of typical upland plants, making it difficult for them to grow and reproduce. In wetlands therefore, the plant community changes to one dominated by plants having physiological adaptations which enable them to grow and thrive in the wet conditions. Often, plants which have become adapted to wetland areas occur nowhere else. For this reason, wetlands harbor comparatively higher numbers of rare, threatened, and endangered species than upland habitats.

Many species of animals use wetlands for some portion of their life cycle, and some kinds of animals, such as amphibian species, are completely dependent on damp soils and standing pools of water for their survival. Other animal species, especially insects, may depend on host plants which occur only in wetlands. Because many plants and animals in wetlands are specialized to survive in saturated or flooded soil conditions, wetlands have unique biological communities which contribute significantly to the biological diversity of the county.

Wetlands frequently occur where the water table intersects low areas in the landscape. This also means that wetlands often are found in close proximity to stream systems. The location of these wetlands, coupled with some unique physical, chemical, and biological processes, allows wetlands to provide important water quality and flood control functions. The combination of water quality, flood control, and habitat functions make wetlands valuable components of the landscape. Unfortunately, many wetlands which were historically present have been lost to agriculture and development. In recognition of this, various regulations and guidelines have been passed at the federal, state, and local government levels in an effort to protect and restore wetlands.

Among the water quality goals for Montgomery County are to "protect, maintain, and restore high quality chemical, physical, and biological conditions in the waters of the state in the county; reverse the past trends of stream deterioration through improved water management practices; maintain physical, chemical, biological, and stream habitat conditions in county streams that support aquatic life along with appropriate recreational, water supply, and other water uses; (and) restore county streams, damaged by inadequate water management practices of the past, by reestablishing the flow regime, chemistry, physical conditions, and biological diversity of natural stream systems as closely as possible (Montgomery County Code, Chapter 19, Article IV)." Protection and restoration of wetlands and wetland functions is vital to the achievement of these goals.

The purpose of this wetland inventory is to broadly identify, characterize, and assess the wetland resources within the study area. The information collected in this inventory may then be used to help identify and prioritize opportunities to protect or restore wetland systems in the study area. It is anticipated that wetland protection or restoration opportunities would be factored into the land use analysis of the master planning process so that recommendations that form the master plan amendment help support County goals of protecting and improving aquatic resources, including wetlands.

The Digital Ortho Quarter Quad (DOQQ) wetland inventory prepared for the Maryland Department of Natural Resources (Md. DNR) formed the basis for the representation of wetland resources in the Olney study area. The DNR inventory represents interpretation of 1993-94 aerial photography. Staff has found the DOQQ inventory to be considerably more accurate than either the federal National Wetlands Inventory (NWI) or the maps of hydric soils in Montgomery County in depicting the likely locations of wetlands, although the DOQQ inventory does include errors of both addition and omission. In general, staff observed that the DOQQ's tended to overestimate the total area of wetlands; however, most areas depicted as wetlands contained at least pockets of wetlands embedded within floodplain plant communities. In a few cases, wetlands are more extensive than represented by the DOQQ.

Based on the DOQQ information, wetlands account for approximately 4 percent of the total acreage of the Olney study area (see Figure 9 and Table 5). According to the most widely accepted standard for wetlands classification in the United States[2] , most of the wetlands (about 49 percent) are palustrine[3] forested (PFO) wetlands. In the study area, as is typical in the county, these forested wetlands occur in low areas adjacent to streams. Palustrine emergent (PEM) wetlands, which lie near streams and are dominated by emergent vegetation, account for a little more than nine percent of the study area's wetlands. (Emergent vegetation consists of herbaceous plants which may have their root systems temporarily or permanently flooded, but which cannot survive if the entire plant is covered with water for any significant length of time.) A little less than four percent of the study area's wetlands are palustrine scrub-shrub (PSS), which consist of wetlands which occur near streams and are dominated by shrubs and small trees. Lakes and ponds account for about 27 percent and 10 percent, respectively, of wetlands in the study area. It should be noted that the lakes and ponds in this study area, as is the case in the county, are man-made. These include two large lakes: Lake Bernard Frank in Rock Creek and Lake Hallowell in the Hawlings River basin.

All the wetlands in the study area lie within a Use III or IV watershed. By definition (Code of Maryland Regulations 26.23.01.01), they are considered to be wetlands of "significant plant or wildlife value". None of the wetlands within the Olney study area are currently listed as wetlands of Special State Concern in the Code of Maryland Regulations. Wetlands may be designated wetlands of Special State Concern if they provide habitat or ecologically important buffers for state or federal rare, threatened, or endangered species, or if the wetlands contain unique or unusual natural communities.

Although there currently are no wetlands of Special State Concern, there are wetland systems that are part of high-quality forest stands with richly diverse native plant communities. One such system lies within the Hawlings River watershed. Two wetland groups within the Rachel Carson Conservation Park are part of a large tract of high quality mixed deciduous forest. These wetland groups

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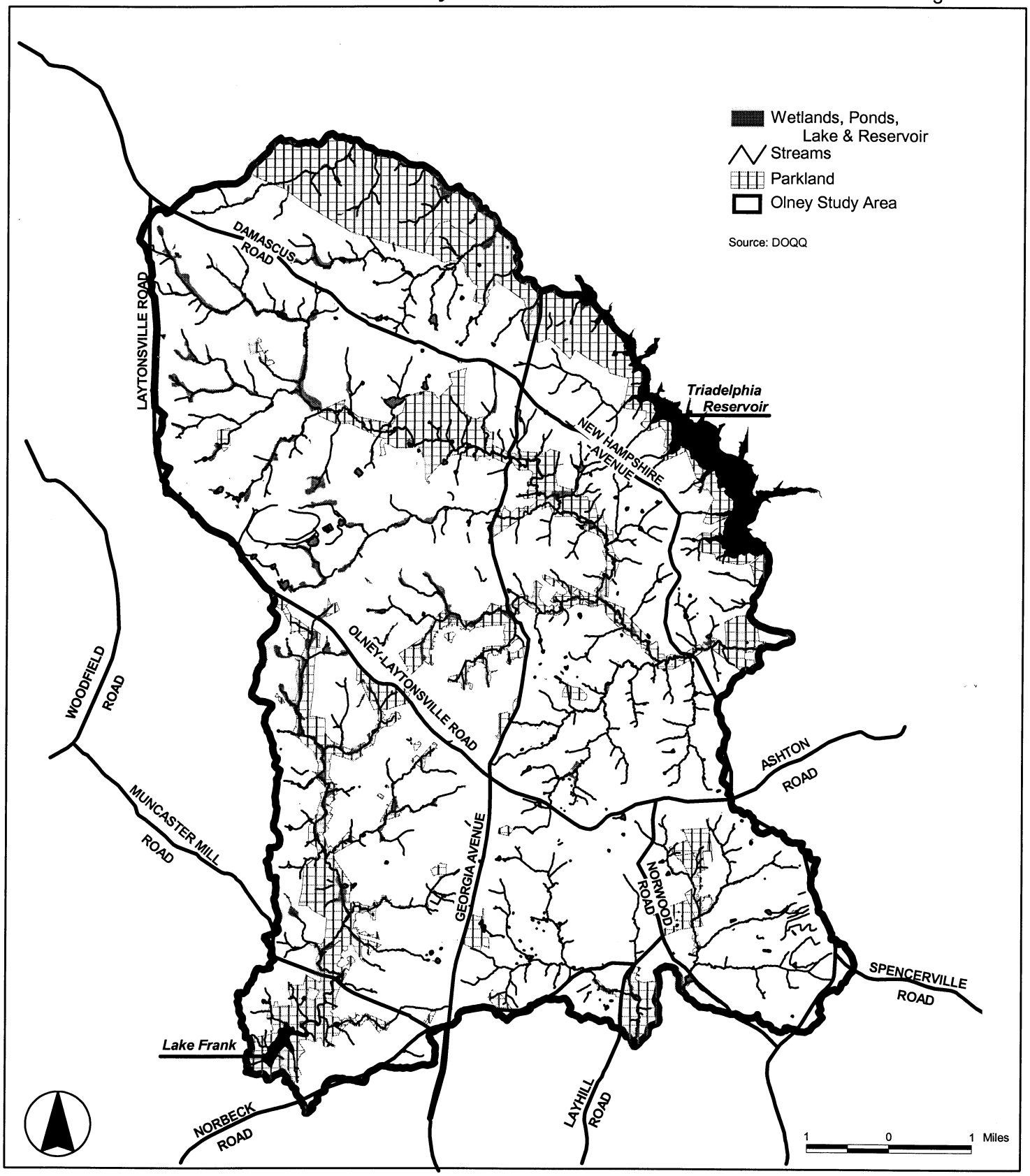
[2] Categories are adapted from Cowardin, et. Al., 1979, "Classification of Wetlands and Deepwater Habitats of the United States", U.S. Department of the Interior, Fish and Wildlife Service.

[3] Palustrine wetlands are wetlands that are traditionally known as marsh, swamp, bog, fen, and prairie. They also include small, shallow, permanent, or intermittent water bodies called ponds. The reader should refer to Cowardin et. al. (1979) for a more complete description.

# Study Area Wetlands

Figure 9



## Study Area Wetlands[1] by Type

**Table 5**

| Wetland Type[2] | Watershed (Acres) | | | | Total (Acres) |
|---|---|---|---|---|---|
| | Northwest Branch | North Branch Rock Creek | Hawlings River | Patuxent River | |
| Forested (PFO) | 26 | 221 | 439 | 75 | 761 |
| Emergent (PEM) | 0 | 23 | 69 | 30 | 122 |
| Scrub Shrub (PSS) | 1 | 3 | 30 | 25 | 59 |
| Ponds (PU and PAB) | 27 | 17 | 91 | 17 | 152 |
| Farmed (Pf) | 0 | 13 | 17 | 4 | 36 |
| Lakes (L) | 0 | 58 | 14 | 348 | 420 |
| Riverine (R) | 0 | 0 | 0 | 2 | 2 |
| **Total Wetlands** | 54 | 335 | 660 | 501 | 1,552 |
| **Total Watershed in Study Area** | 6,502 | 8,015 | 18,069 | 7,011 | 39,694 [4] |
| **Percent of Watershed Covered by Wetlands** [3] | <1% | 4% | 4% | 7% | 4% |

(1) GIS coverage of wetlands (DOQQ), Earth Data 1998.
(2) Categories are adapted from Cowardin, et. al., 1979, Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service.
(3) Percentages rounded to the nearest 1 percent.
(4) This acreage represents the entire study area and includes that part of Great Seneca Creek (98 acres) that lies within the study area.

also support a small and widely scattered population of green dragon (Arisaema dracontium), a state watchlist[4] plant. Another high quality wetland is a large wetland in M-NCPPC parkland in the North Branch of Rock Creek. This wetland is part of a natural area identified by M-NCPPC as a biodiversity area. Such a designation recognizes the high quality, diverse, and unusual nature of the native plant and animal communities found in the designated area. This wetland is also recognized as important to the county's biological diversity by the Maryland Department of Natural Resources Heritage and Biodiversity Conservation Program.

Staff evaluated, at a preliminary level, the extent to which long-term protection has been provided to wetlands in the study area. Generally, the highest level of protection for natural resources occurs if conservation areas within public parkland are created over and around these resources. Using GIS data, staff identified wetlands that currently lie within state parkland, M-NCPPC parkland, or WSSC Triadelphia Reservoir watershed land. The results are summarized in Table 6, and Figure 9. Although this preliminary evaluation does not distinguish the different types of parkland (e.g., conservation parks, local parks, stream valley parks, etc.), the results give an indication of where wetlands are relatively well-protected from significant direct disturbance activities. It should be noted that wetlands, as well as other natural features, may be protected by other means, such as conservation easements on private land. The location and extent of such protective easements were not included in this evaluation.

[4] A watchlist plant or animal is a species that is rare to uncommon with the number of occurrences typically in the range of 21 to 100 in Maryland. According to the Maryland Natural Heritage Program of the Maryland Department of Natural Resources, a watchlist species may have fewer occurrences but with a large number of individuals in some populations, and it may be susceptible to large-scale disturbances. Watchlist species are not actively tracked by the Natural Heritage Program.

## Study Area Wetlands[1] on Public Lands[2]

**Table 6**

| Wetland Type | Acres of Wetlands In: Northwest Branch | | | North Branch of Rock Creek | | | Hawlings River | | | Patuxent River | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | In Parkland | % in Parkland | Total | In Park-land | % in Park-land | Total | In Park-land | % in Park-land | Total | In Parkland | % in Parkland |
| Forested (PFO) | 26 | 13 | 50% | 221 | 159 | 72% | 439 | 91 | 21% | 75 | 39 | 52% |
| Emergent (PEM) | 0 | 0 | ___ | 23 | 11 | 48% | 69 | 13 | 19% | 30 | 25 | 83% |
| Scrub-Shrub (PSS) | 1 | <1 | 7% | 3 | 0 | 0% | 30 | 5 | 17% | 25 | 21 | 84% |
| Ponds (PU and PAB) | 27 | 5 | 19% | 17 | 3 | 18% | 91 | 4 | 4% | 17 | 2 | 12% |
| Farmed (Pf) | 0 | 0 | ___ | 13 | 0 | 0% | 17 | 0 | 0% | 4 | 0 | 0% |
| Lakes (L) | 0 | 0 | ___ | 58 | 58 | 100% | 14 | 0 | 0% | 348 | 301 | 86% |
| Riverine (R) | 0 | 0 | ___ | 0 | 0 | ___ | 0 | 0 | ___ | 2 | 2 | 100% |
| **TOTAL** | 54 | 18 | 33% | 335 | 231 | 69% | 660 | 113 | 17% | 501 | 390 | 78% |

(1) GIS coverage of wetlands (DOQQ), Earth Data, 1998.
(2) Public lands include parkland owned by M-NCPPC and the state of Maryland, and WSSC Triadelphia Reservoir watershed property.

### Assessment of Wetlands by Watershed

This inventory encompassed two levels of assessment of the wetland resources in this study area. A first-level, general assessment was conducted using mapped and previously documented information only. A more detailed assessment of wetlands, wetland types, and their functions was conducted within the Olney policy area. The detailed assessment could not be conducted within the entire study area because of constraints on time and staff. The policy area wetland types are shown in Figure 10 and detailed in Table 7. The more detailed functional assessment is presented in the Appendix.

Conclusions and observations in this section are based on both the general and more detailed assessments. It is anticipated that those parts of the Olney study area which were not part of the wetlands functional assessment will be covered under a future wetlands functional assessment inventory.

It should be noted that the comparisons of wetlands between watersheds made in this inventory apply only within the bounds of this study area. The study area cuts across three of the four watersheds that are included in this inventory (Patuxent, Northwest Branch, upper Rock Creek). Therefore, comparisons of wetlands and watersheds that are only partially located in the study area may not be valid or hold true if such wetlands are inventoried as part of a study that includes the entirety of a watershed.

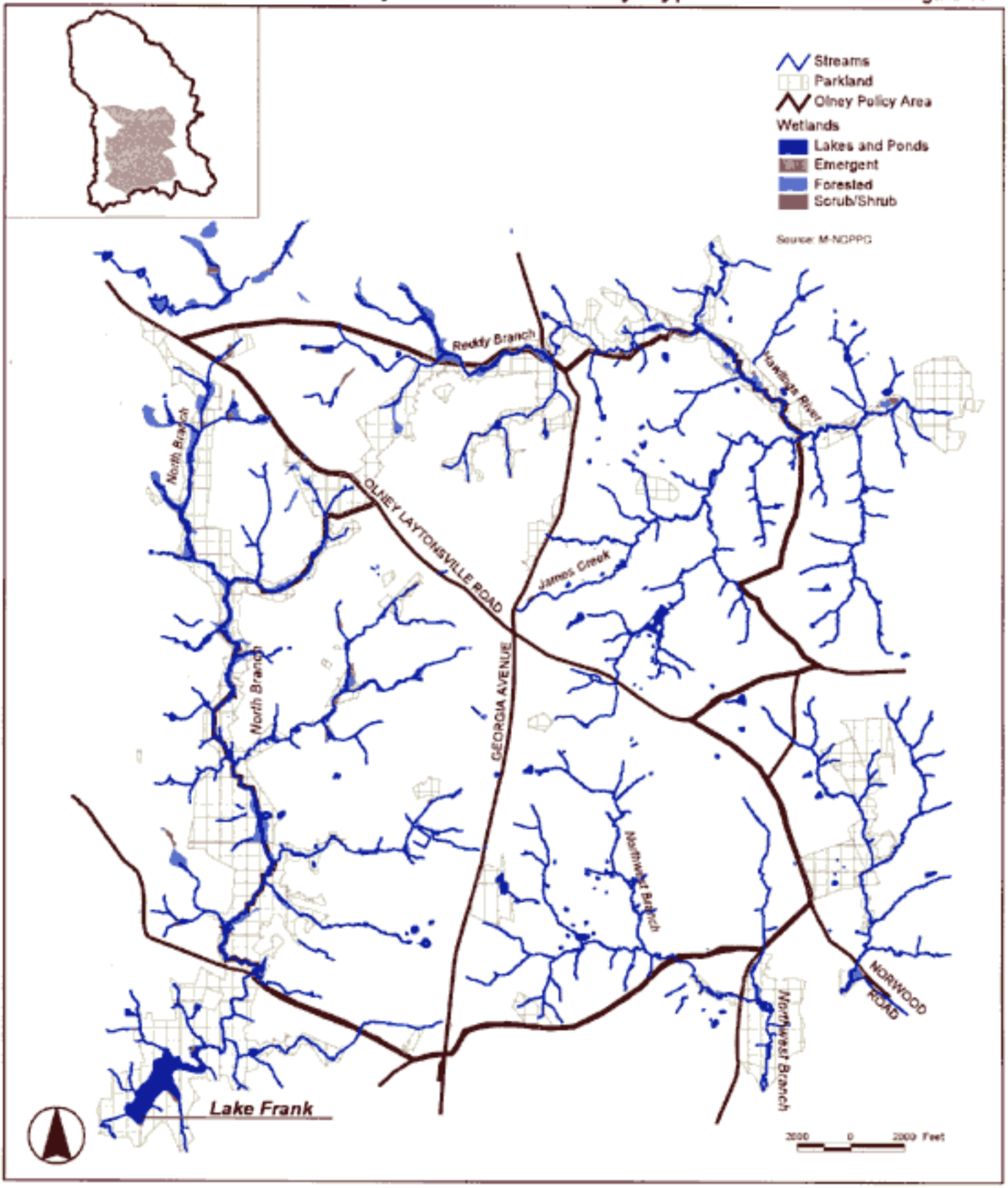
Northwest Branch

In this part of Northwest Branch, about half the wetlands are associated with man-made ponds. Only about one-third of the wetlands lie within public lands (see Figure 10).

There are relatively few wetlands (by acreage and proportion of watershed coverage) within this portion of Northwest Branch. However, some of these wetlands are part of a larger network of forested stream valley features

# Policy Area Wetlands by Type

Figure 10



## Policy Area Wetlands[1] by Type

**Table 7**

| Wetland Type [2]: | Watershed (Acres) Northwest Branch | North Branch Rock Creek | Hawlings River | Total (Acres) |
|---|---|---|---|---|
| Forested (PFO) | 4 | 84 | 35 | 123 |
| Emergent (PEM) | 0 | 13 | 7 | 20 |
| Scrub Shrub (PSS) | 0 | 2 | 1 | 3 |
| Ponds (PU and PAB) | 10 | 11 | 14 | 35 |
| Farmed (Pf) | 0 | 0 | 0 | 0 |
| Lakes (L) | 0 | 0 | 14 | 14 |
| Riverine (R) | 0 | 0 | 0 | 0 |
| **Total Wetlands** | 14 | 110 | 71 | 195 |
| **Total Watershed in Policy Area** | 2,619 | 3,953 | 4,427 | 10,999 |
| **Percent of Watershed Covered by Wetlands [3]** | 1% | 3% | 2% | 2% |

(1) GIS coverage of wetlands (DOQQ), Earth Data 1998.
(2) Categories are adapted from Cowardin, et. al., 1979, Classification of Wetlands and Deepwater Habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service.
(3) Percentages rounded to the nearest 1 percent.

of floodplain, vernal pools, and springs that provide valuable habitat for wildlife, including amphibians such as frogs and salamanders.

North Branch of Rock Creek

Roughly two-thirds of the wetlands in this part of upper Rock Creek watershed are forested. Much of the wetlands (over two-thirds) are found on public lands (see Figure 10).

Wetlands in this watershed include those associated with Lake Bernard Frank in Rock Creek Park.

The North Branch and many of its tributaries harbor a rich variety of high-quality wetlands. The combination of large forested wetlands, high-quality scrub-shrub and emergent wetlands, and large vernal pool areas make the wetlands of North Branch especially valuable as habitat for aquatic, semi-aquatic, and terrestrial plants and animals, including amphibians. A large wetland (in M-NCPPC parkland) in this North Branch complex is part of a natural area identified by M-NCPPC as a biodiversity area. Such a designation recognizes the high quality, diverse, and unusual nature of the native plant and animal communities found in the designated area.

Hawlings River

By far, the greatest amount of wetlands occur within the Hawlings River portion of the study area. However, compared to the other watersheds in the study area, this watershed has the lowest proportion of its wetlands within public lands (see Figure 10).

It appears that high quality wetlands lie throughout the Hawlings River valley around Brookeville Road and north. These wetlands are associated with the mainstem, Reddy Branch, and some of the first and second order tributaries at the extreme western headwaters of the watershed. Many of these wetlands are forested and cover extensive areas. Many of these wetland lie within Rachel Carson Conservation Park and Hawlings River Stream Valley Park and are part of large forest stands. There are also large forested wetlands within private property, especially at the extreme western headwaters of the watershed which lie within private properties.

In contrast, there are groups of wetlands in this watershed which lie within one of the most highly developed portions of the study area. Such wetlands show substantial characteristics of adverse impacts due to urbanization. Generally, these wetlands are small, highly fragmented, and populated by non-native, invasive plant species.

Patuxent River

The Patuxent River watershed has the second highest amount of wetlands in the study area. It has the highest proportions of wetlands lying within protected public lands (see Figure 10).

The watershed of the Patuxent River mainstem contains some large areas of forested wetlands. Many of these wetlands are adjacent to or are near the mainstem and lie within the Patuxent River State Park or the WSSC Triadelphia watershed properties. One large forested wetland which may be of high quality lies on private property within the Haights Branch stream valley (tributary of Patuxent River) north of Damascus Road (Rte. 650), just east of Bridgeton Lane.

## Habitats of Rare, Threatened, and Endangered Species and Areas Likely to Contain Unusual Biological Communities

Wetlands, large contiguous forest blocks, and certain stream valleys are probable habitats for rare, threatened, and endangered species (RT&E). Many stream valleys in Montgomery County have been protected over time by their steep topography or by excessive wetness. Where possible, they have been acquired as park land. Besides providing important habitat for plants and animals, stream valleys historically have served as important migration corridors for many species.

The probability of finding RT&E species or unusual biological communities increases in areas underlain by certain bedrock types such as ultramafic and diabase rock formations and in areas of serpentine soils. There is a very small area containing the ultramafic bedrock formation near the edge of the study area at the top of the Hawlings River watershed, but there are no serpentine soils.

Most of the known locations of rare, threatened, or endangered species of plants and animals occur in Montgomery County's park system. Surveys for RT&E species and unusual biological communities have been conducted on parkland by the Maryland Department of Natural Resources Heritage and Biodiversity Conservation Program as well as by M-NCPPC staff. As a result of these surveys, several areas within the park system have been designated as Biodiversity Areas. Biodiversity Areas included in the Olney study area are shown in Figure 11. A list of rare, threatened and endangered plants identified in these areas is shown in Table 8. The significant habitats and communities identified in the surveys of the areas included: high quality unfragmented forests; upland forest; a large seepage swamp; and a large emergent wetland in the North Branch of Rock Creek; and maturing, high quality, mixed deciduous forest; very high quality mixed deciduous forest; and high quality seeps in the Hawlings River.

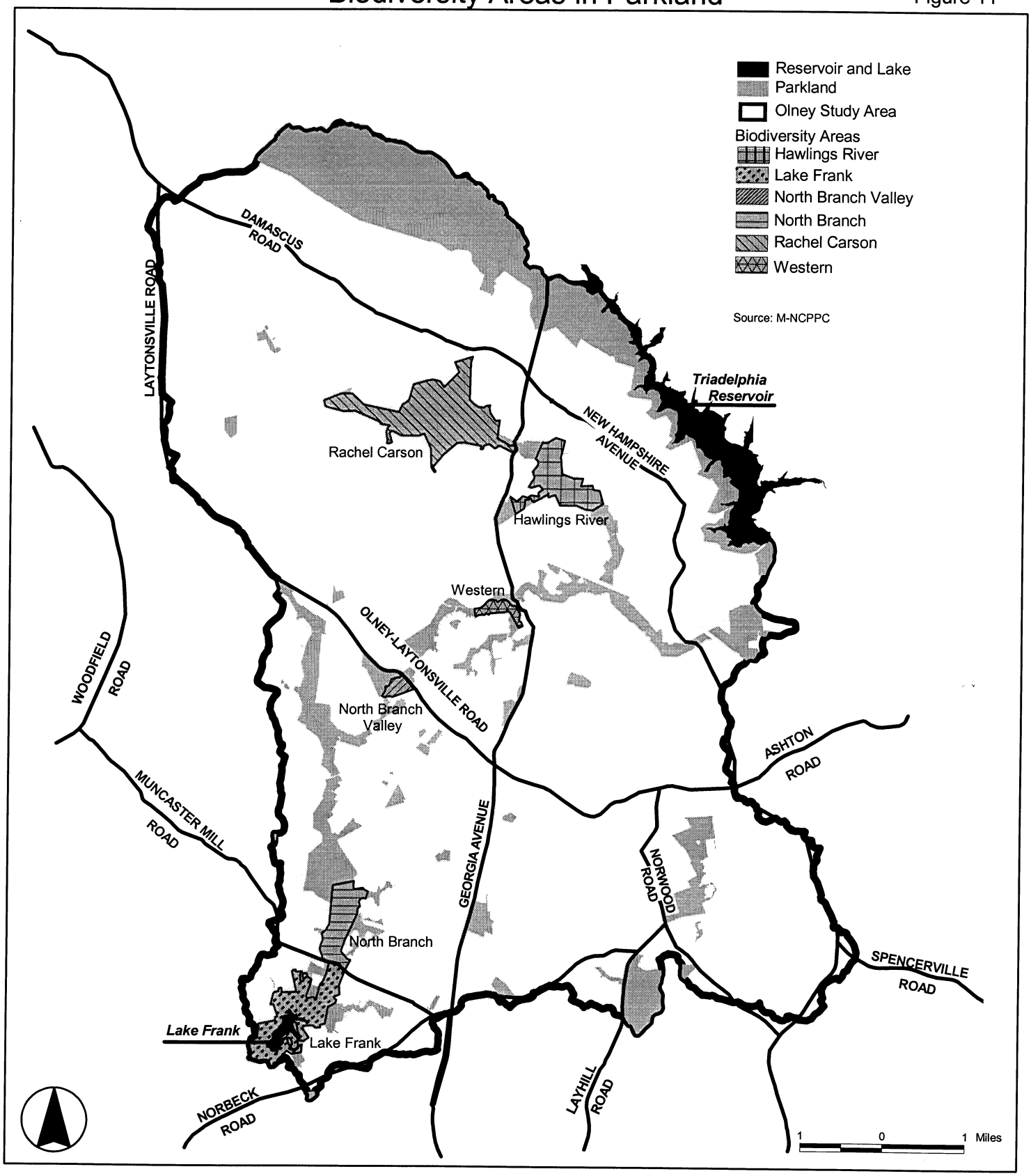
## Wildlife

There have been few comprehensive wildlife inventories conducted in the study area. Only the Maryland Breeding Bird Atlas (1983-1987) covers the entire study area. Other inventories have been conducted on parkland including, breeding bird surveys in the North Branch of Rock Creek, Rachel Carson Conservation Park and Woodlawn Cultural Park. A more comprehensive wildlife inventory including birds, mammals, reptiles and amphibians was conducted as part of the development of the Rachel Carson Conservation Park Master Plan. A list of wildlife species that occur in Rachel Carson Conservation Park is included in the Appendix (see Table A-3).

A number of wildlife habitats and species occur in the study area that are noteworthy because they are declining regionally or they can have a direct or indirect impact on humans and human development issues.

# Biodiversity Areas in Parkland

Figure 11



## Study Area Rare, Threatened, and Endangered Plants

**Table 8**

| Species in the Biodiversity Areas of the North Branch of Rock Creek | | |
|---|---|---|
| **Plant Species** | **Common name** | **Official Status** |
| *Aristolochia serpentaria* | Virginia snakeroot | watchlist (1) |
| *Calystegia spithamaea* | low bindweed | State rare/watchlist(2) |
| *Carex radiata* | stellate sedge | endangered |
| *Castenea* pumila | chinquapin | watchlist |
| *Castanea dentata* | American chestnut | State rare/watchlist |
| *Chamaelirium luteum* | devil's bit | watchlist |
| *Heteranthera dubia* | water stargrass | infrequent in county(4) |
| *Iris cristata* | crested iris | endangered |
| *Linderna dubia* | false pimpernel | infrequent in county |
| *Lysimachia terrestris* | swamp loosestrife | infrequent in county |
| *Melica mutica* | narrow melicgrass | threatened (5) |
| *Ostrya virginiana* | hornbeam | infrequent in county |
| *Penthorum sedoides* | ditch stonecrop | infrequent in county |
| *Potamogeton diversifolius* | variable pondweed | infrequent in county |
| *Quercus imbricaria* | shingle oak | watchlist |
| *Rotala ramosior* | toothcup | watchlist |
| *Scutellaria serrata* | *showy skullcap* | *watchlist* |
| *Senecio pauperculus* | balsam ragwort | watchlist |

| Species in the Biodiversity Areas of the Hawlings River | | |
|---|---|---|
| **Plant Species** | **Common name** | **Official Status** |
| *Arisaema dracontium* | green dragon | watchlist |
| *Aristolochia serpentaria* | Virginia snakeroot | watchlist |
| *Castanea dentata* | American chestnut | State rare/watchlist |
| *Castanea pumila* | chinquapin | watchlist |
| *Commelina virginica* | Virginia dayflower | watchlist |
| *Elisia nyctelea* | ellisia | watchlist |
| *Geum laciniatum* | rough avens | watchlist |
| *Geum vernum* | spring avens | watchlist |
| *Quercus imbricaria* | shingle oak | watchlist |

(1) ***Watchlist***: Rare to uncommon with the number of occurrences typically in the range of 21 to 100 in Maryland. It may have fewer occurrences but with a large number of individuals in some populations, and it may be susceptible to large-scale disturbances. Not actively tracked by the Heritage and Biodiversity Conservation Programs. Source: *Explanation of Rank and Status Categories*. Maryland Department of Natural Resources, Heritage and Biodiversity Conservation Programs. April 19, 1996.

(2) ***State rare***: Imperiled in Maryland because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres in the State) or because of some factor(s) making it vulnerable to becoming extirpated. Actively tracked by the Heritage and Biodiversity Conservation Programs. Source: *Explanation of Rank and Status Categories*. Maryland Department of Natural Resources, Heritage and Biodiversity Conservation Programs. April 19, 1996.

(3) ***Endangered*** species means any species whose continued existence as a viable component of the State's flora or fauna is determined to be in jeopardy including any species determined to be an "endangered species" pursuant to the federal Endangered Species Act. Source: COMAR 08.03.08.

(4) ***Infrequent in Montgomery County***: Species singled out by M-NCPPC biologists as important to the County's biodiversity due to their scarcity in the County.

(5) ***Threatened*** species means any species of flora or fauna which appears likely, within the foreseeable future, to become endangered including any species determined to be a "threatened species" pursuant to the federal Endangered Species Act. Source: COMAR 08.03.08.

## Forest Interior and Riparian Forest Habitat

Forest interior dwelling (FID) species, particularly birds, require large tracts of unfragmented woodland to supply their life requisites. Forested areas at least 100 acres in size or riparian (streamside) forests that are at least 300 feet wide provide appropriate forest interior dwelling species habitat. As forested land throughout the east and central U.S. has been fragmented by development, FID species have declined dramatically. Approximately 2,413 acres of forest interior habitat have been identified in the study area. The Maryland Breeding Bird Atlas (1983-1987) indicates that many of these areas were supporting FID species. Preservation and protection of forest interior and riparian forest habitats needs to be a high priority.

## Grassland and edge habitat

Land use in parts of the study area currently support large areas of grassland (> 20 acres) and edge habitat. Pastureland, hayfields, sod farms, large estates and golf courses provide grassland habitat for several specialized species of birds that are declining regionally. Species include eastern bluebirds, eastern meadowlarks, grasshopper sparrows, kestrels (a small falcon), and other grassland or open country specialists. In addition to providing habitat, these pastoral areas add a distinctive rural character to the landscape and are often of considerable importance to local residents. Unlike forest habitats, large grasslands are often not maintained on parkland. Edges where fields meet other habitats, particularly forest, provide important habitat for other uncommon species including Baltimore orioles, red-tailed and red-shouldered hawks. Second growth areas consisting of shrubs and small trees often occur along edges and provide habitat for shrub specialists. This habitat too is becoming uncommon in the study area.

## Wildlife Species that Impact Humans

White-tailed deer, beaver, and Canada geese have expanded their range and population dramatically within the study area over the past decade. These three species have the potential to have direct or indirect impacts to humans and human development issues.

Increased white-tailed deer populations have resulted in increased deer impacts including: deer-auto collisions, and damage to farm crops, home landscapes and natural vegetation. The county developed and began implementing a comprehensive deer management program in 1995 that includes data collection, public education, and implementation of management options including population management. Given the juxtaposition of parkland, farmland, housing communities and large estates, deer populations in the area will most likely continue to increase for some time. Property development and particularly road construction proposed for the area must take deer populations into consideration when planning new construction or upgrading existing infrastructure. This is especially important where roads cross undeveloped stream valleys or parks.

Beaver are now present in virtually all stream valleys in the study area. Beaver activities include the cutting of trees and the damming and flooding of small streams both of which can impact human development. No studies of beaver populations or habitat usage have been undertaken in the study area but casual observations and the monitoring of citizen complaints indicate that sites are often colonized for a short period of time, usually several months to a year before they are abandoned. Most impacts to private property are limited to properties built close to or within floodplains or adjacent to storm water management ponds. Efforts are underway to develop a management plan similar to the county's deer plan that will focus on education and the use of various management options to address impacts on a site-by-site basis. Current environmental guidelines should minimize problems with private landowners. Roads, sewer lines, and trails that are constructed within floodplains should be designed with the consideration that flooding from beaver will periodically impact them.

Large numbers of Canada geese have taken up residence in the county over the past decade. These resident flocks do not migrate but spend the entire year in the area. Geese are attracted to areas of open grass with ponds or lakes. Golf courses, parks and large estates can attract large numbers resulting in problems with interference in activities including golf, picnicking, swimming etc., and feces buildup on lawn areas and in ponds.

## Fish

Numerous fish surveys have been conducted in the watersheds within the Olney study area since the beginning of this century. Montgomery County Department of Environmental Protection (DEP) assesses streams on a 5-year rotating basis and inventory fish, amphibian, and benthic macroinvertebrate species. A list of the fish species found in the upper Rock Creek, Northwest Branch, Hawlings River, and Upper Patuxent River watersheds, as reported in the *Countywide Stream Protection Strategy* (DEP, 1998) is presented in the Appendix (see Table A-2).

Although the North Branch of Rock Creek upstream of Muncaster Mill Road is designated Use III (Natural Trout Waters), trout are unlikely to be found in this stream. In the early 1990's brown trout were stocked in the North Branch immediately upstream of Muncaster Mill Road. These trout persisted for a few years, but showed no evidence of spawning. Low flows during dry years make this stream marginally suitable for trout at best, despite generally good water quality. Fish surveys in the summer of 2000 found 14 species of fish, including rosyside dace (*Clinostomus funduloides*) and Potomac sculpin (*Cottus giardi*) that are characteristic of high quality cool-water systems. Lake Frank, located just upstream of the confluence of the North Branch with the mainstem of Rock Creek, is managed by the Maryland Department of Natural Resources (DNR) as a recreational fishery, and has been stocked with largemouth bass (*Micropterus salmoides*), tiger muskies (*Esox lucius x masquinongy*), channel catfish (*Ictalurus punctatus*), and several species of panfish.

Northwest Branch is designated Use IV (Recreational Trout Waters), and is stocked by DNR every spring. The portion of Northwest Branch in the study area is well upstream of the stocking points, but trout could be expected to move into the study area on rare occasions. The study area includes the highest quality tributaries of Northwest Branch, where the fish community contains such relatively pollution-intolerant species as rosyside dace, northern hogsucker (*Hypentelium nigricans*), and fantail darter (*Etheostoma flabellare*).

The Hawlings River is designated Use IV, but is not regularly stocked with trout. Although some portions of the watershed have poor water quality, much of the watershed is in good condition, with a fish community that includes rosyside dace, northern hogsucker, shield darter (*Percina peltata*), and greenside darter (*Etheostoma blennoides*).

The portion of the Patuxent River in the study area includes the Triadelphia Reservoir and part of the Use III section of the river upstream of MD 97. Triadelphia Reservoir is owned and managed by the Washington Suburban Sanitary Commission, has been stocked with a variety of game fish, including walleye (*Stizostedion vitreum*), striped bass (*Morone saxatilis*), largemouth bass, smallmouth bass (*Micropterus dolomieu*), tiger muskie, and northern pike (*Esox lucius*). The Use III portion of the river is stocked by DNR with brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*); there is also a spawning population of brown trout upstream of the study area. Water quality is generally good to excellent in the upper Patuxent River, and the fish community includes rosyside dace, northern hogsuckers, and shield darters.

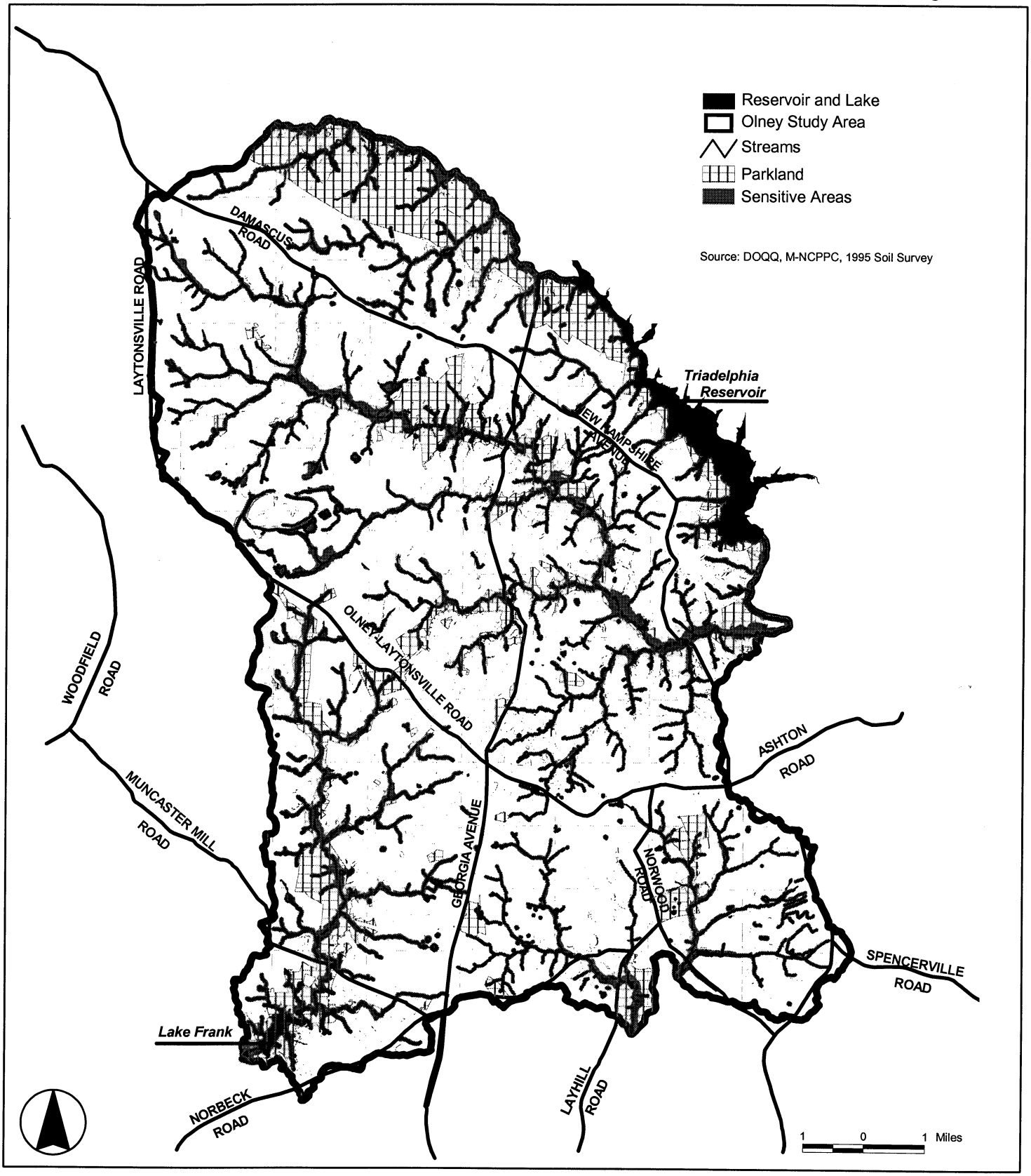
## Sensitive Areas

Sensitive areas are defined by the 1992 State Planning Act as streams and their buffers; the 100-year floodplain; steep slopes; and habitats of rare, threatened, and endangered species. For the purposes of this report, wetlands and wetland buffers are also considered sensitive areas and are included in the relevant maps and tables. Habitats of rare, threatened and endangered species are not mapped as part of sensitive areas because they are not comprehensively documented.

Sensitive areas are distributed across the watersheds of the Olney study area, and are generally contained within the stream valleys (see Figure 12). Sensitive areas cover roughly 8,850 acres extending over approximately 22 percent of the study area (see Table 9). Within the watersheds of the study area, sensitive area extends over approximately 21 percent of the North Branch of Rock Creek watershed area, 18 percent of the Northwest Branch watershed area, 22 percent of the Hawlings River watershed area, and 28 percent of the upper Patuxent watershed area. About 34 percent of all sensitive areas in the study area are contained within parkland. The majority of sensitive areas outside parkland consist of headwater stream buffers.

# Sensitive Areas

Figure 12



Chapter 2 provides a detailed definition of sensitive areas and associated policies under Sensitive Area Protection and Biodiversity. The Appendix provides a description of the components that make up the sensitive area coverage.

### Study Area Sensitive Area[1] by Watershed

**Table 9**

| Watershed | Sensitive Area | | |
|---|---|---|---|
| | Acres | Acres | % of Watershed |
| North Branch of Rock Creek | 8,014 | 1,683 | 21 |
| Hawlings River | 18,069 | 3,998 | 22 |
| Patuxent River | 7,011 | 1,983 | 28 |
| Northwest Branch | 6,502 | 1,180 | 18 |

(1) Geographic sum (overlay) of the following sensitive areas: wetlands and wetland buffers, floodplain, minimum buffers of streams identified in the M-NCPPC, GIS planimetric data, steep slopes and highly erodible soils. Stream buffers, wetlands, floodplain, stream buffer, and steep/erodible soils, overlap significantly (e.g., wetlands may be partially within floodplain areas). See the Appendix for a more detailed definition of sensitive areas.

### The 100-year Floodplain

The 100-year floodplain is defined as the land area adjacent to the streams and lakes that is susceptible to inundation by the 100-year flood as a result of heavy rainfall and runoff from upland areas. The 100-year floodplain is a component of the Sensitive Areas element required by the 1992 State Planning Act. The 100-year floodplain boundary is usually defined through engineering studies, field observations, soils surveys, and historical data.

Protection of the floodplain from development presents several advantages. The floodplain helps guard against injury and destruction of property by moderating and storing floodwaters. The floodplain also helps protect water quality and natural habitats by reducing erosion and sedimentation, and by providing a natural corridor for wildlife.

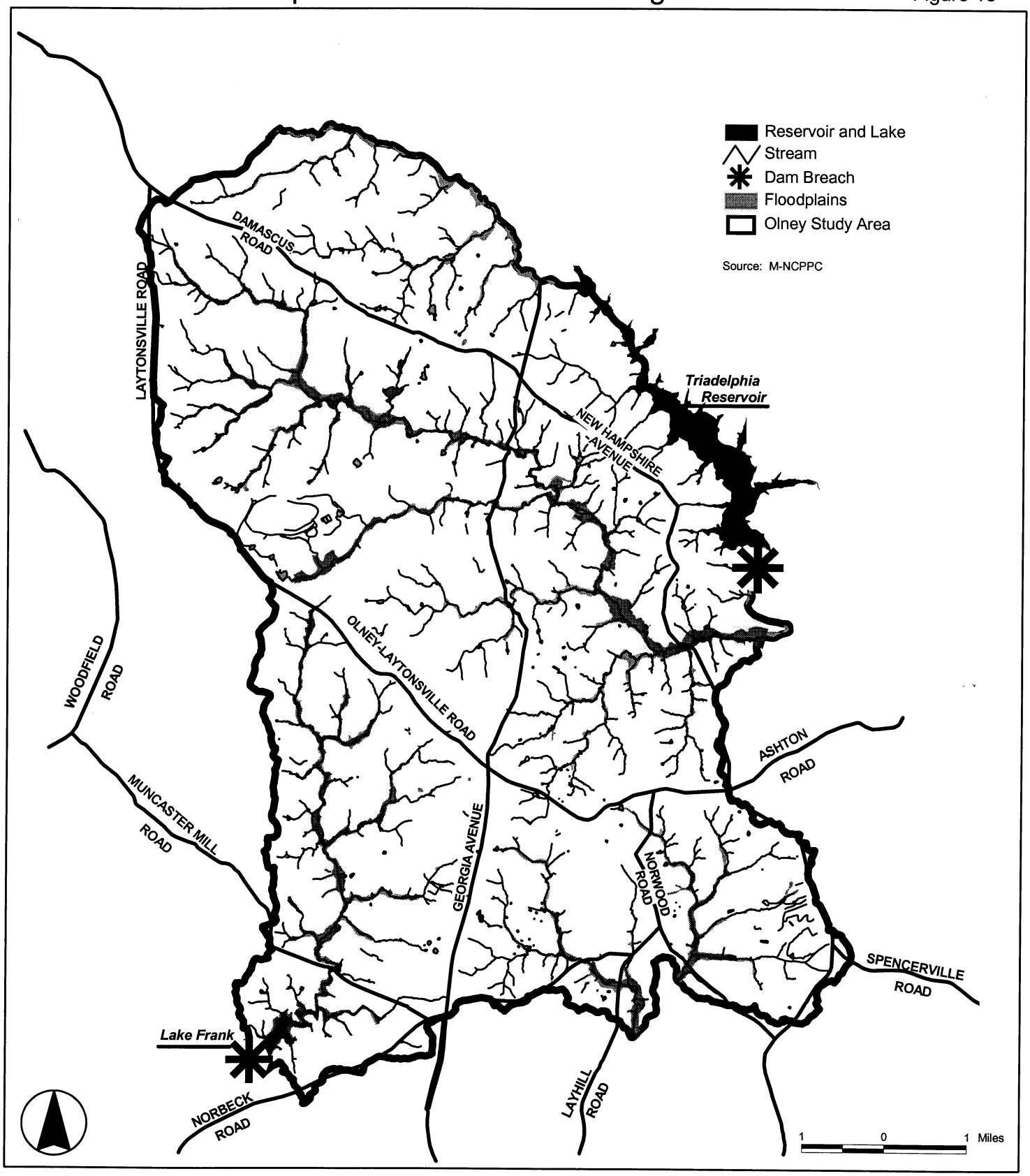
Much of the floodplain information available for the North Branch Rock Creek, Northwest Branch, and Hawlings River consists of the M-NCPPC ultimate land use 100-year floodplain maps. These maps were developed in the late 1970s, taking into account projected development densities based on zoning plans in effect at that time. While they may not satisfy current regulatory requirements, they remain the best available reference for planning purposes.

The floodplain maps are based on a detailed hydrologic study of larger tributaries. The 1995 revised Soil Survey in Montgomery County provides less detailed information on areas that are generally associated with floodplain. The survey provides supplemental floodplain information for areas not covered by the M-NCPPC detailed studies. Figure 13 depicts the floodplain mapping for the study area. The 100-year floodplain areas are contained mostly within parkland. The known or estimated 100-year floodplain outside parkland consists of areas associated with smaller headwater tributaries.

The Rock Creek Stormwater and Water Quality Management Study report (CH2Mhill, 1977) and the Anacostia Watershed Technical Study (CH2Mhill, 1982) included the only comprehensive floodplain analyses of Rock Creek and the Northwest Branch. They identified several roadway stream crossings in both watersheds that

# Floodplain and Dam Breach Danger Reach Area

Figure 13



were subject to frequent flooding. Since the time of these studies, structural improvements at the identified crossings have been completed, which has substantially reduced flooding frequency and problems.

The Patuxent Watershed Management Study (Greenhorne & O'Mara, 1990) included the only comprehensive floodplain analysis of the Hawlings River. It identified all the road crossings (a total of 30) in the Hawlings watershed as being flooded by the 100-year storm. The model predicted a depth of flooding on many of these roads of greater than 2 feet, which creates a hazard to vehicles and makes roads unsafe during the peak of the storm. The model also predicted that most of these roads are also flooded by the 10-year event, with some by the 2-year storm as well. The stream crossings in the Hawlings watershed are older bridges and culverts, which were not designed to pass the larger storm events. Since the time of the study, the county has made structural improvements to some of these bridges and culverts that have substantially reduced flooding frequency.

No county sponsored floodplain study has been conducted for the mainstem Patuxent River watershed. As a result, the floodplain information available on the upper Patuxent River consists of Federal Emergency Management Agency (FEMA) floodplain insurance maps. The FEMA maps for this watershed show that the 100-year floodplain is predominantly confined to the floodplain of the mainstem of the Patuxent, and does not extend significantly up the tributaries. Most of the area within the 100-year floodplain is forested, with minor areas in agriculture.

The Montgomery County Department of Public Works and Transportation (DPWT) maintains a list of roadway locations in Montgomery County that experience frequent flooding. According to the DPWT list, several locations within the study area flood too frequently and should be improved. These include:

- Emory Lane near Pinetree Lane in the North Branch of Rock Creek watershed
- Brighton Dam Road, Goldmine Road, Brookville Road, and Zion Road bridges in the Hawlings River watershed
- The stream crossing on Elton Farm Road across Haight's Branch in the Patuxent River watershed

## Air Quality

The entire Washington metropolitan region, which includes all Montgomery County exceeds the federal air quality standard for only one air pollutant, ground level ozone. Exposure to excessive ground-level ozone can pose health risks to vulnerable populations including children, the elderly, and people with respiratory ailments.

Ground-level ozone is an invisible gas formed when two pollutants -- volatile organic compounds (VOCs) and nitrogen oxides (NOx) -- react in sunlight. The primary sources of these pollutants are emissions from utilities and other industrial sources, automobiles, trucks, buses, lawnmowers, boats, and small businesses that use solvents and cleaning solutions. Other sources of these pollutants include household products such as non-latex paints, household cleaners, and insecticides.

On a typical summer day, over one third the pollutants that cause ground-level ozone in the Washington region come from sources outside the region. Some sources migrate from other states, hundreds of miles away. Likewise, sources in the Washington area emit pollutants that travel many miles and eventually affect ozone concentrations in other regions and states. From 1986 to 1995, the Washington metropolitan region exceeded the federal one-hour ozone standard, on average, twelve days a year. Since 1996, the Region exceeded the federal one-hour ozone standard, on average, six days a year. Today, the region faces the challenge of meeting stricter federal health standards for ground-level ozone. In 1997, the United States Environmental Protection Agency changed the averaging time from one-hour to eight-hours and reduced the standard downward to reflect the best current knowledge of the effects of ozone on human health.

Local carbon monoxide violations noted in the 1980 air quality plan have been virtually eliminated due to cleaner burning fuels.

## Noise

Excessive noise is an environmental health problem, which can interfere with sleep, disrupt speech, cause psychological stress and degrade the quality of life for an impacted community. The degree of annoyance and impact varies among individuals and by the type of noise.

Mobile sources of nuisance noise in the Olney planning area include traffic-generated noise along major roadways. General motor vehicle traffic volume is the most prevalent noise source due to the distribution of roads throughout the Olney planning area.

Noise is expressed in decibels (dB), a standard for units of sound, with "A" weighting (dBA) to account for the sensitivity of the human ear. Noise generated over a 24-hour period is measured as Ldn. Ldn is an average sound pressure level reflecting the variations in noise over time, including "dn", a weighting, or penalty, for nighttime noise. The Federal Highway Administration estimates background noise in typical urban neighborhoods to be approximately 55 Ldn. Humans experience increased levels of interference with sleep, speech and communication at a level greater than 55 Ldn.

The Noise Guidelines (M-NCPPC, June 1983) set attainable goals for all areas of the county. For the Olney planning area, an attainable goal of 55 to 60dBA Ldn has been selected given its low-density residential and rural character. This goal sets a maximum noise level for new residential development and noise-sensitive land uses, measured over a 24-hour period at the building line.

Noise contours of existing conditions for all major roads have been computer-generated using an approved Federal Highway Administration model (see Figure 14). The noise model does have limitations, as it does not account for the influence of existing noise barriers and natural land features, which act as noise barriers. The noise contours do not provide the level of accuracy needed to determine site-specific noise impacts.

A noise contour map can be used to identify where existing houses and other noise sensitive uses are currently impacted by excessive noise. The contours also identify vacant or redevelopable properties that may be affected should they develop or redevelop in the future. The master plan should use this information to:

- identify noise compatible land uses (industrial/commercial) in areas impacted by excessive noise;
- recommend site design criteria to minimize noise impacts; and
- recommend noise compatible uses for existing structures in noise affected areas.

## Solid Waste/Landfills

The Olney planning area has no fully operating landfills within its boundaries. The Oaks landfill, which is located near the intersection of MD 108 and Fieldcrest Road, was closed in October 1997 but still accepts solids collected from the pumping of stormwater management facilities. No other county solid waste facilities are planned in the upper Olney planning area.

Post-closure maintenance and monitoring of the Oaks landfill is required under state and federal regulations for a minimum of 30 years. Responsibilities include leachate and gas management, routine groundwater and gas monitoring wells, maintenance of stormwater management and erosion control systems, and grounds maintenance. These activities do not preclude public use for certain portions of the site. M-NCPPC, the community and the county celebrated the opening of the 1.25 mile Blue Mash Nature Trail in the buffer area of the site in June 2001.

## Water Supply and Sewerage Systems

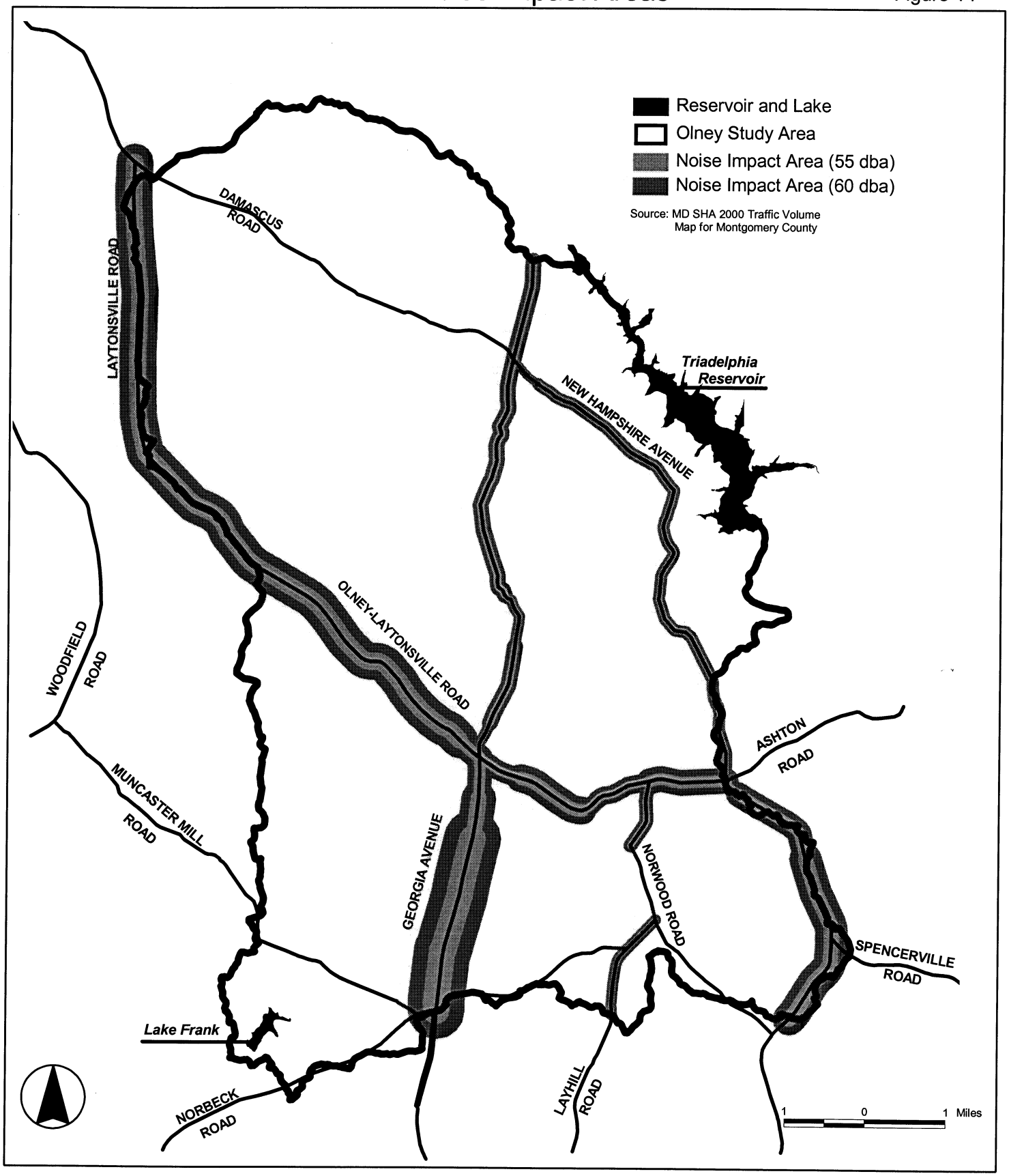
The community public water and sewer systems in the Olney Master Plan Area are operated and maintained by WSSC. The community service mains and other facilities were incrementally extended into this master plan area to serve the growth areas identified in the master plan under the policies of the *Water and Sewer Plan*. *Water and Sewer Plan* policies generally provide for community service to property zoned for one-half acre lots or more dense development, and for clustered lots in the one and two units per acre zones. The *Water and Sewer Plan* also allows for the provision of community water service only to areas zoned for one- to two-acre lots, and to clustered lots with a one unit per five-acre density. Although the 1980 master plan predates this *Water and Sewer Plan* water service policy, the County Council has acknowledged its appropriate application in this master plan area.

### Service Areas

The current water and sewer envelopes are shown in Figures 15 and 16. In Olney, community water and sewer are generally available to areas zoned for high and

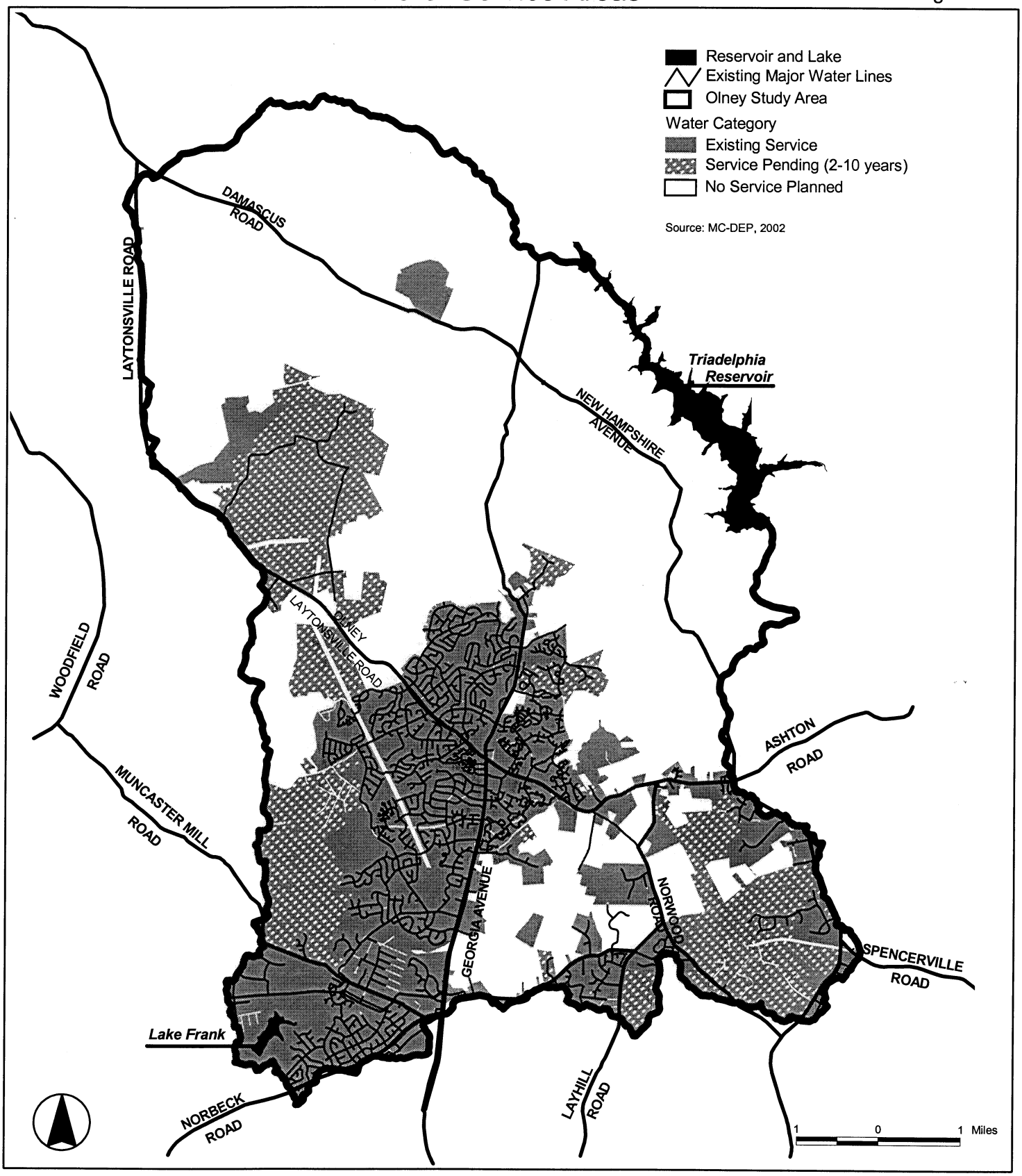
# Traffic Noise Impact Areas

Figure 14



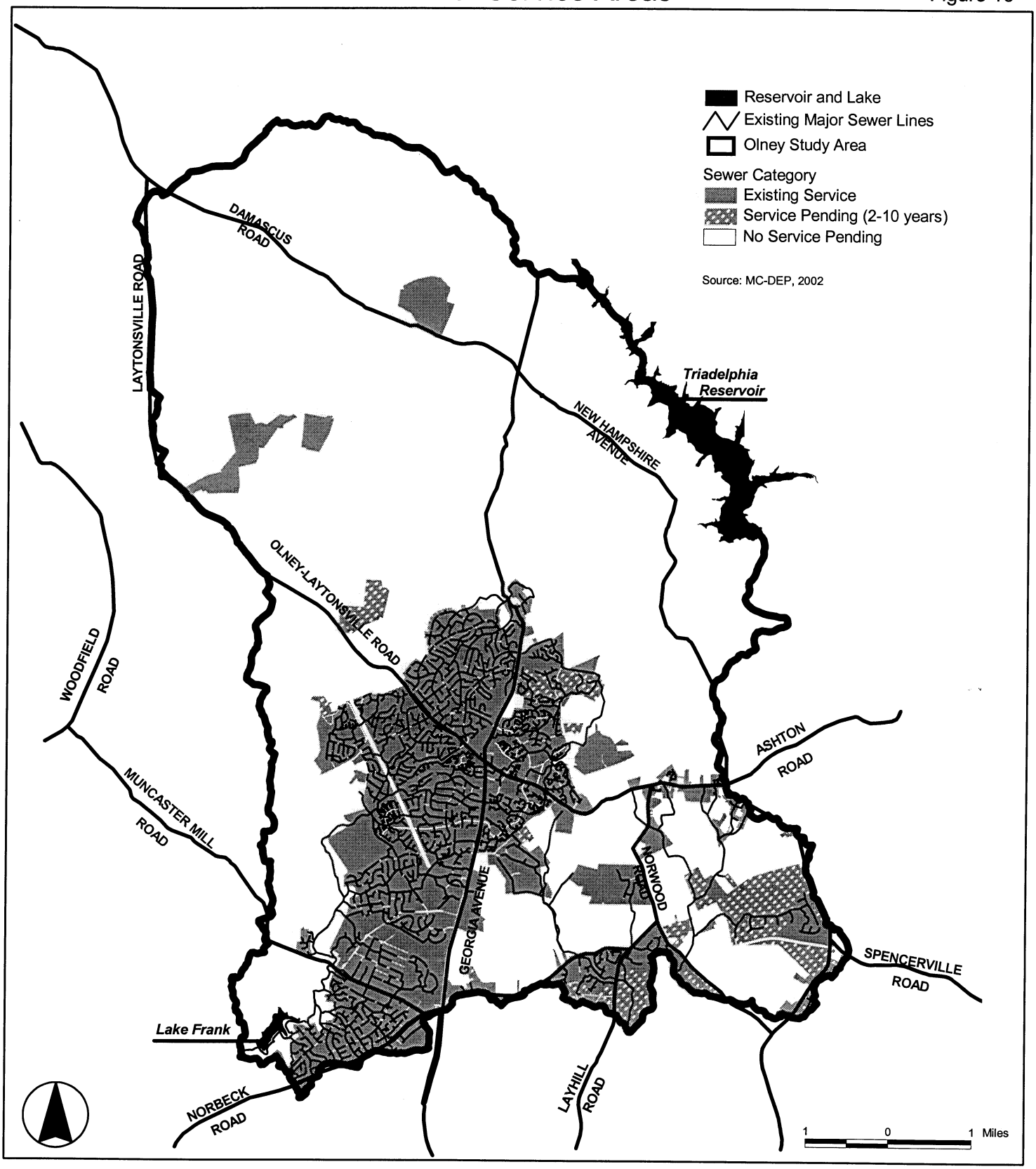
# Water Service Areas

Figure 15



# Sewer Service Areas

Figure 16



moderate density development, and to the commercial town center. Areas north of the Olney Policy area towards the Patuxent River (within Patuxent River drainage) are generally outside of planned expansion area for the water and sewer envelope. An exception to this general trend is in the vicinity of the county's Oaks Sanitary Landfill near Mount Zion. Under an agreement between the County and the local community, WSSC extended public water service to properties surrounding the landfill. The County has also approved and is planning for the provision of community water service to most of the Town of Laytonsville, which is located adjacent to the master plan area.

The 1980 master plan recommended an exception to the general *Water and Sewer Plan* policies with regard to the area referred to as Southeast Olney, an area east and south of Georgia Avenue, Old Baltimore Road, and Olney–Sandy Spring Road. There the master plan advocated providing community water and sewer service to those properties rezoned from one unit per two acres (RE-2) to Rural Cluster (RC) as part of the Olney sectional zoning map amendment, and which would use the RC zone cluster development option. In the mid-1990s, the County Council approved the use of a new, floating five-acre cluster zone, Low-Density Rural Cluster (LDRC), to accomplish a similar goal using local zoning map amendments. Only a few of these projects have been approved to date.

Properties located outside the existing/planned community water and sewer service envelopes are served by private, on-site wells and septic systems. MCDPS regulates and permits these on-site systems.

## Water Service

For areas receiving community water service, WSSC provides water primarily from the Potomac Water Treatment Plant, supplemented by water from the Patuxent Water Treatment Plant near Laurel. The Patuxent River and the Triadelphia Reservoir form the northeastern boundary of the master plan area. The reservoir is one of two along the river supplying the Patuxent Water Treatment Plant. A number of water storage facilities and pumping stations are located in the planning area to transmit water. WSSC has identified the need for additional water storage capacity in the Olney area. The agency has planned for a new ground-level storage tank, scheduled for completion in FY 2006, to meet that need. WSSC expects to locate the new tank, with a capacity of up 4.3 million gallons, on WSSC-owned property at Norbeck.

## Sewer Service

An important policy related to water quality is the provision of community sewer service. Providing community sewer service to relieve failed septic systems minimizes groundwater contamination. However, the provision of community sewer service can damage the environment by impairing water resources and facilitating development to the maximum zoned density, leading to increased imperviousness. Extensions along stream valleys can also create habitat disturbance, forest fragmentation, corridor creation for invasive exotic plant species entry- threatening native species survival, and general disruption to the natural hydrologic systems. Once sewer lines are in-place, their structural integrity may deteriorate over time, resulting in sewerage leaks and further ecosystem disturbance. This is particularly troublesome where eroding or shifting stream channels expose sewer mains and manholes, leaving them more susceptible to damage.

Unlike the water system, which operates under pressure, the vast majority of sewers in the planning area rely on gravity to transmit sewage flows, thus they are located in the stream valleys and other low areas. Rock Creek and the North Branch and Northwest Branch all have large trunk lines that convey flows from the planning area south to the District of Columbia's Blue Plains Sewage Treatment Plant. The District of Columbia has operated the wastewater treatment facilities at Blue Plains since 1938. The Olney Planning Area (PA23) falls within the Blue Plains Sewerage Service Area.

The Rock Creek trunk sewers serve the entire Rock Creek Basin, the most intensely developed basin in Montgomery County. The limited wastewater transmission capacity in the Rock Creek trunk sewers at the point where they enter the District of Columbia has been a major constraint in meeting the wastewater conveyance needs on the Rock Creek Basin since the early 1980s. The peak flow from Montgomery County through the Rock Creek Basin to the Blue Plains WWTP is limited to 56.6 mgd by the 1985 IMA.

An agreement between the District and the WSSC limits the amount of sewage that can be conveyed through the Rock Creek sewer main within the District of Columbia. Flow meters located at the point where the Rock Creek sewer enters the District, indicate that the WSSC has reached the limits outlined in the inter-municipal agreement. The WSSC is currently studying alternatives that will allow it to expand within peak flow capacity limitations in the Rock Creek sewerage system, as established by an agreement with the District of Columbia. The WSSC has also identified segments of the North Branch trunk sewer that will reach capacity in the next 20 years. Under current forecasts, portions of the sewer upstream of the confluence with the Rock Creek trunk sewer and downstream of Muncaster Mill Road may need relief in the 10 to 20 year time frame. While the anticipated relief measures for these constraints may not directly affect the Olney and Vicinity Planning Area, growth within the Rock Creek sewerage basin in the master plan area will affect these capacity limitations in the future.

Not all the areas approved or planned for community sewer service have access to gravity sewerage systems; these areas are served by wastewater pumping stations and force mains. The Reddy Branch and James Creek stations pump sewage flows from within the Hawlings River watershed into the North Branch of Rock Creek and Northwest Branch sewerage systems, respectively. The North Branch station pumps sewage flows from the TDR-receiving area north of Bowie Mill Road into a trunk main further downstream in the subwatershed. This pump-around avoided the need for trunk sewer construction through a portion of the North Branch Stream Valley Park. There are no community sewerage systems existing or planned for the Upper Patuxent River watershed.

## Tributary Watersheds of Olney and Vicinity

The major streams of the Olney study area include the North Branch of Rock Creek and its tributaries, the headwater tributaries of Northwest Branch, Hawlings River and its tributaries, and a portion of the Patuxent River and its tributaries[5]. The watershed character and stream water quality of each of these streams is discussed in this section. Watershed management strategies for each stream is also covered.

The discussion of stream water quality covers both historical data and current conditions. The historical data is presented largely from Montgomery County Department of Environmental Protection (MCDEP) stream water quality monitoring at numerous stations throughout the county conducted during the 1970's. This monitoring included several stations within the study area. Parameters analyzed included DO, pH, temperature, BOD, nitrite-nitrate nitrogen, total phosphorus, mean turbidity, and fecal coliform. Monitoring results have been published each year presenting annual parameter averages for each station.

Current conditions of each watershed are summarized from both county and state sources. Current conditions of the natural stream waters in the study area are summarized in the *County-wide Stream Protection Strategy* (CSPS) document (MCDEP, 1998). The CSPS is based on a biological monitoring program (1994-1996 data) that assesses all county streams according to the same methodology. The CSPS ranks biological stream conditions as excellent, good, fair, or poor. The results of the CSPS monitoring have been presented in this inventory with update added when more recent information was available. More detailed presentation of these results may also be found in separate MCDEP assessments that have been done for the watersheds in the study area. These assessments also include monitoring data for DO, pH, air and water temperature, TDS, and conductivity.

The Maryland Department of Natural Resources (DNR), through the Maryland Biological Stream Survey (MBSS) program, conducts biological sampling of streams throughout Maryland. The MBSS program uses a score ranking scale of good, fair, poor, or very poor.

Maryland's water quality standards are described in Maryland regulations. (COMAR § 26.08.01 General, which contains definition of terms, and COMAR § 26.08.02- Water Quality, which describes the uses, criteria and policies). Under section 303(d) of the federal Clean Water Act, the state of Maryland is required to prepare a list of all water bodies in which applicable water quality standards are not being met through the use of required controls, as set forth in the Code of Federal Regulations, 40 C.F.R. 130.7(b)(1)(i, iii). Also, under section 305(b) of the Clean Water Act the state is required to prepare a water quality report that includes an inventory of Maryland's waters and an update on the progress made toward meeting the goals of the federal Clean Water Act. The Maryland 305(b) report identifies water pollution problems and sources, describes water quality control programs, and highlights special state concerns. The 303(d) list and 305(b) report are updated and submitted to the US Environmental Protection Agency (EPA) every two years.

Watershed management strategies are also summarized from both county and state sources. Based on the assessments and projections of potential development (with existing zoning), the CSPS assigns a management category for each subwatershed in the study area, and identifies a set of management tools to address the stream conditions and anticipated levels of development. The management categories and tools provide a basis for prioritizing resources to address stream quality problems using a focused, watershed approach. The Appendix in this report contains a detailed

[5] The Northwest Branch is a major tributary of the Anacostia River system. Its watershed covers 53.2 square miles (34,048 acres), of which 19,603 acres lie in Montgomery County. Rock Creek drains 77.4 square miles (49,536 acres), flowing into the Potomac River; about 60.6 square miles (38784 acres) of its watershed lies within Montgomery County. Great Seneca Creek also flows into the Potomac River; its watershed lies entirely within the county and covers 75 square miles (47,791 acres). The Patuxent River, the largest river entirely contained within the state of Maryland, drains 910 square miles (582,000 acres) of land, of which 60.2 square miles (38,550 acres) lie in Montgomery County. Of the 60.2 square miles of the Patuxent River watershed in the county, 28.2 square miles (18,069 acres) make up the watershed of the Hawlings River, a major tributary of the Patuxent River.

description of the management categories from the CSPS.

The Maryland Clean Water Action Plan identifies several watersheds in Montgomery County that need restoration and deserve priority consideration. The Maryland Unified Watershed Assessment (UWA) under the 1998 Clean Water Action Plan (see Chapter 2 of this report) categorizes watersheds based upon consideration of components of the watershed related to aquatic systems including; biological, physical, and chemical characteristics, and related landscape factors. Category 1 watersheds are those found to not meet clean water and other natural resource goals, and to be in need of restoration.

Watersheds may also be designated as watershed restoration priorities under the Maryland Clean Water Action Plan. The schedule of restoration and protection actions must be coordinated with the state's schedule to determine Total Maximum Daily Loads (TMDLs) for pollutants from watersheds.

## North Branch of Rock Creek

### Watershed Character

The North Branch of Rock Creek watershed consists of roughly half of the upper Rock Creek basin, and about one quarter of the entire Rock Creek drainage area in Montgomery County. It includes approximately 48 miles of streams that drain 12.5 square miles (8,014 acres) of land upstream of Norbeck Road/MD 28 east of Georgia Avenue and south of Route 108 in central Montgomery County. Most of the stream is designated as Use III, with a relatively small portion south of Muncaster Mill Road designated as Use IV.

The North Branch of Rock Creek originates in Mount Zion Park, between Olney and Laytonsville. From there it flows south to its confluence with the mainstem Rock Creek north of Norbeck Road, which continues south before ultimately discharging in the Potomac River. Floodplain areas are largely undeveloped parklands. Wetlands are often present within the floodplain and may extend beyond floodplain boundaries.

The upper reaches of the North Branch are the most rural of the streams in the watershed. The rolling landscape is dominated by farm fields and forested areas punctuated by large-lot development. Imperviousness in this portion of the watershed ranges from 4 to 6 percent (MCDEP, 1998, see Figure 17).

Between Bowie Mill Road and Muncaster Mill Road, low to medium density residential development predominates, with some areas of large-lot development. The stream valley, thus far, is in succession from farm fields to young forests. The imperviousness of the basins which drain directly to the mainstem range from 3 to 7 percent, but the larger tributaries to this segment of the drainage basin have considerably higher percentages of imperviousness. Cherrywood Manor and Williamsburg Run drain subwatershed areas with imperviousness ranging between 14 and 19 percent (MCDEP, 1998).

The stream reaches between Muncaster Mill Road and Norbeck Road/MD 28, accommodate the confluence of another large tributary, Manor Run. This region of the watershed contains Lake Frank. Downstream of the lake, North Branch joins the mainstem that flows south to Norbeck Road thereby entering the lower Rock Creek watershed. The land surrounding the lake and the North Branch is mostly undeveloped parkland with low imperviousness (MCDEP, 1998).

### Stream Water Quality

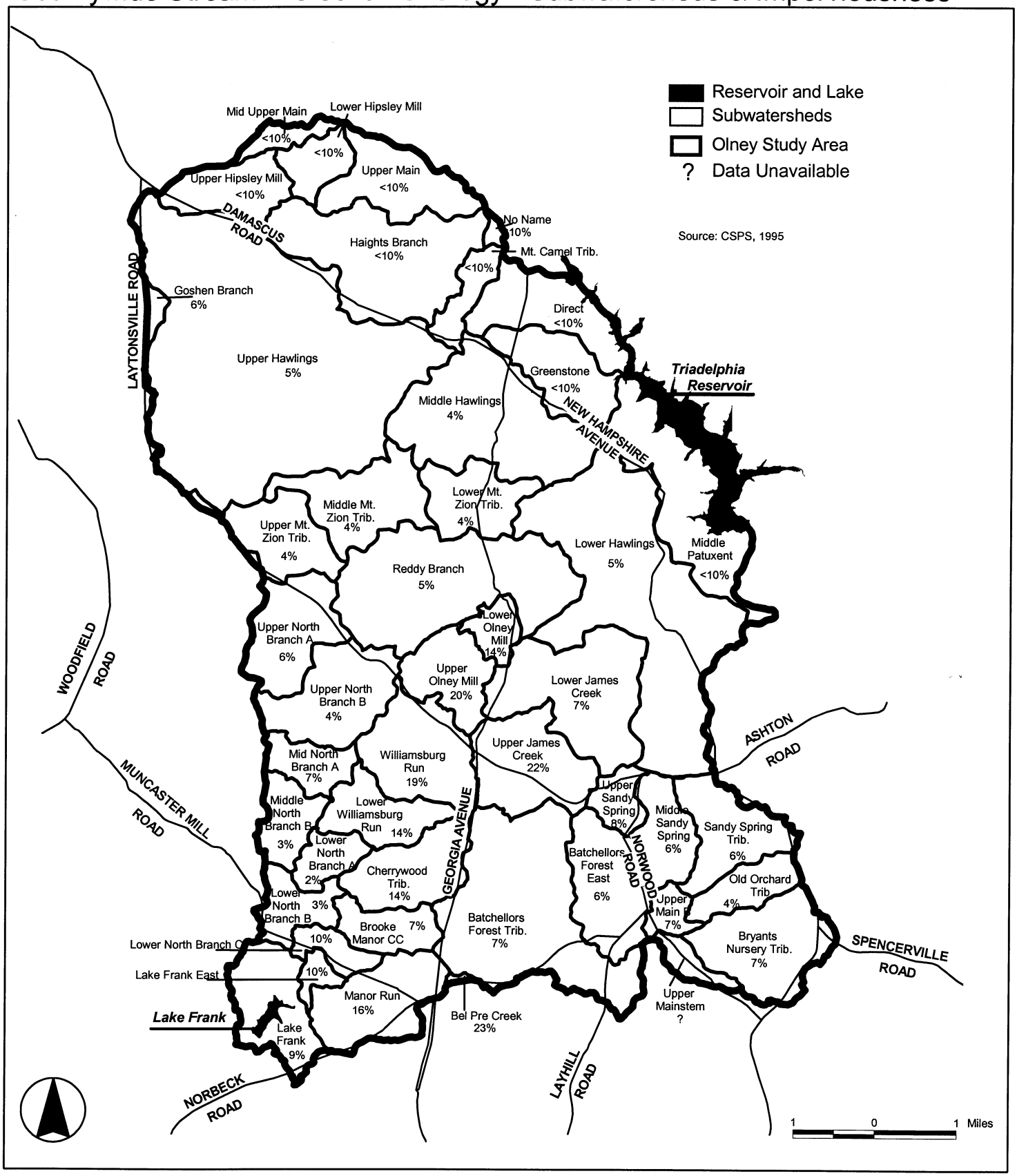
Historical Data

In 1962, a work plan for the upper Rock Creek (Montgomery County, 1962) addressed generalized water quality issues as they pertained to increased erosion and sediment damage. This work plan led to the construction of two sediment and flood control lakes: Lake Needwood on the mainstem Rock Creek, and Lake Bernard Frank on the North Branch.

In 1977, a water quality management study (CH2MHill, 1977) presented an overview of water quality conditions in the upper Rock Creek subwatershed. The North Branch Rock Creek was characterized as "Medium" to "Low" problem severity (CH2M Hill, 1977). The following three water quality criteria failed occasionally (<25 percent of the time): turbidity, fecal coliform, and temperature.

Figure 17

# Countywide Stream Protection Strategy - Subwatersheds & Imperviousness



The Montgomery County DEP stream monitoring conducted in the 1970's in the study area included two stations on the North Branch of Rock Creek. Water quality was generally found to be in the permissible category. In 1981, DEP determined that water quality in the North Branch had improved from permissible to good. Water quality improvements were attributed to decreases in turbidity, BOD (biochemical oxygen demand), and fecal coliform levels (MCDEP, 1981).

Between 1991 and 1993, the Maryland Department of the Environment's bioassessment of upper Rock Creek indicated an apparent water quality impact. Unimpaired habitat conditions were observed, but the biological community was moderately or severely impaired. Increased levels of nutrient and sediment flow into Lake Frank had caused eutrophic water conditions. The water quality problems in the lakes were a result of urban land use patterns and developing areas (MDE 1994, p. 211).

In 1996, a Rapid Stream Assessment Technique (RSAT) survey rated the stream condition of the North Branch and individual tributaries (Galli, 1996). Most mainstem reaches were rated good for overall stream condition (see Figure 18) and excellent for biological indicators. This was interpreted as evidence of slight levels of degradation. The major tributaries were also mostly in the good and excellent range for overall rating and biological indicators respectively. However, two of the tributaries, Williamsburg Run and Manor Run received an overall rating of fair, indicating moderate degradation. These subwatersheds are among the most heavily developed in the North Branch watershed. Measurements of physical and chemical parameters were generally consistent with the state of Maryland stream water Use III and Use IV designations.

Current Conditions

Countywide Stream Protection Strategy

According to the CSPS, the stream condition in the North Branch of Rock Creek watershed ranges from excellent to poor (see Figure 19). Brown trout still survive in some portions of Rock Creek, but almost certainly not in the North Branch. Most of the mainstem subwatersheds exhibit good or excellent biological conditions, with Williamsburg Run, Brooke Manor Country Club tributary and one mainstem subwatershed showing fair conditions. Poor stream biological conditions were reported in Manor Run where higher density developments were built with little or no stormwater management controls.

Maryland Biological Stream Survey

Two sites were sampled in the North Branch of Rock Creek in 1997. The benthic scores for that year reflect fair conditions, and the fish scores indicate good conditions. The physical habitat index for both sites was in the fair range.

Maryland 303 (d) List and 305 (b) Report

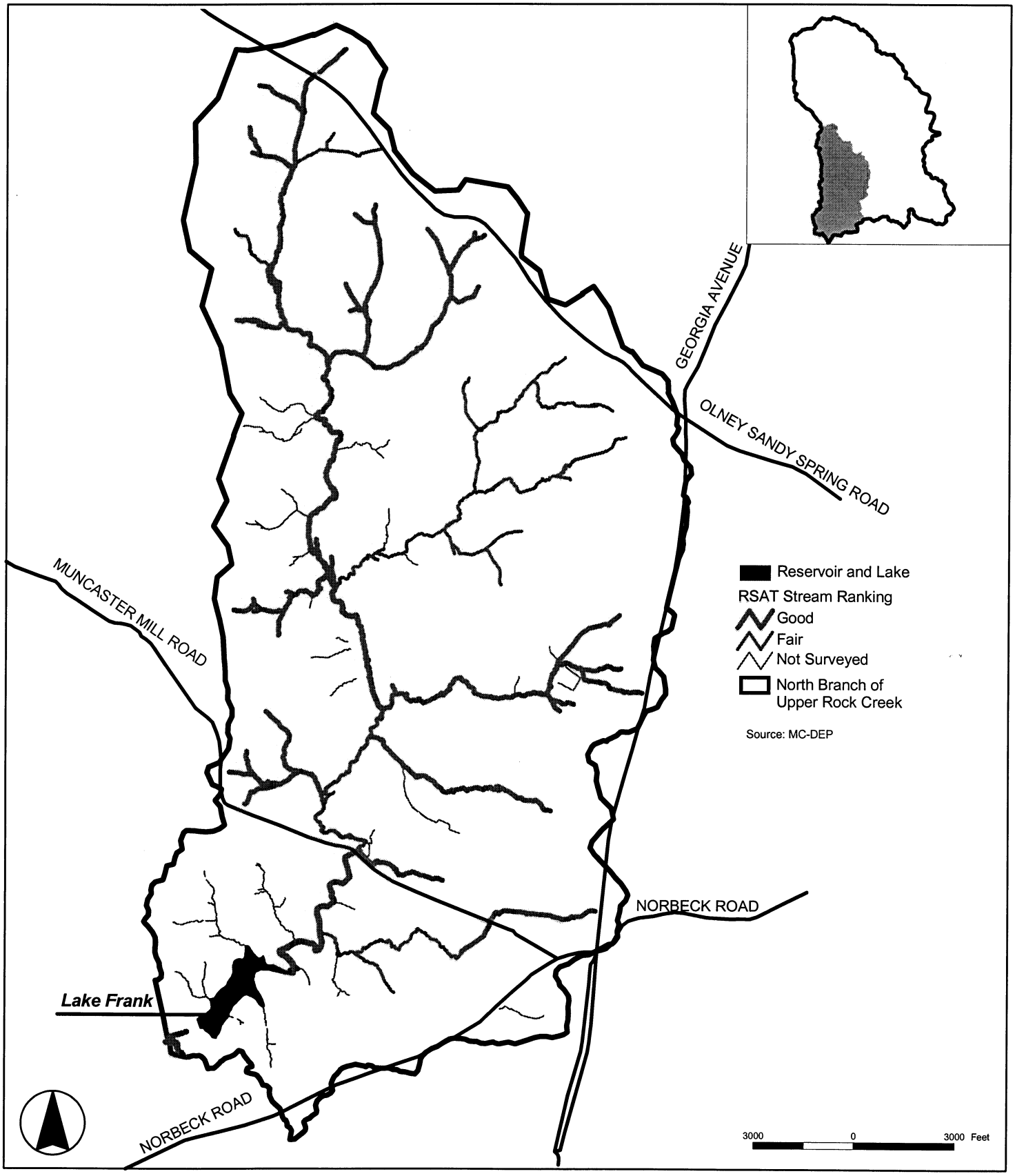
Rock Creek is identified in the 1996 DNR 303(d) list as not meeting applicable water quality standards through the use of required controls. Identified sources of pollution are nutrients and suspended sediments originating from non-point and natural sources. Nutrient impairment of Rock Creek in the 303(d) list is based on the inclusion of Rock Creek in the Chesapeake Tributary Strategies and does not necessarily indicate a localized nutrient impairment. A 1998 update to the 303(d) list added Lake Bernard Frank to the list of water bodies impaired by nutrient pollution from non-point sources.

The 1996 DNR 305(b) report indicates that water quality in the Rock Creek watershed varies from good in the headwaters (upper Rock Creek) to fair in the lower portion (lower Rock Creek). High bacteria, nutrient (phosphorus) and suspended sediment levels are due to agricultural runoff in the upper areas, and to suburban development and urban runoff. Some unimpaired habitat conditions were observed, but the biological communities were moderately to severely impaired. Lake Frank is classified as eutrophic due to nutrients and sediments from upstream areas (DNR 1996).

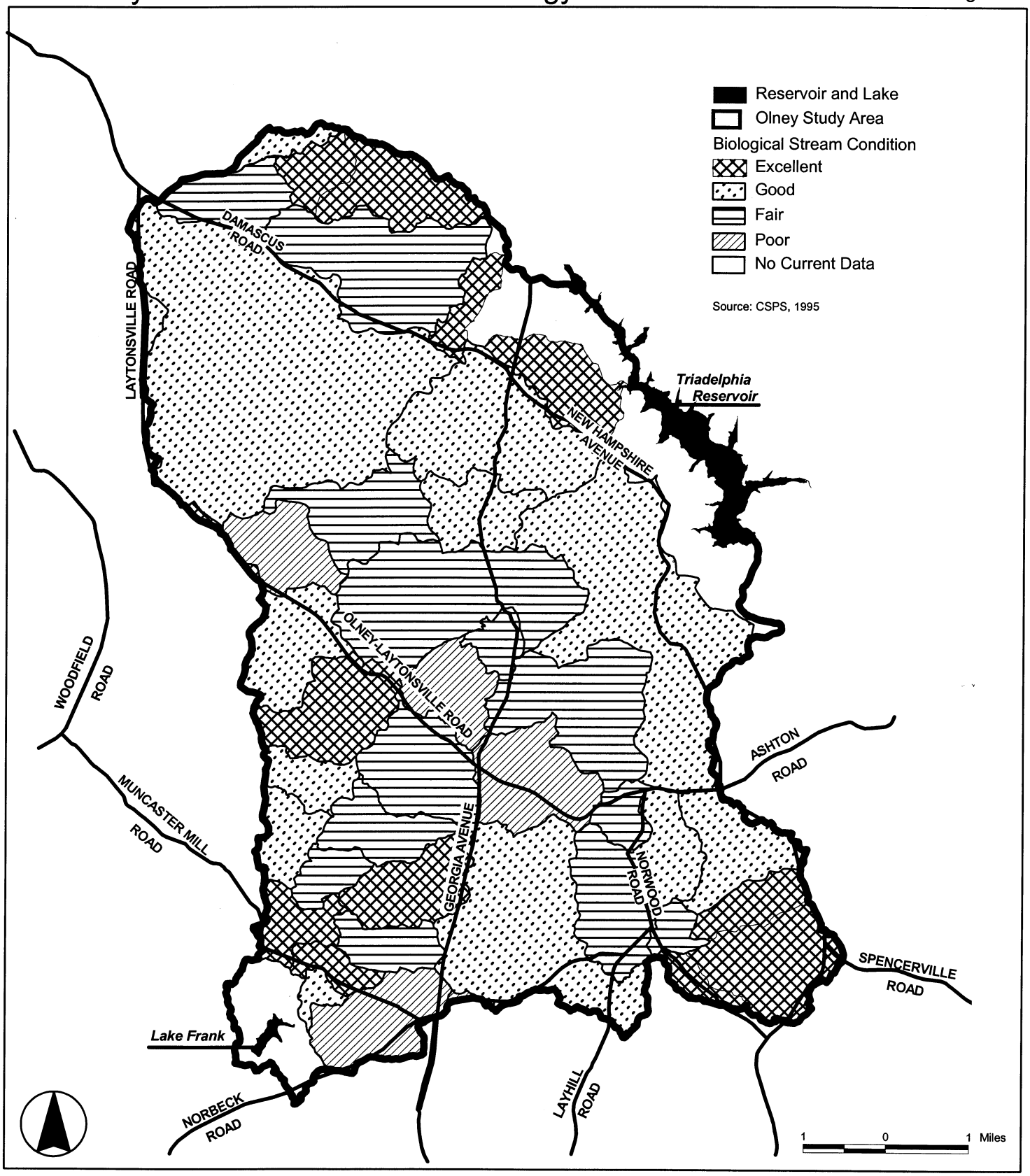
The 1998 DNR 305(b) report indicated that water quality criteria were not recently exceeded, and that no use impairments were noted at the state's water quality monitoring stations in the Potomac-Washington Metropolitan Area Sub-basin that includes the Rock Creek watershed. This finding is based on data from seven ambient water quality monitoring stations in the Washington Metropolitan Area, including a single station on Rock Creek near East-West Highway. The report also indicates that Lake Frank is listed as partially supporting aquatic life. The lake experiences seasonally low oxygen levels in the deeper portions as a result of accelerated

# Upper Rock Creek - North Branch Rapid Stream Assessment

Figure 18



# Countywide Stream Protection Strategy - Subwatershed Condition Figure 19



eutrophication due to nutrients from unspecified non-point source runoff (DNR, 1998).

Originally built to control flooding and trap eroded sediments from upstream, Lake Frank has become important as a recreational facility and wildlife habitat. In order to preserve these uses, a watershed management plan would be desirable to help reduce and mitigate the impacts of excessive sedimentation and nutrient enrichment.

### Watershed Management

Maryland Clean Water Action Plan

The entire Rock Creek watershed is in Category 1 of the Maryland Unified Watershed Assessment (UWA). Rock Creek is also designated a priority watershed being most in need of restoration. In addition, Rock Creek is listed as a Category 3 (Preservation) watershed having at least some stream in pristine or high quality conditions. Thus, the watershed shows signs of stress and degradation but still contains pristine or sensitive habitat resources.

Countywide Stream Protection Strategy

The CSPS divides the North Branch of Rock Creek watershed into 13 subwatersheds. Except for Lower North Branch B, all subwatersheds are designated as either restoration or protection areas. Restoration areas consist primarily of densely developed areas, while protection areas are mostly rural or low density (see Figure 20). The CSPS also identifies six priority subwatersheds, representing about one half the entire North Branch of Rock Creek watershed area. They include four special level Watershed Protection Areas in the north central portion of the watershed. The special level designation reflects the need to protect sensitive resources in headwater areas where projected increases in imperviousness are high.

Rock Creek Watershed Restoration Action Plan

MCDEP has recently completed a major component of the Rock Creek restoration action plan with publication of their Rock Creek Watershed Feasibility Study (DEP, 2001) covering the entire Rock Creek basin within Montgomery County. The study identified, prioritized, and designed stormwater management and stream restoration projects. The life expectancy of Lakes Needwood and Frank were also evaluated in terms of maintaining water quality and quantity benefits for Rock Creek.

Twenty proposed priority sites were evaluated with respect to their locations in the twenty priority subwatersheds and within the entire Rock Creek watershed. Of these, ten top priority sites were selected for preliminary concept design. Two sites in the North Branch watershed, one in Williamsburg Run and the other in the Cherrywood Tributary, are among the top twenty projects. One of these, the Olney Oaks project in Williamsburg Run, was ranked among the top priority sites. A section of the lower North Branch, in the Lower North Branch B and C subwatersheds was identified as a proposed stream restoration project. See Figure 21 for location of the priority retrofit and stream restoration projects.

Based on sediment volume and yield values, Lake Frank was estimated to have a life expectancy from about 105 to 245 years from present. In addition, Lake Frank was found to have a high sediment trapping efficiency, with significant sediment reduction value for the waters downstream of the lake. Although the location of the lake outlet structure will ensure good flood control benefits even if the lake becomes filled with sediment, the recreational benefits would, of course, be lost. Eventually, dredging or the creation and maintenance of a forebay will be required to retain the recreational function of the lake (MCDEP, 2001).

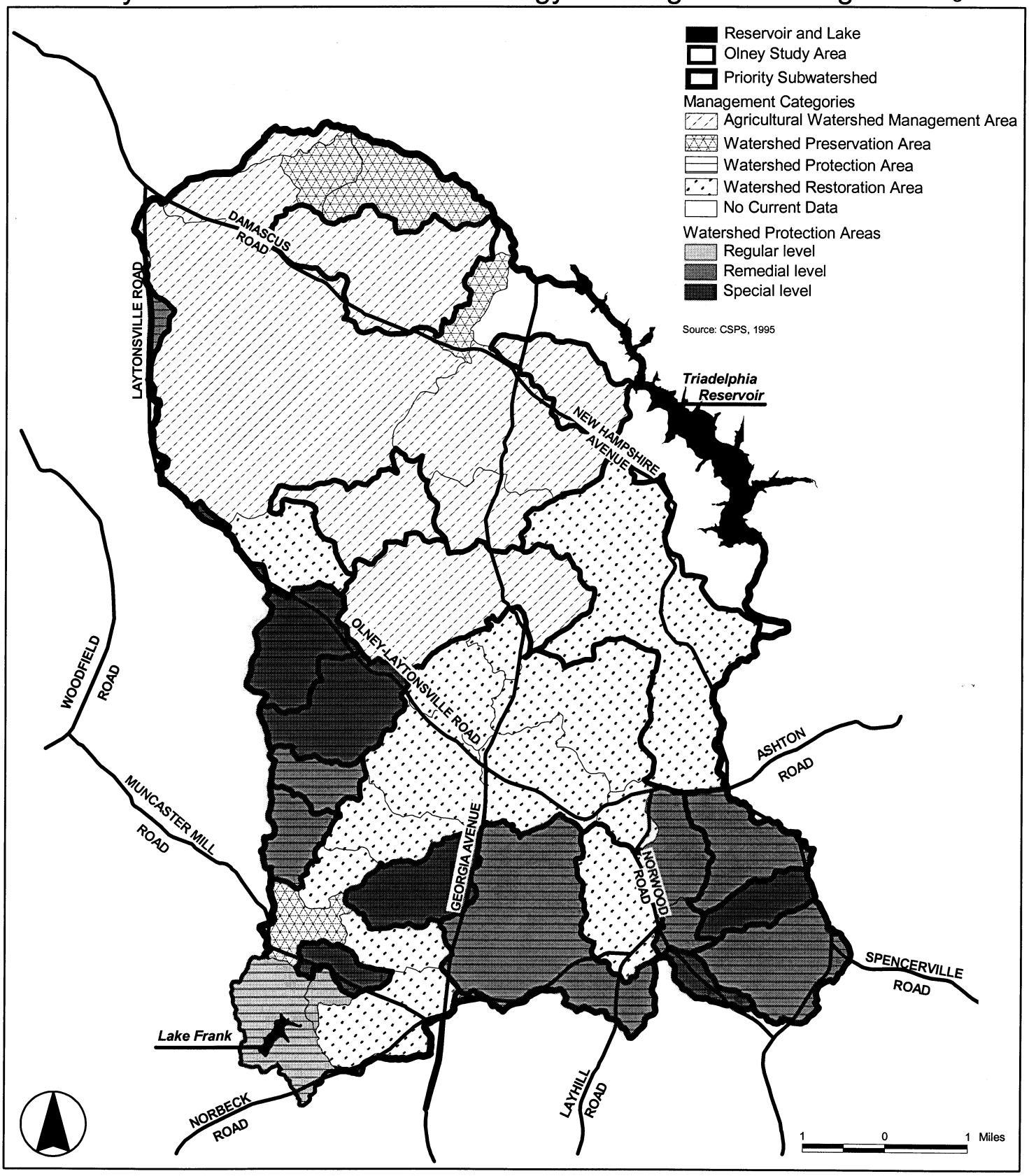
## Northwest Branch

### Watershed Character

The Northwest Branch, a Use IV stream located in the eastern part of the county, is the largest of the county's four contributing watersheds to the Anacostia River. Land uses differ greatly from the headwaters downstream to where the Northwest Branch flows into Prince George's County. Different development patterns have shaped the watershed, affecting the stream system to different degrees. Tributaries in the upper part of the watershed, particularly the headwaters, support the few remaining streams with excellent and good conditions in the Northwest Branch watershed (MCDEP, 1998)

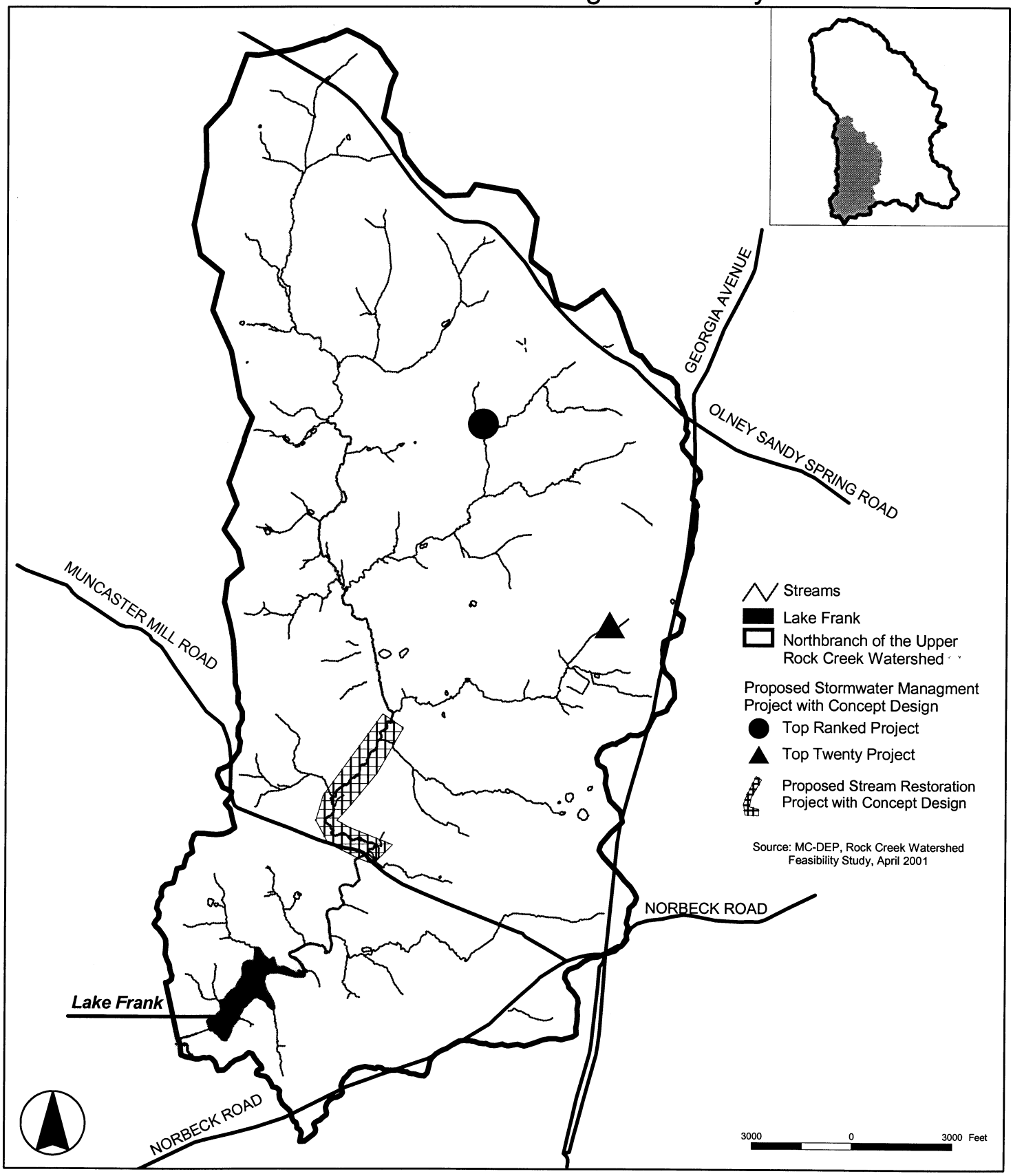
The Olney master plan area encompasses only the

# Countywide Stream Protection Strategy - Management Categories Figure 20



# Upper Rock Creek - North Branch Priority Stream Restoration and Stormwater Managment Facility Retrofits

Figure 21



uppermost reaches of the Northwest Branch watershed, mostly those north of Layhill Road and Norwood Road. Consequently, only the headwater subwatersheds are covered in this inventory (see Figure 2). This area includes approximately 40 miles of stream that drain 10.1 square miles (6,502 acres) of land.

Land use in these subwatersheds is dominated by low-density uses including forest, pasture, and open space. Nevertheless, some areas such as Bryant's Nursery tributary have seen an increase in residential development. Imperviousness levels are fairly low, especially compared with the rest of the watershed, and in 1997 ranged from 4 percent to 8 percent (Figure 17).

In the upper reaches, then, the landscape is in a transition from formerly widespread agricultural land uses to a more suburban landscape. The streams in this area are also in a transition, from carrying sediment loads and nutrients associated with past farming activities, to a watershed condition that includes less widespread land disturbance, but higher imperviousness. As this area develops and the imperviousness increases, today's environmental standards will provide forested buffers, floodplain and wetland protection, and management of stormwater runoff. However, even with application of modern stormwater controls, some changes in watershed hydrology are inevitable (MCDEP, 1998).

## Stream Water Quality

Historical Data

MCDEP's monitoring from the early 1970's to 1981 included two stations in upper Northwest Branch. During the period of record, upper Northwest Branch received a rating of permissible water quality.

The Anacostia Technical Watershed Study, prepared in 1982 by CH2Mhill, summarized water quality conditions in the Northwest Branch watershed, and used the MCDEP water quality data to calibrate the Hydrologic Simulation Program Fortran (HSPF) water quality model. The data as of 1981 indicate that water quality criteria for temperature and dissolved oxygen were seldom or never exceeded, a typical occurrence in well shaded streams with adequate aeration. Limited data on turbidity indicated that elevated turbidity values occasionally occurred in Northwest Branch, usually associated with high flows. The data also indicate that pH was not a serious problem throughout the Northwest Branch watershed. However, a large majority of fecal coliform measurements made in the Northwest Branch including the headwaters exceeded the state standard. Possible sources of bacteria include leaking or overflowing sewers or urban stormwater runoff. In the upper, less developed areas of the watershed, runoff from pastures may also be a significant source of coliform loadings.

Current Conditions

Countywide Stream Protection Strategy

Nine subwatersheds in the Northwest Branch fall within the study area for the Olney Master Plan. According to the CSPS, the stream conditions in these Northwest Branch headwater subwatersheds range from fair to excellent (see Figure 19). Bryants Nursery tributary, Old Orchard tributary, and Upper Mainstem reflect excellent biological conditions. Batchellors Forest tributary, Middle Sandy Spring, and Sandy Spring tributary are in good condition. Three subwatersheds including Upper Sandy Spring, Batchellors Forest East, and upper Mainstem B show fair stream conditions. Most of the upper reaches are in good or excellent condition reflecting more forest area, open space, and the lower imperviousness percentages associated with a relatively low level of development compared with the rest of the watershed.

Maryland Biological Stream Survey

DNR reported 1997 MBSS biological and habitat data for 2 stations in the upper Northwest Branch – one in Batchelor's Forest East and one just downstream of the Upper Mainstem subwatershed. The data for these stations indicate fair conditions based on benthic, fish, and habitat scores, except for the site near the Upper Mainstem subwatershed that showed good conditions based on fish data.

Maryland 303(d) List and 305(b) Report

The Anacostia River (of which Northwest Branch is a part) is one of a number of low priority streams identified in the 1996 DNR 303(d) List. Identified pollutants are nutrients and suspended sediments originating from non-point and natural sources. Watersheds are assigned to low priority status when the state believes the impairments may be corrected through the implementation of the high priority Tributary Strategies or

through other routine regulatory and voluntary programs currently underway. Low priority also reflects the fact that the information supporting the listing may not be reliable and that the impairment may be very localized within the segment.

The 1998 DNR 305(b) report indicated that water quality criteria were not recently exceeded, and that no use impairments were noted at the state's water quality monitoring stations in the Potomac-Washington Metropolitan Area Sub-basin that includes the Northwest Branch watershed. This finding was based on data from seven ambient water quality monitoring stations including a single station on the mainstem Anacostia River at Bladensburg far downstream of the study area. However, the 1996 305(b) report noted elevated bacteria levels at this station. These elevated levels are due to urban and upstream agricultural runoff.

### Watershed Management

Maryland Clean Water Action Plan

The Anacostia River watershed is in Category 1 of the Maryland Unified Watershed Assessment (UWA) under the 1998 Clean Water Action Plan, being found not to meet clean water and other natural resource goals, and being in need of restoration. The Anacostia River is also designated a priority watershed most in need of restoration. In addition, the Anacostia River is listed as a Category 3 (Preservation) watershed considered to have at least some stream in pristine or high quality condition. Thus, the watershed shows signs of stress and degradation in some sections, but still contain pristine or sensitive habitat resources.

Countywide Stream Protection Strategy

Of the nine Northwest Branch CSPS subwatersheds that are part of the study area for this inventory, six, including Batchellors Forest Tributary, Middle Sandy Spring, Sandy Spring Tributary, Old Orchard Tributary, Upper Mainstem, and Bryants Nursery Tributary are identified as Watershed Protection Areas. The three remaining watersheds: Batchellors Forest East, Upper Sandy Spring, and Upper Main B are designated as Watershed Restoration Areas (see Figure 20). Restoration areas consist primarily of densely developed areas, while protection areas are mostly rural or low density. In addition, with the exception of Batchellors Forest East, Upper Sandy Spring, and Upper Main B, the CSPS identifies all the study area subwatersheds as being priority subwatersheds. The priority level designation reflects the need to protect sensitive resources, especially in headwater areas.

## Hawlings River

### Watershed Character

The Hawlings River, a Use IV stream located in the northeastern part of the county, originates near Etchison, just below the intersection of Routes 108 and 650. It includes approximately 129 miles of streams that drain 28.1 square miles (18,069 acres) of land upstream of its confluence with the Patuxent River, between the Triadelphia and Rocky Gorge (T.Howard Duckett) reservoirs. As a major tributary to the Patuxent, the Hawlings plays an important role in the overall efforts to reduce nutrient and sediment loadings to this river, and in particular, to the Rocky Gorge reservoir, a public drinking water supply downstream (MCDEP, 1998).

Much of the Hawlings River watershed, particularly above the Reddy Branch tributary, is agricultural land, parkland, and newer large lot residential areas. Subwatershed imperviousness ranges from 4 to 7 percent, averaging about 5 percent (see Figure 17). A relatively small portion of the watershed, about 10%, in the Olney Mill and Upper James Creek subwatersheds has a primarily residential land use, with mostly medium sized lots. Imperviousness in these subwatersheds ranges from 14 to 22 percent, with an average of about 20 percent (MCDEP, 1998).

The Hawlings River passes through three distinct land uses. The upper watershed above Sundown Road is in rolling agricultural lands east of Laytonsville. This headwater area has many small tributaries that flow to create the Hawlings River mainstem. The middle section passes though a narrow, rocky valley area where the velocity of the stream increases. Within Rachel Carson Conservation Park, there is some of the best stream habitat in the watershed. Below Georgia Avenue, the stream passes through a sandy loam floodplain. The change to sandy soils and the addition of uncontrolled storm flows from the Olney Mill tributary has resulted in severe bank erosion and scour pools. The tributaries

flowing into the Hawlings from the southwest, including James Creek and the Olney Mill tributary in Reddy Branch, contain much higher densities than in the rest of the watershed as a result of development in and around Olney. The resulting higher impervious conditions and regional in-stream stormwater ponds such as the Christie Property facility in James Creek have contributed to the degradation of stream conditions in certain areas. In general, regional in-stream ponds control runoff from large areas, through one large facility rather than many on-site structures. Streams above these types of facilities are often exposed to uncontrolled high runoff velocities from contributing areas with high imperviousness (MCDEP, 1998).

## Stream Water Quality

Historical Data

MCDEP stream water quality monitoring conducted in the 1970's included seven stations in the Hawlings River watershed. Throughout the period of record, water quality in the Hawlings watershed was good for most years, with some years showing slightly lower, but permissible water quality. In recent years MCDEP has been conducting water quality monitoring of two small first order tributaries to the Reddy Branch subwatershed, near the inactive Oaks Landfill where some stream impairment has been detected.

As part of its reservoir monitoring program, the Washington Suburban Sanitary Commission (WSSC) has at various times conducted stream water quality monitoring of the Hawlings River watershed. Approximately twenty-five parameters have been analyzed, including nutrients and metals. From 1973 to 1979 the station was located at Haviland Mill Road near the confluence with the Patuxent River. Since 1998, the monitoring station has been near Sandy Spring at New Hampshire Avenue and the Hawlings River.

In 1990, a watershed management study conducted by Greenhorne & O'Mara (G&O, 1990) presented an overview of water quality conditions in the Hawlings River watershed. As part of this study, water quality data for the Hawlings River at New Hampshire Avenue was collected for an eighteen-month period from April 1986 to October 1987. Based on this data and a review of existing data, water quality in the Hawlings River was found to be typical for a watershed with mainly agricultural uses. Phosphorus, nitrogen, and suspended solids were measured in relatively high concentrations, particularly during storm events. HSPF models for the Hawlings River and the reservoirs were calibrated and run. The model was used to predict major sources of sediment, total phosphorus, and total nitrogen within the Hawlings River watershed. Two priority areas near the headwaters were identified based on pollutant contribution on a unit area basis. The model was also used to predict DO concentrations. Over 9 years of simulation, DO concentrations were found to be generally good, remaining well above the state standard for a Use IV-P stream. This study also identified stream reaches with medium to high erosion potential. Most of these are located on the Mt. Zion, Reddy Branch, Olney Mill, and James Creek tributaries. The Hawlings River mainstem stream reaches between Sundown Road and Mt. Zion Road, and downstream of Reddy Branch to the Patuxent River were also identified as having medium to high erosion potential.

Current Conditions

Water Quality Monitoring

WSSC completed its third year of water quality monitoring at the station on the mainstem near Sandy Spring. A final report will be available in Spring 2002. A preliminary evaluation of the data shows that phosphorus is carried into the stream system primarily during storm events. By contrast, most of the nitrogen appears to be associated with groundwater flow (Patuxent Reservoir Watershed Annual Report, 2001).

Countywide Stream Protection Strategy

According to the CSPS, the stream condition in the Hawlings River ranges from good to poor (see Figure 19). Stream conditions were evaluated for 11 subwatersheds. Throughout the watershed, a cool-water fish community may be found. Overall, the Hawlings River, particularly the mainstem, continues to maintain good resource conditions. Subwatersheds with lower impervious values or primarily in agricultural land use, including upper, middle and lower Hawlings, and lower Mt. Zion tributary, had a good stream condition rating. Below Georgia Avenue, however, stream habitat conditions degrade with large areas of bank erosion, scour pools, and sediment deposition. The upper Olney Mill and upper James Creek

subwatersheds are predominantly urbanized and reflect poor stream conditions. The upper Mt Zion tributary drains an area containing the closed Oaks Landfill, and also reflects poor stream conditions. The subwatersheds that are immediately downstream of those in poor condition, namely middle Mt. Zion tributary, Reddy Branch, lower Olney Mill, and lower James Creek are in fair condition before transitioning to the good conditions along the Hawlings River mainstem.

Maryland Biological Stream Survey

Four sites were sampled in the Hawlings River watershed in 1997. Both the benthic and the fish scores for that year reflect fair to good conditions. The physical habitat index for three of the sites was in the good range, with one site in poor condition.

Maryland 303(d) List and 305(b) Report

The 303(d) lists for 1996 and 1998 do not list the Hawlings River. The 1996 305(b) Report listed the Hawlings River as having unimpaired habitat and an unimpacted benthic community. The 1998 Report provided no further information on the Hawlings River. The 2000 Report, in reference to the Rocky Gorge Reservoir drainage (which includes the Hawlings River) states that there are no long-term state monitoring sites in this segment. Data from biological sampling sites in three Rocky Gorge drainage subwatersheds were analyzed using draft biological protocols. No impairments to the aquatic community were observed.

## Watershed Management

Patuxent Primary Management Area (PMA)

The Patuxent Primary Management Area (PMA) in Montgomery County is a water quality protection and restoration area, providing a stream buffer and transition zone, where land use activities are managed to protect and enhance water quality in the Patuxent River and its tributaries. The PMA is composed of strips of land that run along the entire length of all streams within the watershed. In the study area approximately 25,000 acres of land within the Hawlings River and Patuxent River watersheds fall within the PMA (see Figure 22). The recommended land uses and related activities within the PMA are managed through a series of specially designed programs directed to promote water quality and improve overall stream condition by reducing nonpoint source pollution, providing Best Management Practices (BMPs), preserving agricultural land, and protecting and re-establishing forest cover. The ultimate goal for the PMA is to maintain low-density, low intensity land uses in the stream valleys of the Patuxent River and its tributaries, and to actively establish a minimum 50-foot forested buffer immediately adjacent to all streams.

Maryland Clean Water Action Plan

The Maryland Clean Water Action Plan identifies the Rocky Gorge Dam watershed, which includes the Hawlings River (see Figure 23), as needing restoration and deserving priority consideration. The watershed is in Category 1 (Restoration Watersheds) of the Maryland Unified Watershed Assessment (UWA) being found not to meet clean water and other natural resource goals, and being in need of restoration. The Rocky Gorge Dam watershed is also designated a priority watershed most in need of restoration. In addition, the watershed is listed as a Selected Category 3 (Preservation) watershed that has at least some stream in pristine or high quality condition. Thus, the watershed shows signs of stress and degradation but still contains pristine or sensitive habitat resources.

Countywide Stream Protection Strategy

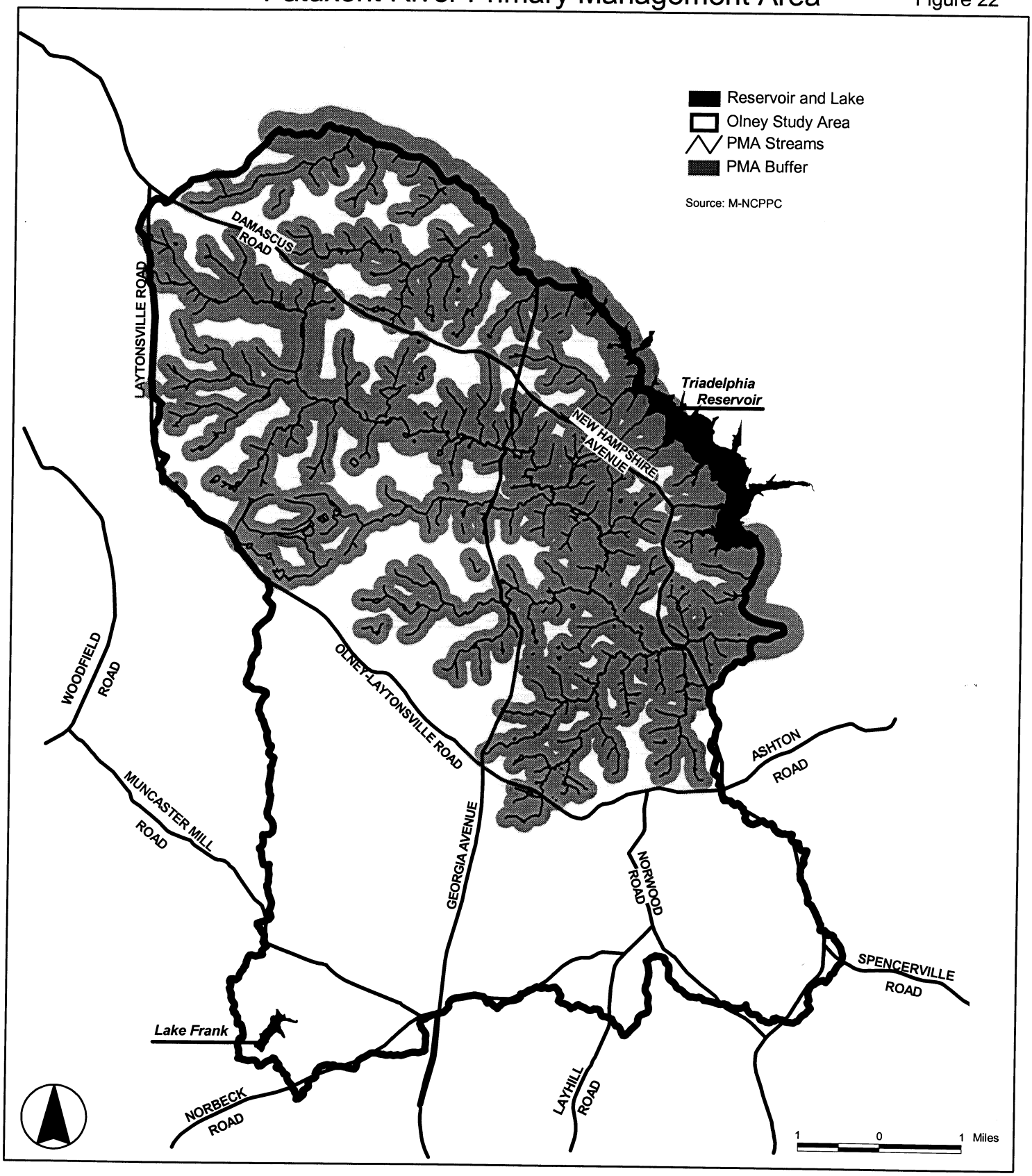
The CSPS divides the Hawlings River watershed into 11 subwatersheds. The subwatersheds in the upper portion of the Hawlings River, with the exception of upper Mt. Zion Tributary are designated as Agricultural Watershed Management Areas. Upper Mt. Zion Tributary and the lower portion of the watershed are designated as Watershed Restoration Areas. Restoration areas consist primarily of densely developed areas, while protection areas are mostly rural or low density (see Figure 20).

Hawlings River Watershed Restoration Study

Montgomery County's Department of Environmental Protection (MCDEP) is currently conducting a watershed feasibility study to identify, prioritize, and design stormwater management and stream restoration projects comprehensively throughout the watershed, in support of the county's watershed restoration program. During the year 2000, MCDEP awarded the Task Order for the Hawlings River Watershed Restoration Study. The purpose of the study is to identify and rank projects that

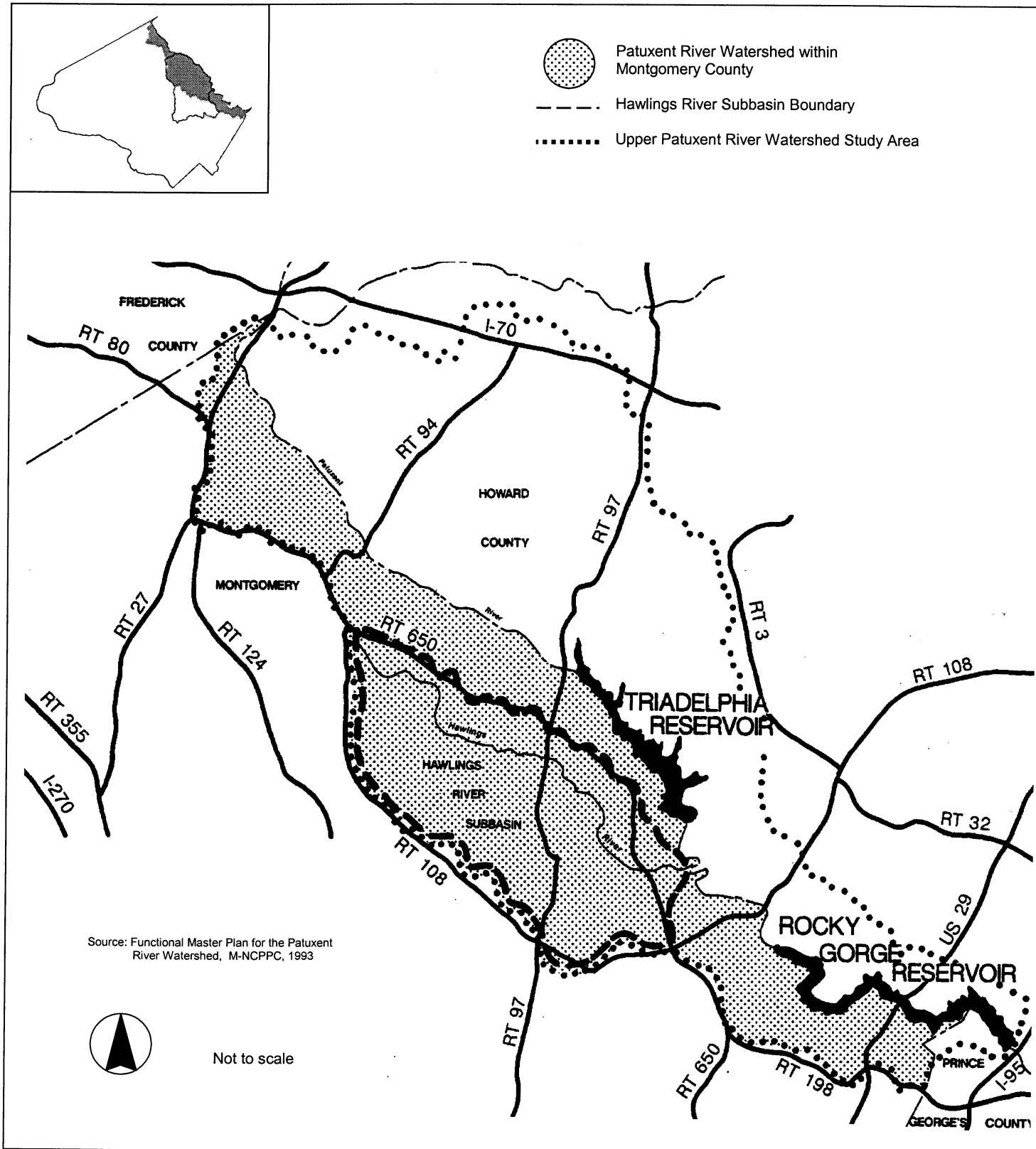
# Patuxent River Primary Management Area

Figure 22



# Location of Rocky Gorge and Triadelphia Reservoirs Watersheds

Figure 23



will enhance and protect aquatic and riparian habitat in the Hawlings River watershed and reduce sediment and associated nutrient loadings to the Rocky Gorge Reservoir. The Task Order elements included: an inventory and summary of data and major results from previous studies and available maps; hydrology modeling to evaluate pre- and post-development storm flows; an inventory of opportunities for stream restoration, habitat enhancement, and stormwater retrofits; design concept sketches and costs for potential projects; and estimates of stream habitat and water quality benefits associated with implementing these projects.

The study continues on target for completion in early 2002. Bank pin and crest gauge monitoring to evaluate stream channel configuration changes associated with high flows have been completed at eight stations for six storm events. Fourteen miles of priority stream reaches, from approximately 100 miles total in the watershed, have been walked and field assessments for stream restoration and enhancement projects completed. See Figure 24 for preliminary mapping showing locations of streambank erosion problems and inadequate stream buffers. Consultants are developing concept sketches for 12 stream restoration projects in the stream reaches and concept designs for 5 potential stormwater retrofits in the watershed. Next steps are to set priorities for these projects and to estimate benefits from their implementation. Implementation will proceed as grant funding becomes available over the next several years.

## Upper Patuxent River

### Watershed Character

The Patuxent River originates in the northeast corner of Montgomery County at the Montgomery County-Frederick County border (see Figure 23). Downstream of its source, the upper Patuxent River forms the boundary between Montgomery County and Howard County. It includes approximately 108 miles of stream that drain 11 square miles (7,011 acres) of land upstream of the Triadelphia reservoir. The upper Patuxent is designated by the state as a Use III stream. The Olney Master Plan study area covers approximately the lower two thirds of this drainage area, from the confluence of Scott's Branch to the Triadelphia Reservoir, a major component of our drinking water system. The watershed on both sides of the river includes large forested areas, particularly along the mainstem of the Patuxent River, along with agricultural cropland, pasture, and large-lot rural residential development. Forest and agricultural land predominate in this watershed, with imperviousness in all subwatersheds below 10 percent (see Figure 17).

A naturally reproducing brown trout population occurs in the stream above Annapolis Rock Road (Route 94). To protect this resource, the upper Patuxent above Georgia Avenue (Route 97) has been designated a special trout management area (catch and release stream) by the Maryland Department of Natural Resources. The brown trout population is part of a generally high quality cold water fish community found throughout this watershed. Extensive forested areas in the Patuxent River State Park surround the upper Patuxent for much of its length. Areas of the state park are or will soon be designated as Maryland Wildlands. The mature floodplain and upland forests support a rich wildlife community with some of the best forest interior breeding bird habitat remaining in the county. The streams in the Patuxent watershed are among the best remaining in the county and many serve as reference streams for the county's stream monitoring program (MCDEP, 1998).

There has been some concern about accelerated rates of sedimentation, elevated nutrient levels, and depressed dissolved oxygen concentrations being observed at Triadelphia Reservoir, and further downstream at the Rocky Gorge Reservoir. These two reservoirs have a total capacity of over 11 billion gallons of drinking water for suburban Montgomery County and Prince George's County, and to limited extent, Howard County (MCDEP, 1998).

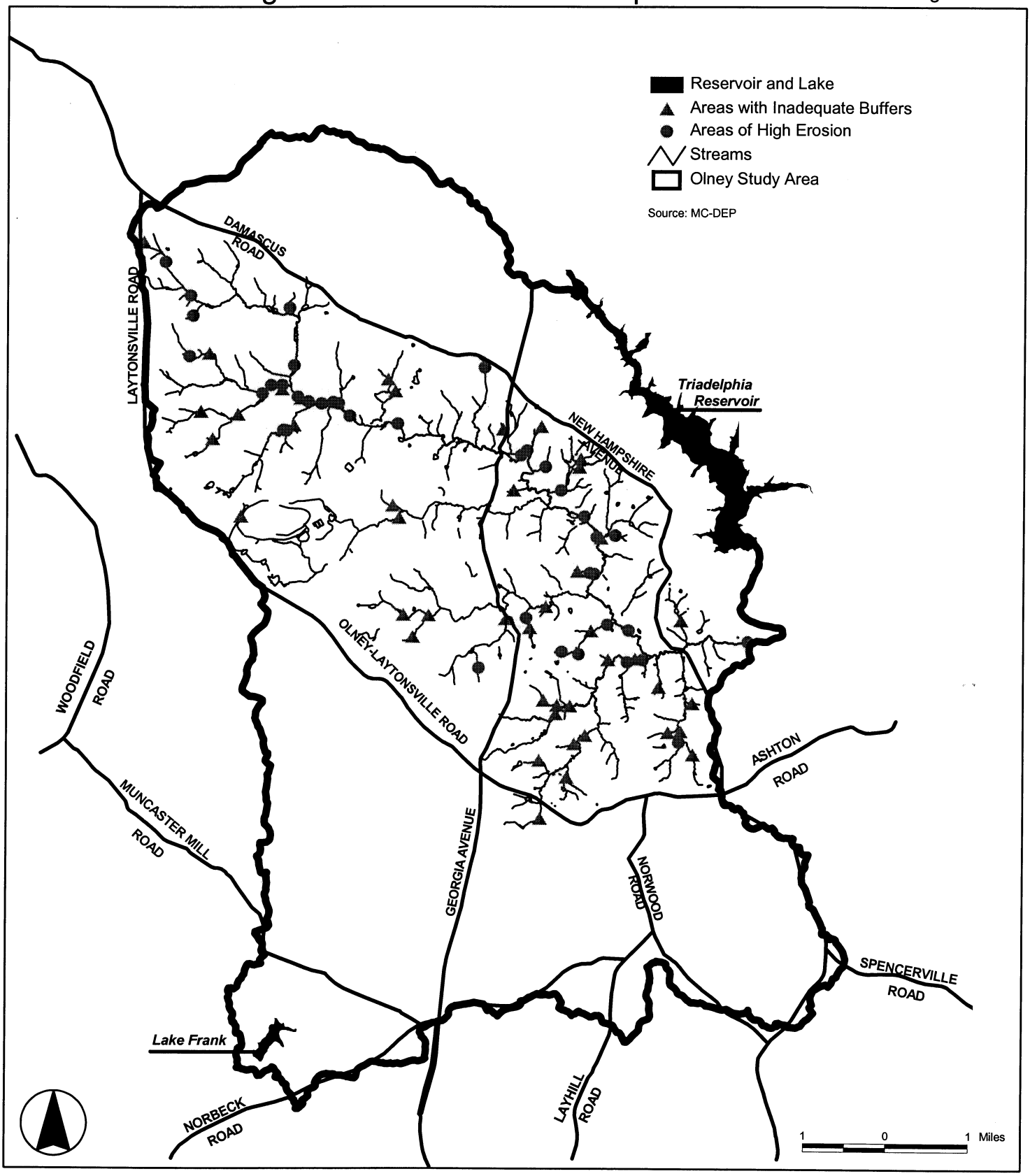
### Stream Water Quality

Historical Data

The MCDEP stream water quality monitoring conducted during the 1970's included two stations along the mainstem of the Patuxent River above the Triadelphia Reservoir, and one station below the reservoir, just downstream of the Hawlings River confluence. Throughout the period of record, water quality in the

# Hawlings River Erosion and Inadequate Buffer Areas

Figure 24



Patuxent River was good for most years and slightly lower, but permissible for the others.

From 1969 to the present, WSSC, in conjunction with various other agencies including USGS and MDNR, has conducted long-term sampling in the mainstem approximately 0.8 miles upstream of the Triadelphia Reservoir, at the Route 97 bridge. Sampled parameters include pH, DO, turbidity, sediment, COD, BOD, and nutrients. Data from this station indicate generally good water quality over the years. However, elevated nutrients and sediment levels reflect non-point source input from agricultural runoff.

In 1990, a watershed management study conducted by Greenhorne & O'Mara (G&O, 1990) presented an overview of water quality conditions in the Patuxent River watershed in Montgomery County. As part of this study, water quality data from the Patuxent River downstream of the Triadelphia Reservoir was collected over an eighteen-month period from April 1986 to October 1987. Sampled parameters included nutrients, TSS, and BOD. The data from this station indicate good water quality. The high trap efficiency of the Triadelphia Reservoir, particularly for small storm events, most likely explains the good quality of released water.

Triadelphia Reservoir

The Triadelphia Reservoir is an 800-acre water supply/storage reservoir on the upper Patuxent River. The reservoir is owned by WSSC and water is released from Triadelphia to meet demands on the Rocky Gorge Reservoir, located downstream on the Patuxent River. Using a trophic classification scheme and data from samples collected as part of the statewide lake assessment program in 1991, Triadelphia reservoir was classified as a mesotrophic lake, meaning it has a moderate amount of dissolved nutrients. Over the years, the reservoir has experienced water quality problems due to sediment and nutrient enrichment from agricultural runoff and increased urban development in the watershed.

WSSC received a grant from the Maryland Department of the Environment (MDE) to develop a reservoir eutrophication model that will be used in support of the State's Source Water Assessment Program. WSSC contracted with Tetra Tech, Inc. to develop the model. The contract includes a trend analysis of the reservoir water quality data that WSSC has been collecting over the past 10 years. Resource Management Concepts (RMC), Inc., will perform this work as well as compare how the Patuxent reservoirs' water quality trends compare with that of the nearby Baltimore reservoirs. Sedimentation survey results from prior years will also be evaluated and compared for both WSSC and Baltimore reservoirs.

Current Conditions

Countywide Stream Protection Strategy

According to the CSPS, the stream condition in the portion of the upper Patuxent within the study area ranges from fair to excellent (see Figure 19). Stream conditions were evaluated for 8 subwatersheds in the lower portion of the upper Patuxent. Data for two additional subwatersheds adjacent to the Triadelphia Reservoir were not available. The lower portion of the upper Patuxent supports a generally high-quality cold water fish community, although sculpin, which are usually found in these communities are absent. Although adequate habitat and water quality exist in the upper Patuxent to support sculpin, their absence is probably due to the isolation of the stream from the rest of the watershed caused by the presence of the Triadelphia reservoir. The mainstem upstream from Route 94 supports a naturally reproducing trout population. A very short segment of the mainstem at the furthest upstream portion of the study area (from Route 94 to Scott's Branch) falls within the lowermost part of this natural trout stream section. Overall, the lower upper Patuxent continues to maintain good to excellent stream resource conditions, with most of the subwatersheds exhibiting an excellent resource condition. Most of the excellent subwatersheds are within the Patuxent River State Park and are heavily forested. Mid upper Mainstem B has a mixed agricultural and forest cover and is in good condition. Upper Hipsley Mill and Haight's Branch have much less forest cover, poor bank stability with high levels of sediment deposition, and are in fair condition (MCDEP, 1998).

2001 Patuxent Reservoirs Technical Advisory Committee Annual Report

The 2001 Patuxent Reservoirs Technical Advisory Committee Annual Report contains a compilation of data collection and analysis conducted by the advisory committee agencies for the Patuxent Reservoirs

watershed. During 2000, MCDEP monitored 14 stations along the mainstem and its tributaries. The benthic macroinvertebrate community, fish community, and habitat was monitored and assessed. Stream channel configuration, water temperature, dissolved oxygen, pH, and conductivity were also monitored at each station. Water temperature, dissolved oxygen, and pH almost all fell within the State's acceptable water quality ranges. Rapid habitat assessment results all scored in the good to excellent range.

Four stations within second order reaches were identified as needing further examination. The main limiting factor at those stations appeared to be reduced stream flow related to small contributing drainage areas. Even though there was apparently a lack of enough seasonal flow to sustain a healthy diverse fish population at all sites, the benthic macroinvertebrates scored excellent or good.

Continuous temperature monitoring at five stations during the summer months showed that all sites exceeded the state established criterion (20°C) to protect trout at various times, but never remained over the criterion for any length of time. These temperature spikes may be due to sites being downstream of open agricultural areas or below roads.

Seven stations showed moderately to severely entrenched streams, with steep high banks. Even though the biological community is not currently showing severe effects from adverse temperature or stream channel impairments, the continuation of these impacts may eventually harm the benthic macroinvertebrate and fish communities.

Maryland Biological Stream Survey

A number of sites were sampled along the upper Patuxent mainstem in 1997. The benthic score, fish score, and physical habitat index for that year reflect predominantly good conditions, with some of each type of score falling in the fair range.

Maryland 303(d) List and 305(b) Report

The 1996 303(d) report listed the entire Patuxent River for nutrients. The 1998 303(d) report listed the upper Patuxent River draining to the Triadelphia Reservoir for nutrients and sediment. The 1996 305(b) report indicated that water quality in this segment is generally good. However, it notes that some high nitrate, total nitrogen, and elevated phosphorus, bacteria and temperature levels were observed at a monitoring station above the Triadelphia Reservoir in the study area. These higher levels were presumably due to agricultural runoff. Bioassessment of three sites in the upper Patuxent showed unimpaired habitat and unimpacted or moderately impacted biological communities, suggesting some water quality impact. The 2000 305(b) report indicated that data from the sampling stations upstream of the reservoir do not show any water quality impairment. However, based on biological sampling data, the state's Biological Criteria Advisory Committee identifies these watershed segments as potentially impaired.

The 1996 305(b) report stated that the Triadelphia Reservoir experienced water quality problems due to moderate nutrient enrichment from agricultural runoff and increasing urban development in the watershed. The 1998 and 2000 305(b) reports list the reservoir as only partially supporting aquatic life uses as a result of low oxygen levels in the deeper portion of the lake. These hypoxic conditions are the result of natural stratification, which restricts circulation of oxygen to deeper portions of the lake, worsened by eutrophication from non-point source runoff.

Triadelphia Reservoir Monitoring

WSSC staff has completed its tenth year of reservoir monitoring that includes a suite of chemical and physical parameters. Water quality is monitored at three locations within the reservoir. This information will be used in the development of the reservoir eutrophication model (Patuxent Reservoir Watershed Annual Report, 2001).

In the past year, bottom samples were collected to perform a sediment flux study. Evaluating the contribution of nutrients released from the reservoir sediment along with the nutrients flowing into the reservoir from tributaries provides insights into nutrient management techniques that may be most suitable for the reservoir and the streams in the watershed. Preliminary results show that the bottom sediments are indeed contributing to the nutrients seen in the reservoir water column (Patuxent Reservoir Watershed Annual Report, 2001).

## Watershed Management

Patuxent Primary Management Area

The Patuxent Primary Management Area (PMA) and its implications for land use decisions have been discussed earlier in this report in the watershed management section for Hawlings River. The upper Patuxent watershed in the study area also falls within the PMA (see Figure 22). These areas should also be maintained in low-density, low intensity land uses with establishment of a minimum 50-foot forested buffer immediately adjacent to all streams.

Countywide Stream Protection Strategy

The CSPS divides the lower part of the upper Patuxent River watershed into 10 subwatersheds. The mid upper Main B, upper Hipsley Mill, Haight's Branch, and Greenstone Tributary are designated as Agricultural Watershed Management Areas. The remaining watersheds are designated as Watershed Preservation Areas (see Figure 20).