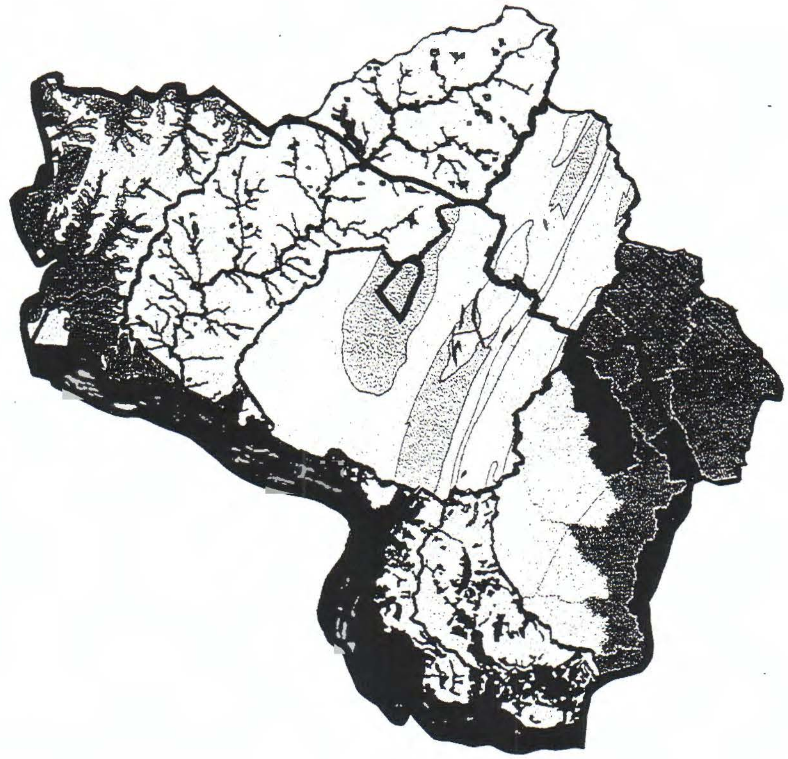
January 1998



Environmental Resources Inventory

POTOMAC SUBREGION

Lower Seneca ✦ Muddy Branch ✦ Watts Branch ✦ Rock Run
Cabin John Creek ✦ Potomac River Direct Watersheds

The Maryland-National Capital Park and Planning Commission
Montgomery County Department of Park and Planning

With the Assistance of: EA Engineering, Science and Technology, Inc.

ABSTRACT

TITLE:	Environmental Resources Inventory for the Potomac Subregion — Including the Lower Seneca, Muddy Branch, Watts Branch, Rock Run, Cabin John Creek, and Potomac River Direct Watersheds.
AUTHOR:	The Maryland-National Capital Park and Planning Commission
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ABSTRACT:	This report contains technical and historical background information to support the preparation of the *Potomac Subregion Master Plan*. The master plan should be consulted for the specific area environmental recommendations.

Environmental Resources Inventory

for the
Potomac Subregion

Including the Lower Seneca, Muddy Branch,
Watts Branch, Rock Run, Cabin John Creek, and
Potomac River Direct Watersheds

Prepared by The Maryland-National Capital Park and
Planning Commission
Montgomery County Department of Park and Planning

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January, 1998

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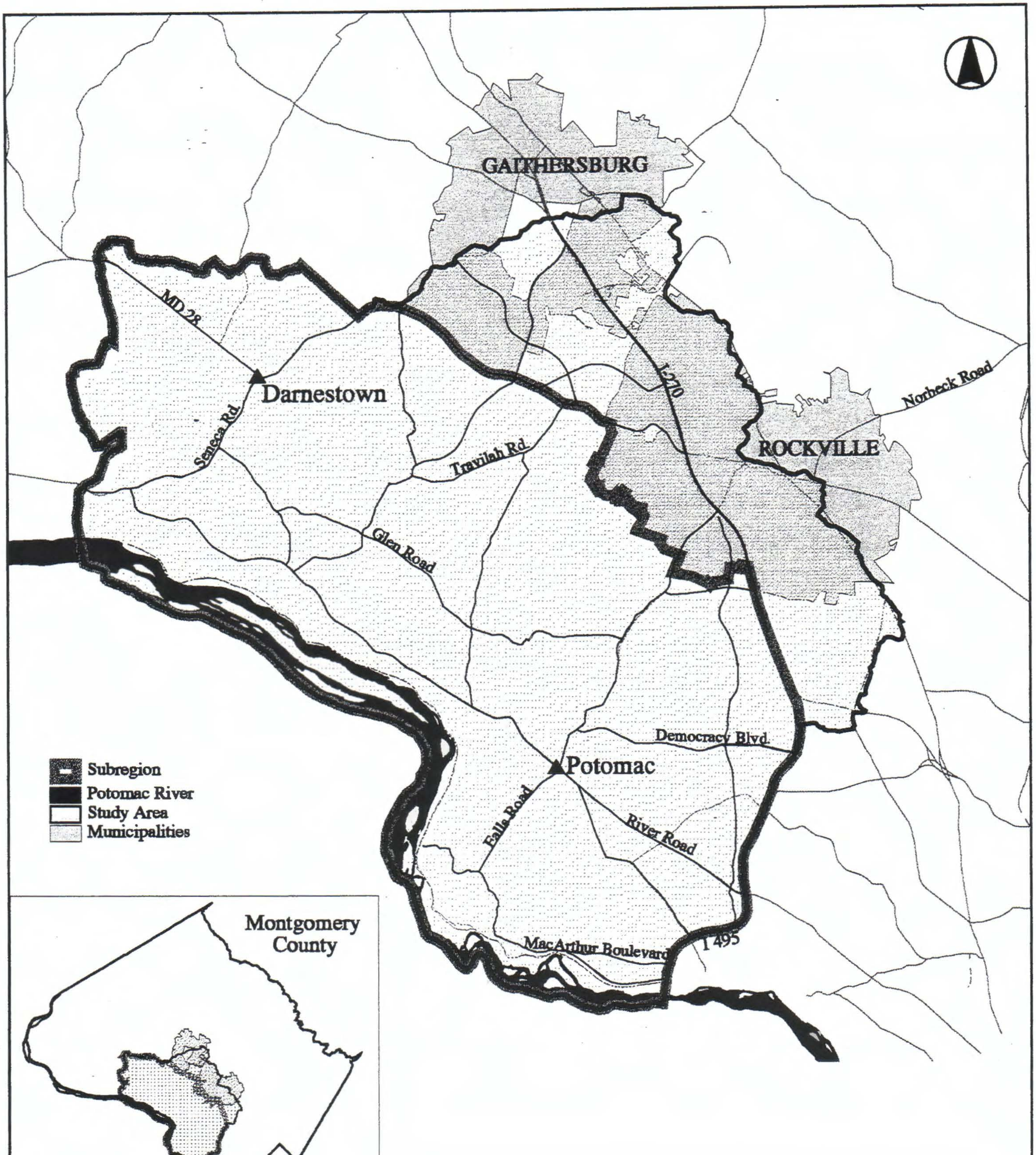


Introduction and Executive Summary

This environmental resources report provides an inventory of environmental conditions in the Potomac Subregion and the policy context that applies to environmental resource protection. The report provides background information on the environment for the master planning process. That process, which follows the publication of this report, will develop environmental goals, objectives and recommendations specific to the Potomac Subregion.

Description of the Potomac Subregion

The Potomac Subregion encompasses approximately 68 square miles in south central Montgomery County, Maryland (see Figure 1). Bounded on the east by the Capital Beltway (I-495) and the densely developed I-270 Corridor, and on the north by Rockville, Gaithersburg, and MD 28, the character of the Subregion is a mix of traditional suburban neighborhoods, bucolic large lot residential development, and rural open space interspersed with agricultural activity.

The Potomac Subregion comprises all or part of several stream drainage basins within the Potomac River watershed. The Potomac River itself dominates the regional ecosystem, connecting the Chesapeake Bay to the Appalachian Mountains. The river corridor lies along part of the eastern flyway through which millions of birds migrate each year. Aquatic life, too, is abundant in the river, and millions of people in Maryland, Virginia, and the District of Columbia depend on the Potomac for drinking water. The influence of the river is evident far up the forested stream valleys of the County, miles beyond the Potomac River. The stream valleys that connect to the Potomac River exhibit an increase in the amount and variety of wildlife beyond similar stream valleys in other parts of the County.

Within the Potomac Subregion, tributaries generally run from northeast to southwest, with their sensitive headwaters lying outside the Subregion in the concentrated growth areas surrounding the I-270 corridor.

This technical report uses a watershed approach to the inventory of existing conditions, examining the entirety of the Muddy Branch, Watts Branch, and Rock Run watersheds, as well as several of the very small watersheds that drain the area directly adjacent to the Potomac River (see Figure 2). The portion of the Cabin John Creek watershed studied includes the tributaries inside the Potomac Subregion and the headwaters upstream of the planning area. Study of the Seneca Creek watershed was limited to its tributary subwatersheds within the Potomac Subregion (on the east side of the mainstem below MD 28). This latter area is called the "Lower Seneca" for convenience in this report. The entire area described above, including the Potomac Subregion and headwaters beyond the planning area, is referred to as the "study area" in this report (see Figure 2).

Summary of Environmental Resources

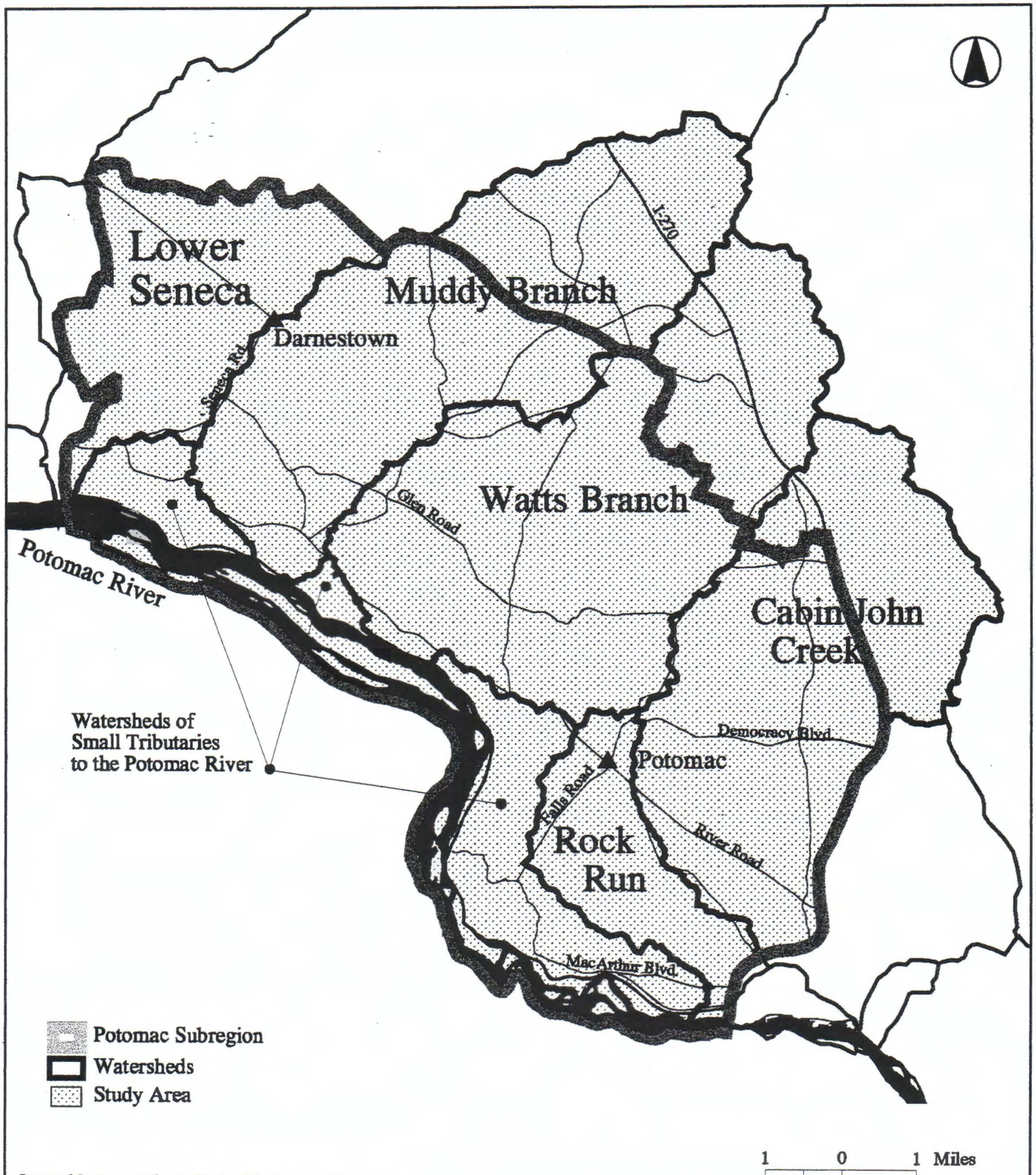
All streams in the Potomac Subregion are currently designated by the State of Maryland as Use I-P streams[1]. The condition of aquatic habitat and water quality of the streams varies considerably from good to poor. Those streams with poor conditions were mostly degraded by development that took place prior to adoption of most environmental protection guidelines and regulations. The large amount of fast-flowing and often pollutant-laden runoff from the headwater areas outside the Potomac Subregion poses special challenges to aquatic life in the mainstem reaches of Muddy Branch, Watts Branch, and Cabin John Creek. Within the Planning Area, some smaller tributaries farther downstream act as refuges for aquatic life. These refuge streams serve as source areas for the repopulation of the mainstems following large storms or significant pollution events.

The forests of the Potomac Subregion are a substantial regional natural resource. Large blocks of contiguous forest are relatively rare in Montgomery County due to agriculture and land development. The Potomac Subregion has a substantial number of large blocks of contiguous forest which are important as habitat for forest interior dwelling species. The forests generally follow the Potomac River and stream valleys, with significant forest habitat in the Seneca watershed and the lower part of the Muddy Branch watershed. Cabin John Regional Park, Great Falls National

[1] State Water Use designation I-P is defined as suitable for water contact, recreation, protection of aquatic life, and public water supply.

Potomac Subregion and Watersheds Under Study

Figure 2



Source: Montgomery County Dept. of Environmental Protection

Park, and the area south of the Rockville Crushed Stone Quarry also hold significant forest resources.

Wetlands occur throughout the Potomac Subregion, generally along streams. Floodplains and wetlands are bordered by steep-sided valleys. A variety of functions are performed by these wetlands, including provision of terrestrial and aquatic wildlife habitat, amelioration of flooding, filtering of stormwater, and provision of groundwater flow to surface streams.

A large serpentinite rock formation, within the upper Muddy Branch and Watts Branch watersheds, provides a significant habitat for unusual biological communities. This rock formation also is a valuable mineral resource which is mined at the Rockville Crushed Stone Quarry. The shallow bedrock in this area significantly limits the potential for individual on-site sewage disposal (septic systems) and adds to the cost of infrastructure.

Natural resources in the Seneca Creek, Muddy Branch, Watts Branch, and Cabin John mainstem stream valleys are mostly protected by wide bands of parkland. Protection of smaller tributary streams relies more on conservation areas set aside during the land development process. Rock Run has narrower parkland areas, and both Rock Run and Cabin John Creek tend to be surrounded by higher density development.

Air quality and noise conditions in the Potomac Subregion are similar to those found throughout the County. Ground-level ozone is formed from a regional mixture of vehicle and industrial emissions, creating unhealthy ozone levels throughout the metropolitan area several days each summer. Noise is created along main roads by high levels of traffic; noise also is generated around quarries by truck traffic and blasting. While the Potomac Subregion is outside the regulatory noise contours of the flightpath to National Airport, aircraft noise still is of concern to residents near the Potomac River, especially in the southern part of the Potomac Subregion.

Sewer and water systems in the Potomac Subregion serve all Montgomery County and parts of Virginia. The source of most of the County's drinking water is the Potomac River just downstream from the mouth of the Watts Branch. The city of Rockville, Fairfax County, and the District of Columbia also draw water from the Potomac. In addition, the Dulles Interceptor (the major trunk line carrying sewage from the west side of the County and parts of Virginia to the Blue Plains treatment plant in the District of Columbia) runs along the Potomac River through much of the Potomac Subregion.

A new wastewater treatment plant is planned in the Rock Run watershed, in the Avenel development, to offload a portion of the wastewater flow in the Dulles Interceptor. Sewer lines serving development in the I-270 Corridor and the Capital Beltway (I-495) follow the Muddy Branch, Watts Branch and Cabin John Creek mainstems and connect into the Dulles Interceptor. The capacity of the Muddy Branch sewer recently has been increased through a relief project. A similar project is planned for the Watts Branch. The Cabin John Creek sewer system is the possible recipient of a pumpover project to relieve the Rock Creek sewer in the central part of the County.

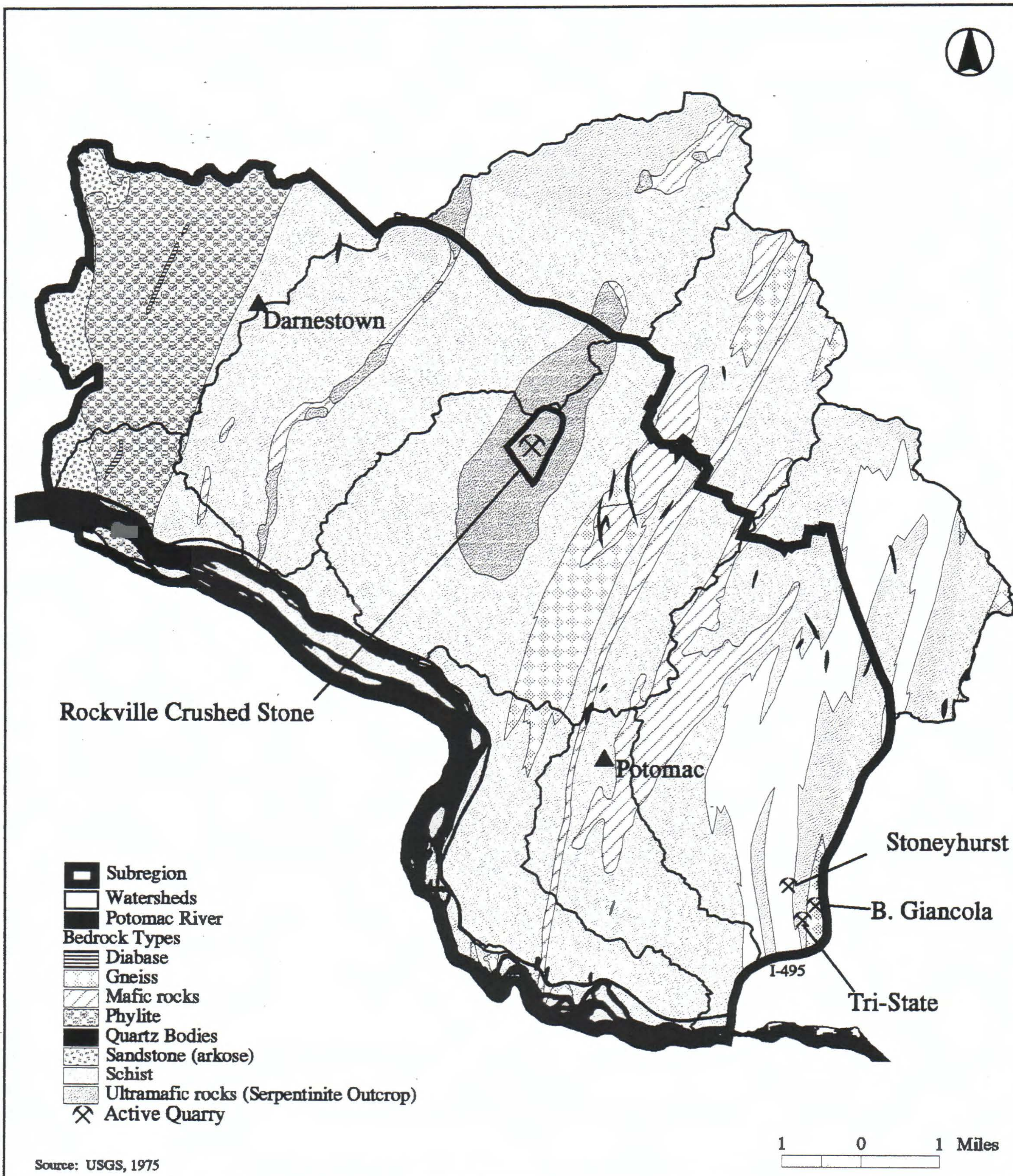
Outside the Potomac Subregion, the Seneca wastewater treatment plant is being upgraded and enlarged to handle the growth of the Germantown and Clarksburg areas by the year 2003. Located on Seneca Creek twelve miles upstream of the Potomac River, the permitted discharge will be increased from five million gallons of treated wastewater per day to a maximum of 20 million gallons per day of treated wastewater into Seneca Creek.

Environmental Policy Framework

Many existing environmental laws, policies, and regulations affect planning for the Potomac Subregion. This policy framework is reflected in the environmental goals and objectives of the *General Plan Refinement*. The federal, State and local framework helps identify resources to be protected and guides local decisions regarding land use planning and zoning as it affects the natural environment.

Geologic Features

Figure 3



Source: USGS, 1975

Existing Environmental Conditions

The following description of the natural resources of the Potomac Subregion is organized in two sections. The beginning of the chapter provides an overview of the study area that examines geology and soils, vegetation and sensitive areas, habitats of rare, threatened and endangered species, air quality, noise conditions and the availability of sewer and water service. The remainder of the chapter provides a more detailed description of the natural resources and environmental conditions of the component watersheds, including portions of Seneca Creek, Muddy Branch, Watts Branch, Rock Run, and Cabin John Creek. In the Watts Branch watershed resources are described on the basis of key subwatersheds (i.e., Piney Branch, Sandy Branch, Greenbriar Branch).

Geology and Soils

The geology of the Potomac Subregion strongly influences the environmental character of the area. The underlying rock formations determine the mineral composition of the soil, help shape the topography, and affect the flow of water through the Subregion. Rock outcroppings of serpentinite and other minerals give rise to quarry operations, affect the ability to build septic systems, raise the cost of developing in certain areas, and create conditions necessary for the habitats of some rare and unusual species of plants and animals.

The Potomac Subregion lies within the Piedmont physiographic province. The bedrock of the Piedmont province in the Washington Metropolitan Area is composed of metamorphic and igneous rocks of Pre-Cambrian to early Paleozoic age. In part of western Montgomery County, these rocks are overlaid by sedimentary rocks of Triassic age and, in scattered areas, upland gravels of more recent age overlie the Triassic formations (see Figure 3). Seneca sandstone, used in early local building projects and quarried near Seneca Creek, is part of this Triassic sequence of rocks. Some of the shallow Triassic sandstones in western Montgomery County are important as local aquifers, but are not sufficiently developed east of Great Seneca Creek to be important in the Potomac Subregion.

The northeast to southwest orientation of Seneca Creek, Muddy Branch, Watts Branch, and Cabin John Creek result from subsurface faults which parallel the mountains to the west. The faults also contribute to the distinctive rock outcrops which are exposed along the Potomac River from Violettes Lock Road westward. These outcrops of serpentinite and ultramafic rock are among the most significant geologic features of the Potomac Subregion. A large serpentinite formation which lies close beneath the soil's surface in the Muddy Branch and Watts Branch watersheds is important both as a commercial mineral resource and because it results in the presence of an unusual biological community.

The Great Falls of the Potomac are evidence of another geologic feature, the fall line. This feature exists where the soft sedimentary rocks of the Coastal Plain have eroded away to expose the harder rocks of the Piedmont province.

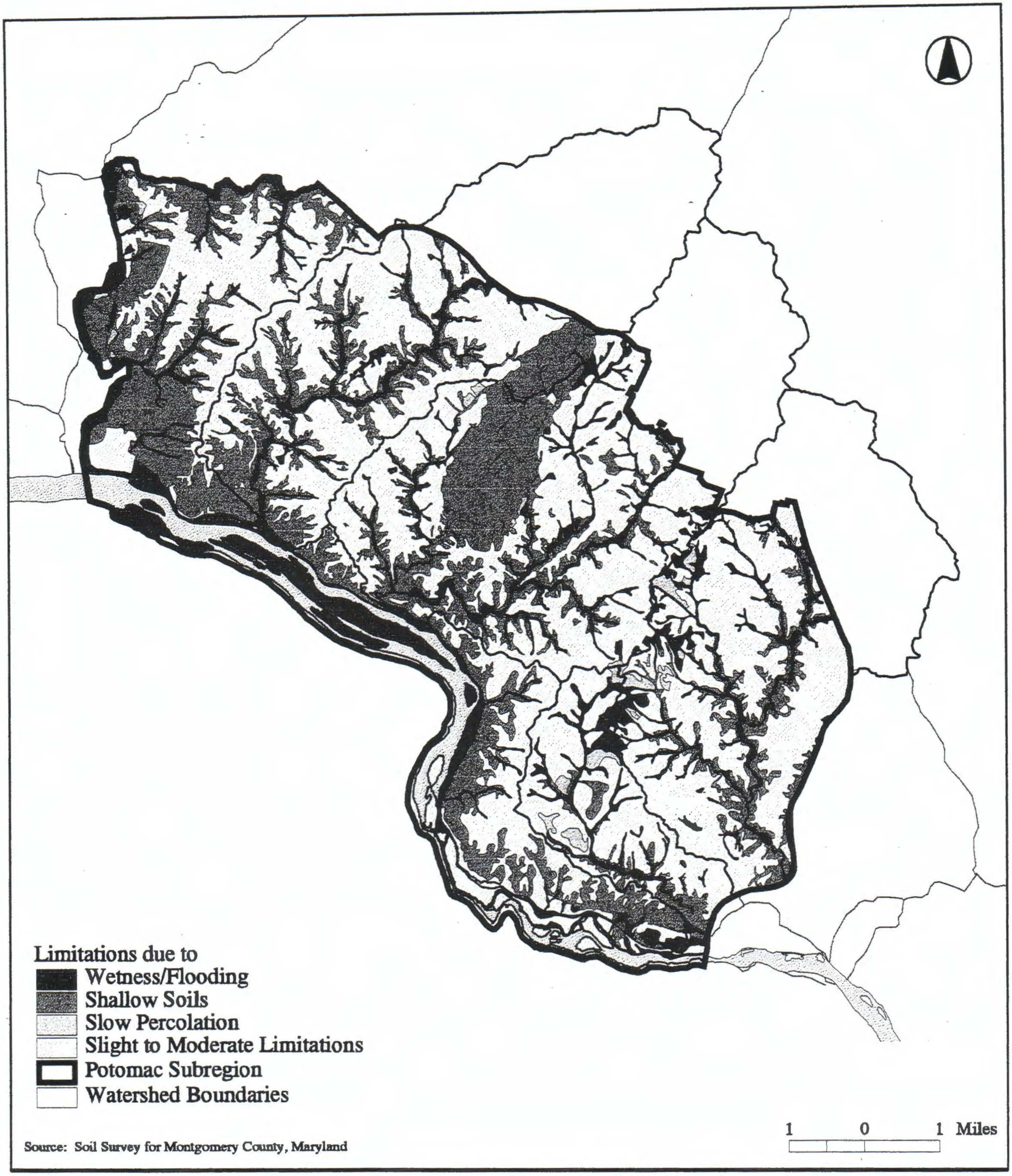
The Potomac Subregion includes large areas of thick, well-drained soils generally suitable for development. However, nearly one-third of the total area has construction limitations due to shallow bedrock, alluvium (water-deposited soils), steep slopes, and excessively or poorly drained soils (M-NCPPC 1980). Areas with construction limitations are generally found adjacent to the Potomac River, Seneca Creek, Cabin John Creek, Muddy Branch, Watts Branch, and Rock Run. The large serpentinite outcrop which is traversed by Piney Meetinghouse Road is poorly suited to development due to shallow and poorly drained soils (M-NCPPC 1980). These conditions limit the feasibility of constructing septic tanks, basements, and swimming pools and increase the cost of grading and infrastructure.

The shallow soils found in some portions of the Subregion can significantly influence the amount of water available for vegetation growth and stream recharge. Shallow soils have limited water storage capacity and may become saturated more quickly than deeper soils, reducing infiltration of water and increasing runoff. The results can be reduced water available for plant growth (especially during droughts), quicker peak flows in streams during and after storms, and reduced stream baseflows. These effects of shallow soils on both groundwater storage and baseflow conditions can be seen in the streamflow conditions in the Piney Branch and the Greenbriar Branch, both of which lie on top of shallow soils over the serpentine rock outcrop in the Watts Branch watershed.

Generally, soils west of I-270 present limitations to septic system percolation(see Figure 4). Throughout the Subregion, development using individual on-site sewage disposal systems may be constrained due to soils with a high clay content, shallow bedrock, and a high water table. This results in lower housing yields than would be expected if community sewer service were available. Especially in

Soils with Severe Limitations for Septic Systems

Figure 4



Source: Soil Survey for Montgomery County, Maryland parts of the Sandy Branch, Greenbriar Branch, and Piney Branch basins, of the Watts Branch watershed extremely shallow bedrock limits potential for development with on-site sewage disposal systems.

Topography and Slopes

The topography of the Potomac Subregion is rolling to moderately steep. Vertical elevations within the Subregion range from approximately 70 feet above mean sea level at the mouth of the Cabin John Creek to a high of 460 feet above mean sea level in the headwaters of Muddy Branch and Watts Branch.

Slopes of the Potomac Subregion **Table 1**

Slope	Approximate Percent of Total Area
<15%	81
15 - 25%	12
> 25%	7

The majority of the Subregion has flat to moderate slopes of 0 to 15 percent (see Table 1). Steep slopes (greater than 25 percent) in the Subregion occur on the terrain facing the Potomac River and in the stream valleys. The slopes inside the Rockville Crushed Stone Quarry in the Greenbriar Branch watershed (a subwatershed of Watts Branch) are also greater than 25 percent but exist due to quarry activities and are wholly contained within the Rockville Crushed Stone Quarry property. Slopes between 15 percent and 25 percent make up a small proportion of the Subregion and generally bound the steeper slopes within the stream valleys.

Mineral Resources

Quarry products including stone and aggregate, clays, and shales are the mainstay of mineral resource extraction in the Potomac Subregion (Maryland Office of Planning, 1997) (see Table 2). These resources are actively mined at the Rockville Crushed Stone Quarry (Rockville Crushed Stone Quarry Bardon, Inc.); Stoneyhurst Quarries; Tri-State Stone and Building Supply, Inc.; and B. Giancola, Inc. Stone Quarry (see Figure 3). All these quarries are operating at a relatively low intensity as they near the end of their reserves or they reach a point of diminishing returns due to other limiting factors, as in the case of the Rockville Crushed Stone Quarry described below.

The Rockville Crushed Stone Quarry is by far the largest operating quarry. Approximately 85 percent of the rock in the quarry is serpentinite; the remaining 15 percent is composed mainly of rodingite. The quarry began operations in 1958. In 1991, the quarry was estimated to have a remaining useful life of 25 years (Boschuk et al. 1991). The three other small quarries produce building stone and flagstone. The time frame for closure of these quarries cannot be estimated. The mining will continue as long as the benefits of the operation exceed the benefits of reclaiming and developing the property.

Expansion of the Rockville Crushed Stone Quarry to mine the remainder of the serpentinite outcrop is limited.

At one time much of the mineral-bearing land surrounding the Rockville Crushed Stone Quarry was owned by the same mining company. Over time, this land has been sold and new residential communities have been

Active Mines and Quarries

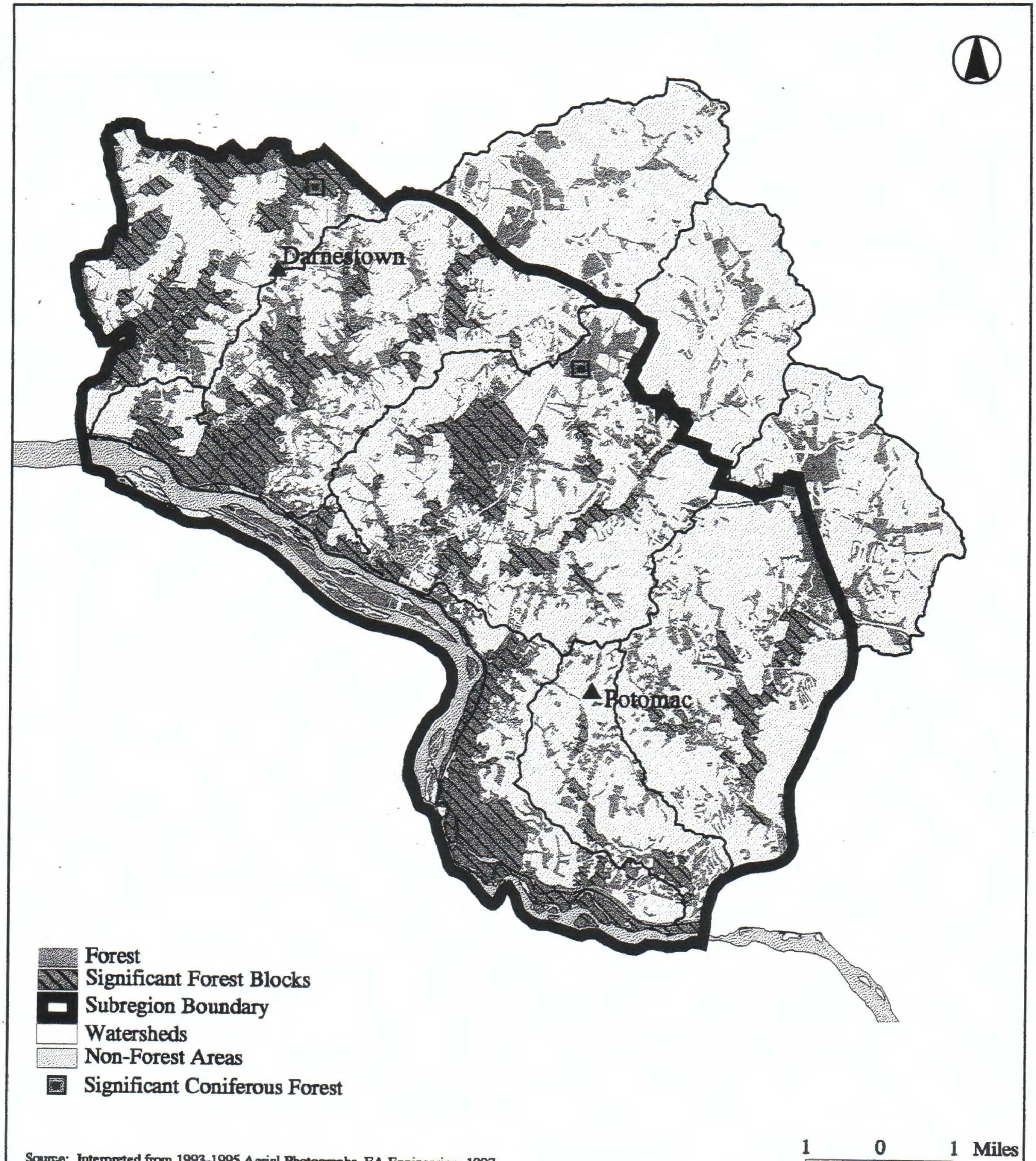
Table 2

Name of Quarry	Size[1] (acres)	Zoning	Minerals Extracted	Use of Materials	Adjacent Land Use
Rockville Crushed Stone Quarry Bardon, Inc.	302.5	I-2	Hunting Hill Crushed Stone	Road Beds Foundation	Residential
Stoneyhurst Quarries	13.3	C-1	Slate/granite	Building Stone, Flagstone	Residential/Fire Station/Road
Tri-State Stone & Building Supply, Inc.	21.5	C-1	Specialty Stone/Shale	Building Stone, Flagstone	Residential/Stream Valley Park
B. Giancola, Inc. Stone Quarry	5.5	C-1	Mica Schist	Building Stone	Residential/Major Highway

1. Size of property containing current quarry operations.

Forest Areas

Figure 5



Source: Interpreted from 1993-1995 Aerial Photographs, EA Engineering, 1997 developed such that this quarry is almost completely surrounded by residential development. The 245-acre undeveloped site south of the quarry has also been sold. This large parcel is crossed by major utility lines, and is home to rare plant and animal species, limiting the potential for future quarry use.

General Characteristics of Vegetation and Sensitive Areas

Forests

The forest areas of the Potomac Subregion provide valuable natural resource functions, including natural stream water quality and quantity management and provision of wildlife habitat and recreational opportunities. Most of the forest resources are deciduous woodlands. Pure coniferous woodland stands within the Subregion are relatively rare, and in many cases have been planted by landowners. Stands of mixed deciduous and coniferous trees[2] may occur in areas where a young forest is succeeding to a mature deciduous forest or where soil conditions favor the growth of coniferous species. Successional woodlands cover areas where forest growth is very young.

There are approximately 14,183 acres of forest in the Potomac Subregion, with 16,171 acres of forest in the larger study area (see Table 3). Approximately one-third of the Potomac Subregion is in one of the four categories mentioned above (see Figure 5 and Table 5).

The largest component of the forest is deciduous woodland, comprising 80 percent of the total woodlands in the Potomac Subregion and 78 percent of the total woodlands in the study area (EA 1997a).

The majority of the forest resources within the Potomac Subregion are associated with stream valleys and parks (see Table 4). Steep slopes and wet soils have limited logging of stream valley forests, and current development guidelines make these areas a priority for retaining or replanting trees. The forest cover within the floodplains of major streams and along the Potomac River is fragmented in places by utility, sewer line, and road crossings. Despite this fragmentation, tracts of mature woodland ("significant forest blocks") potentially large enough to support forest interior dwelling bird species are present in the stream valleys of the Subregion. Approximately 7,174 acres of significant forest blocks have been identified in the Potomac Subregion (M-NCPPC 1997b). Forest interior dwelling species require large tracts of unfragmented woodland to supply their life requisites, and therefore are vulnerable to the fragmentation of woodland areas.

Dominant tree species within the Subregion include tulip poplar (*Liriodendron tulipifera*), red oak (*Quercus rubra*), white oak (*Quercus alba*), red maple (*Acer rubrum*), sycamore (*Platanus occidentalis*), and eastern red cedar (*Juniperus virginiana*). The understory varies from location to location; however, the understory of the mature stands generally is open.

According to Brush *et al.* (1980), the tulip poplar forest association is the predominant forest type throughout most of the Potomac Subregion. This association is characterized by tulip poplar, red maple, flowering dogwood (*Cornus florida*), Virginia creeper (*Parthenocissus quinquefolia*), black gum (*Nyssa sylvatica*), white oak, sassafras (*Sassafras albidum*), black cherry (*Prunus serotina*), wild grape (*Vitis* spp.), mockernut hickory (*Carya tomentosa*), arrowwood (*Viburnum dentatum*), and Japanese honeysuckle (*Lonicera japonica*). Where this association occurs on or adjacent to well-drained bottomlands, common associates may include black locust (*Robinia pseudo-acacia*) and musclewood (*Carpinus caroliniana*); in other areas, common associates may include hickories (*Carya* spp.) and American beech (*Fagus americana*) (Brush *et al.*, 1980). Common upland associates also include various oaks (*Quercus* spp.) and occasionally mountain laurel (*Kalmia latifolia*).

Bottomlands of the upper mainstems and tributaries of Watts Branch, Rock Run, and Cabin John Creek are dominated by the sycamore-green ash-box elder-silver Maple forest association. Characteristic species of this forest association include sycamore, green ash (*Fraxinus pennsylvanica*), box elder (*Acer negundo*), silver maple (*Acer saccharinum*), flowering dogwood, wild grape, red maple, white oak, Virginia creeper, poison ivy (*Rhus radicans*), spicebush (*Lindera benzoin*), tulip poplar, black walnut (*Juglans nigra*), slippery elm (*Ulmus rubra*), and white ash (*Fraxinus americana*) (Brush *et al.*, 1980).

Bottomlands along the Potomac River and Muddy Branch as well as the lower portions of Seneca Creek, Watts Branch, Rock Run and Cabin John Creek feature the River Birch-Sycamore association. Species included in this association are river birch (*Betula nigra*), sycamore, slippery elm, green ash, spicebush, poison ivy, red maple, Virginia creeper, greenbriars (*Smilax* spp.), Japanese honeysuckle, arrowwood, tulip poplar, and black gum.

The Chestnut Oak-Post Oak-Blackjack Oak forest association occurs in the vicinity of the serpentine soil formation just south of the Rockville Crushed Stone Quarry (Brush *et al.*, 1980). Species characteristic of this forest association include chestnut oak (*Quercus prinus*), post oak

[2]This classification is composed of two subclasses: 1) mature deciduous trees with occasional coniferous trees inter-mixed with the other tree species, and 2) older successional areas where deciduous trees are overtaking and shading out the conifer component, but the conifers are still evident in the sub-canopy.

Parkland, Natural Resources, and Agriculture by Watershed[1]

Table 3

	Watershed	Parkland[2]		Sensitive Areas[3]		Forest[4]		Agriculture[5]	
	Acres	Acres	% of water-shed	Acres	% of water-shed	Acres	% of water-shed	Acres	% of water-shed
Potomac River[6]	3,394	346	10	3,178-3,394	94-100	526	15	0	0
Potomac Subregion without River	39,987	6,745	17	10,380-11,614	26-29	13,657	35	2,086	5
Lower Seneca	5,776	1,493	26	1,510-1,707	26-30	2,497	43	1,149	20
Rock Run	3,210	273	9	738-825	23-26	807	25	56	2
Direct Tributaries	5,283	1,972	37	2,138-2,195	40-42	2,796	53	245	5
Cabin John Creek	7,654	1,030	13	1,765-1,982	23-26	1,812	24	0	0
Muddy Branch	7,732	1,297	17	1,719-1,927	22-25	2,515	33	281	4
Watts Branch	10,332	680	7	2,510-2,978	24-29	3,230	31	355	3
Headwaters									
Cabin John Creek	4,138	199	5	NA[7]	NA	791	19	0	0
Muddy Branch	4,899	167	3	NA	NA	783	16	255	5
Watts Branch	3,961	271	7	NA	NA	414	10	568	14

(1) Parkland, sensitive areas, forest areas and agricultural areas overlap significantly (e.g., forest may be partially within sensitive areas). The corresponding acres and percent figures in each row should not be summed as this may result in double counting.

(2) GIS coverage of existing Parkland, M-NCPPC 1997.

(3) Range includes streams, stream buffer area (stream buffer size ranges from a minimum of 100 feet to a maximum of 150 feet for Use I streams, depending on adjacent slopes), wetlands (NWI data, DNR guidance maps, riparian areas within 15 feet of a stream, and hydric soils), wetland buffers (60 feet for Piney Branch, 100 feet for wetlands of Special State Concern and 25 feet elsewhere), 100-year floodplain (M-NCPPC and FEMA data), and steep slopes (greater than 25%) per 1997 M-NCPPC Environmental Guidelines. See Table A-1, Sensitive Resources, for more detailed information.

(4) GIS coverage of Forest interpreted from 1993-1995 aerial photography and M-NCPPC planimetrics, EA 1997.

(5) GIS coverage of Undeveloped Resources interpreted from 1993-1995 aerial photography and M-NCPPC planimetrics, EA 1997.

(6) Area defined by CSPS subwatershed, includes the Potomac River and islands in the river. See Figure 9 for subwatershed boundaries.

(7) Not Available.

Natural Resources and Agriculture in Parkland[1]

Table 4

	Sensitive Areas[2]			Forest[3]			Agriculture[4]		
	Acres of Resource in Watershed	Acres of Resource in Parkland	Percent of Resource in Parkland	Acres of Resource in Watershed	Acres of Resource in Parkland	Percent of Resource in Parkland	Acres of Resource in Watershed	Acres of Resource in Parkland	Percent of Resource in Parkland
Potomac River[5]	3,178-3,394	346	10	526	287	54	0	0	0
Potomac Subregion without River	10,380-11,614	3,959-4,157	36-38	13,657	5,239	38	2,086	136	7
Lower Seneca	1,510-1,707	716-779	46-47	2,497	1,113	45	1,149	133	12
Rock Run	738-825	198-204	25-27	807	210	26	56	0	0
Direct Tributaries	2,138-2,195	1,274-1,280	58-60	2,796	1,672	60	245	1	< 1
Cabin John Creek	1,765-1,982	586-632	32-33	1,812	791	44	0	0	0
Muddy Branch	1,719-1,927	727-762	40-42	2,515	1,004	40	281	2	< 1
Watts Branch	2,510-2,978	452-506	17-18	3,230	449	14	355	0	0
Headwaters									
Cabin John Creek	NA[6]	NA	NA	791	128	16	0	0	0
Muddy Branch	NA	NA	NA	783	76	9	255	0	0
Watts Branch	NA	NA	NA	414	145	35	568	0	0

(1) Resources within *existing* parkland, by watershed. Sensitive areas, forest areas and agricultural areas overlap significantly (e.g., forest may be partially within sensitive areas). The corresponding acres and percent figures in each row should not be summed as this may result in double counting.

(2) Range includes streams, stream buffer area (buffer size ranges from a minimum of 100 feet to a maximum of 150 feet for Use I streams, depending on adjacent slopes), wetlands (NWI data, DNR guidance maps, riparian areas within 15 feet of a stream, and hydric soils), wetland buffers (60 feet for Piney Branch, 100 feet for wetlands of Special State Concern and 25 feet elsewhere), 100-year floodplain (M-NCPPC and FEMA data), and steep slopes (greater than 25%) per 1997 M-NCPPC Environmental Guidelines. See Table A-1, Sensitive Resources, for more detailed information.

(3) GIS coverage of Forest interpreted from 1993-1995 aerial photography and M-NCPPC planimetrics, EA 1997.

(4) GIS coverage of Undeveloped Resources interpreted from 1993-1995 aerial photography and M-NCPPC planimetrics, EA 1997.

(5) Area defined by CSPS subwatershed containing the Potomac River and islands in the river. See Figure 9 for subwatershed boundaries.

(6) Not Available.

Forest[1] by Watershed

Table 5

	Watershed Area (Acres)	Total Forest Area (Acres / %)		Deciduous Woodland (Acres / %)		Mixed Woodland (Acres / %)		Coniferous Woodland (Acres / %)		Successional Woodland (Acres / %)	
	Acres	Acres	% of water-shed area	Acres	% of forest area	Acres	% of forest area	Acres	% of forest area	Acres	% of forest area
Potomac River	3,394	526	15	513	97	4	1	6	1	3	<1
Potomac Subregion Without River	39,987	13,657	34	11,086	81	1,084	8	540	4	947	7
Lower Seneca	5,776	2,497	43	1,914	77	287	12	110	4	186	7
Rock Run	3,210	807	25	734	91	45	6	23	3	5	1
Direct Tributaries	5,283	2,796	53	2,710	97	38	1	8	<1	40	1
Cabin John Creek	7,654	1,812	24	1,496	83	132	7	108	6	75	4
Muddy Branch	7,732	2,515	33	1,793	71	194	8	112	4	417	17
Watts Branch	10,332	3,230	31	2,439	75	388	12	179	6	224	7
Headwaters											
Cabin John Creek	4,138	791	19	466	59	188	24	69	9	68	9
Muddy Branch	4,899	783	16	536	68	63	8	24	3	161	20
Watts Branch	3,961	414	10	349	84	21	5	3	1	40	10

(1) GIS coverage of Forest interpreted from 1993-1995 aerial photography and M-NCPPC planimetrics, EA 1997. The forest categories used represent generalized forest types recognized by the Maryland state forest inventory.

(2) Area defined by CSPS subwatershed, includes the Potomac River and islands in the river. See Figure 9 for subwatershed boundaries.

(*Quercus stellata*), blackjack oak (*Quercus marilandica*), chinkapin (*Castanea pumila*), sassafras, Virginia pine (*Pinus virginiana*), eastern red cedar, pitch pine (*Pinus rigida*), blueberries (*Vaccinium* spp.), mountain laurel, and huckleberries (*Gaylussacia* spp.).

In several small upland areas, isolated patches of Chestnut Oak association forests occur. These forests are characterized by chestnut oak along with red maple, white oak, sassafras, black cherry , black gum, red oak, black oak (*Quercus velutina*), pignut hickory (*Carya glabra*), flowering dogwood, serviceberries (*Amelanchier spp.*) blueberries, mountain laurel, and root sprouts of American chestnut (*Castanea dentata*).

Wetlands

Based on hydric soil indicators derived from the Soil Survey of Montgomery County (USDA, 1995), approximately 4,900 acres of wetlands cover 12 percent of the Potomac Subregion (EA 1997a). These figures do not include the area of the Potomac River along the south edge of the Potomac Subregion.

The Maryland Non-tidal Wetlands Act (1989) lists several wetlands of special State concern in the Potomac Subregion area: Great Falls Floodplain, Great Falls Natural Heritage Area, and the Violettes Lock Floodplain (see Figures 12 and 17 for the location of these wetlands). Wetlands may be designated nontidal wetlands of special State concern if they provide habitat or ecologically important buffers for the habitat of State or federal rare, threatened, or endangered species, or if they contain unique or unusual natural communities. Wetlands of special State concern are designated by the Maryland Department of Natural Resources and are listed in COMAR 26.23.06.01.

Wetlands in the Potomac Subregion can be grouped into four categories: forested, scrub-shrub, emergent, and open water. Plant communities occurring in wetlands are usually dominated by species such as skunk cabbage and sycamore which are adapted to saturated conditions. Wetlands may also contain species such as tulip poplar, musclewood and multiflora rose (*Rosa multiflora*) which typically occur in drier environments.

Wetlands are located in the stream valleys of the Potomac Subregion, within the floodplains, in low-lying areas beyond floodplain boundaries or at the base of steep slopes. Groundwater pathways supplying base flow to streams in the region occasionally exit from the floodplain, sometimes at the base of steep slopes. These seep areas and other depressed areas close to the water table have developed hydric soils that are capable of supporting hydrophytic (wetland) vegetation.

Forested wetlands are the most common wetland type, comprising 28 percent of total wetland acreage (see Table 6). Tree species typically occurring in forested wetlands include sycamore, green ash, red maple and box elder.

Understory shrubs in the forested wetlands may include natives such as spicebush, blackberry (*Rubus* spp.), arrowwood, musclewood, and non-native species such as Japanese honeysuckle, bamboo (*Phyllostachys* sp.), and multiflora rose.

Emergent, scrub-shrub, and open water wetlands are dominated by a variety of herbaceous and woody species including poison ivy, various unidentified *Carex* species, broom-sedge (*Andropogon virginicus*), reed canary grass (*Phalaris arundinacea*), soft rush (*Juncus effusus*), several species of goldenrod (*Solidago* spp.), rice-cutgrass (*Leersia oryzoides*), cattails (*Typha latifolia*), field mint (*Mentha arvensis*), pickerelweed (*Pontederia cordata*), smartweeds (*Polygonum* spp.), clearweed (*Pilea pumila*), jewelweed (*Impatiens capensis*), asters (*Aster* spp.), fescue (*Festuca arundinacea*), several species of *Rubus*, and larger water-starwort (*Callitrichie heterophylla*).

EA Engineering, Science and Technology, and M-NCPPC evaluated 40 wetland assessment groups[3] in the six major watersheds which comprise the Potomac Subregion (Seneca Creek, Muddy Branch, Watts Branch, Cabin John, Rock Run, and tributaries draining directly to the Potomac River). The wetland assessment group boundaries were developed by the M-NCPPC in cooperation with the Maryland Department of the Environment (MDE). Boundaries were based upon stream order, hydrologic connection, road crossings with extensive embankments and culverts, and significant inflows from tributary streams. The Appendix contains a brief description of the determination of wetland assessment groups and the wetlands functional assessment methodology. **For additional details, see the *Potomac Wetland Functional Assessment Study*, which is a separate appendix incorporated by reference into this report (EA, M-NCPPC, 1997.)**

The five wetland functions assessed for the wetland assessment groups of the Potomac Subregion during this study were:

- **Groundwater Discharge** — areas where flow from the groundwater system reaches the surface. This flow may occur in springs or seeps. Springs are areas of concentrated flow; seeps are areas of saturation.
- **Floodflow Attenuation** — ability of wetlands to hold floodwaters.

[3] A wetland assessment group is a group of wetlands which are hydrologically linked.

Wetlands(1) by Watershed

Table 6

	Water-shed Area	Total Wetland Area		Forested Wetlands(2)		Emergent / Shrub Wetlands		Forested Riparian Wetlands		Open Water / Emergent Wetlands		Emergent / Shrub / Spring Seep Wetlands		Emergent / Shrub Riparian Wetlands		Forested / Spring Seep Wetlands	
	Acres	Acres	% of water-shed area	Acres	% of wet-land area	Acres	% of wet-land area	Acres	% of wet-land area	Acres	% of wet-land area	Acres	% of wet-land area	Acres	% of wet-land area	Acres	% of wet-land area
Potomac River	3,394	3,145	93	381	12	408	13	17	1	419	13	0	0	1,921	61	0	0
Potomac Subregion without River	39,987	4,893	12	1,884	39	1,255	26	456	9	562	11	194	4	371	8	171	3
Lower Seneca	5,776	843	15	414	49	106	13	50	6	113	13	31	4	87	10	41	5
Rock Run	3,210	424	13	148	35	137	32	35	8	17	4	59	14	16	4	14	3
Direct Tributaries	5,283	1,071	20	305	28	148	14	213	20	221	21	17	2	150	14	17	2
Cabin John Creek	7,654	761	10	269	35	324	43	38	5	30	4	38	5	39	5	24	3
Muddy Branch	7,732	719	9	332	46	180	25	66	9	80	11	12	2	21	3	27	4
Watts Branch	10,332	1,075	10	416	39	360	34	54	5	101	9	37	3	58	5	48	4
Headwaters																	
Cabin John Creek	4,138	248	6	58	23	51	20	25	10	50	20	39	16	12	5	13	5
Muddy Branch	4,899	654	13	164	25	223	34	5	1	132	20	89	14	19	3	22	3
Watts Branch	3,961	402	10	134	33	174	43	6	1	38	10	31	8	14	3	5	1

(1) GIS coverage of Wetlands, EA 1997. Includes data from NWI wetlands maps, DNR wetlands guidance maps, M-NCPPC planimetric GIS coverage of streams, riparian areas within 25 feet of a stream, and hydric soils from 1995 *Soil Survey of Montgomery County*.

(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.

- **Sediment Retention/Nutrient Removal** — ability of wetlands to settle sediments or take up nutrients such as nitrogen and phosphorus.
- **Aquatic Habitat** — ability of the wetlands to support plants and animals in the water.
- **Wildlife Habitat** — ability of the wetlands to support a variety of wildlife.

The following conclusions were documented in the *Potomac Wetland Functional Assessment Study* (M-NCPPC and EA Engineering, 1997):

- Park acquisition has protected and preserved many significant wetlands in the Potomac Subregion.

- Instream habitat associated with the forested, scrub-shrub and emergent wetlands is moderately to severely stressed throughout the developed portions of the Potomac Subregion. Streambank erosion, downcutting within the channel, tree loss, extensive deposition and heavy sediment loads were observed during field investigations in these areas. This degradation is affecting adjacent wetlands and vernal pools by altering the natural hydrologic processes of overbank flooding, groundwater discharge to wetlands, and maintenance of stream baseflow.

- The cumulative impacts of sewer line rights-of-way, power lines, and road crossings may present a greater threat to wetlands habitat in the study area than adjacent low-density residential land use. Loss of mature forest canopy, introduction of invasive species, and fragmentation of wetlands and riparian ecosystems was documented during the field investigations. Wetlands adjacent to and within the sewer line rights-of-way are fragmented and often subject to encroachment or disturbance by maintenance or expansion activities.

Descriptions of wetlands characteristics and functions for each watershed are presented later in this chapter under the individual watershed sections. The State requested that priority wetlands be designated as part of this wetlands functional assessment study, as they are for other such studies conducted with State assistance. The criteria for designating "priority wetlands" were developed in consultation with the Maryland Department of the Environment. Priority wetlands are wetlands that receive a high composite score for aquatic and wildlife habitat. These wetlands support a diverse community of animals and plants and deserve special consideration in the master planning process. The use of habitat scores as criteria for designation is consistent with the approach used in the *Countywide Stream Protection Strategy* (CSPS)(MCDEP, 1997), which ranks streams according to biological life and instream habitat.

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

The Potomac River long has served as a migration corridor for plant and animal species. The steep slopes above the river have limited disturbance of these areas, as has ownership by the National Park Service. In addition, the river itself modifies the climate near its banks. The combination of these factors has resulted in a high concentration of rare, threatened, and endangered species near the river. In particular, Great Falls National Park is home to many RTE (Rare, Threatened, and Endangered) species.

The probability of finding rare, threatened, or endangered species or unusual biological communities increases in wetland areas, in areas with underlying bedrock types such as ultramafic and diabase rock formations, in areas of serpentine soils, and with increasing proximity to the Potomac River.

Surveys for RTEs species and unusual biological communities have been conducted by the Maryland Department of Natural Resources Heritage and Biodiversity Conservation Program as well as by the M-NCPPC and consultants under its direction. RTE species found in the Potomac Subregion include plant, bird, and invertebrate species (see Table 7 for examples of RTE plant species found in the Subregion).

Areas with more frequent occurrences of RTEs species and unusual biological communities include portions of Seneca Creek State Park and several Montgomery County parks, as well as Great Falls National Park, the C&O Canal National Historical Park, and a large tract of land in the Greenbriar Branch watershed.

The Greenbriar Branch site sits atop a large serpentine soil deposit. Serpentine soils are rich in chromium and magnesium and poor in other essential plant nutrients. The vegetation found in serpentine areas is more tolerant of high levels of soil magnesium and chromium than many other plants. Such areas may be dominated by grasses with pines often interspersed (M-NCPPC 1997a). Serpentine areas provide habitat for many plant and animal species listed as rare, threatened, or endangered. The Greenbriar Branch serpentine area not only contains several RTE plant species, but also supports a biological community which includes post oak, blackjack oak, and pitch pine as significant components. This community is rare in Montgomery County.

The major stream valleys have many of the attributes of the Potomac River: they serve as migration corridors, have altered microclimates, and have been protected both by topography and by their status as parks. While detailed surveys generally are not conducted on private lands, surveys have been prepared for some County parklands by the Maryland Heritage and Biodiversity Conservation Program. These surveys have identified areas containing RTE species in Cabin John Regional Park, Buck Branch Stream Valley Park, Watts Branch Stream Valley Park, Muddy Branch Stream Valley Park, and Blockhouse Point Conservation Park.

Within Cabin John Regional Park, a site north of Tuckerman Lane and west of I-270, contains four State watchlist plant species and at least five plant species rare to uncommon in the County. Two watchlist species were documented in Buck Branch Stream Valley Park south of Bells Mill Road.

Surveys of Muddy Branch Stream Valley Park have yielded two locations for RTE species. The first site, north of River Road and south of Esworthy Road, contains at least four watchlist plant species. The second site, just south of MD 28, supports two watchlist plants and several other species which are rare to uncommon in Montgomery County.

Blockhouse Point Conservation Park near the Potomac River is home to one watchlist, one State threatened, and one State endangered plant species. In addition, Blockhouse Point Park contains one of the largest undisturbed forest blocks in the Potomac Subregion. This forest provides habitat for forest interior dwelling bird species.

The survey of Watts Branch Stream Valley Park recorded one watchlist plant species south of Glen Road and east of Piney Meetinghouse Road. Additional surveys by the M-NCPPC have added one more watchlist plant species in this same area. In addition, M-NCPPC surveys have found watchlist plant species in two other areas of Watts Branch Stream Valley Park, specifically at a site north of River Road and west of Piney Meetinghouse Road, and at a site between the Glen Road bridge over Watts Branch and the end of Gregerscroft Road. Both sites also contain other plant species rare or uncommon in Montgomery County. Additionally, all three Watts Branch sites serve as habitat for forest interior dwelling bird species, which are of concern nationwide due to declining populations.

Hemlock (*Tsuga canadensis*) stands are located in Seneca Creek State Park near Berryville Road (M-NCPPC 1977). This community type is rare in the Potomac Subregion due to early logging activities and a general lack of micro-climatic conditions necessary for these stands to develop.

Rare, Threatened, and Endangered Plant Species

Table 7

Scientific Name	Common Name
Asclepias verticillata	Whorled milkweed
Arisaema dracontium	Green dragon
Aristolochia serpentaria	Virginia snakeroot
Aster shortii	Short's aster
Bromus latiglumis	Broad-glumed brome
Carex grayi	Asa Gray's sedge
Carex hitchcockiana	Hitchcock's sedge
Carex shortiana	Short's sedge
Castanea pumila	Chinquapin
Chamaelirium luteum	Devil's-bit
Chrysogonum virginianum	Golden-knees
Clematis viorna	Leatherflower
Cynanchum laeve	Honeyvine
Dirca palustris	Leatherwood
Dodecatheon meadia	Shooting-star
Ellisia nyctelea	Nyctelia
Erigenia bulbosa	Harbinger-of-spring
Erythronium albidum	White trout lily
Eupatorium altissimum	Tall boneset
Gentiana villosa	Striped gentian
Geum vernum	Spring avens
Heuchera pubescens	Downy heuchera
Hibiscus laevis	Halberd-leaved rose-mallow
Hybanthus concolor	Green violet
Krigia dandelion	Potato dandelion
Liparis loeselii	Loesel's twayblade
Matteuccia struthiopteris	Ostrich fern
Melica mutica	Narrow melicgrass
Passiflora lutea	Yellow
Phacelia purshii	Miami mist
Ptelea trifoliata	Water-ash
Quercus imbricaria	Shingle oak
Ranunculus micranthus	Rock crowfoot
Ruellia strepens	Rustling wild-petunia
Scutellaria ovata	Heart-leaved skullcap
Stenanthium gramineum	Featherbells

Wildlife and Fish

There have been few comprehensive wildlife inventories conducted in the study area. There are, however, several wildlife habitats and species known to occur in the study area that should be noted because they are declining regionally or they can have a direct or indirect impact on humans and land development.

Numerous fish surveys have been conducted in various Potomac subwatersheds since the beginning of this century. A list of the fish species found in Potomac Subregion streams as reported in the *Countywide Stream Protection Strategy* is presented in the Appendix (see Table A-2).

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 FID habitat. As forested land throughout the east and central U.S. has been fragmented by development, FID species have declined dramatically. Approximately 7,174 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. In addition to FID species, undisturbed riparian forests along the Potomac River and on river islands currently support nesting Bald Eagles.

Grassland and Edge Habitat

Current land use in parts of the study area support large areas of grassland and edge habitat. Pasture land, hayfields, sod farms, large estates and golf courses provide grassland habitat for several specialized species of birds that are declining regionally. Species include bluebirds, eastern meadowlarks, grasshopper sparrows, kestrels (a small falcon), and other grassland or open country specialists. The edges where these fields meet other habitats, particularly forest, provide important habitat for other uncommon species including Baltimore orioles, and red-tailed and red-shouldered hawks.

Wildlife Management Concerns

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

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 plan in 1995 that includes data collection, public education, and implementation of management options including population management. Given the juxtaposition of parkland, housing communities and large estates, deer populations in the area are likely to continue increasing for some time.

Beaver now are 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 affect private and public lands. 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 often are 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 before current environmental guidelines were in effect. 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.

Large numbers of Canada geese have taken up residence in the County over the past decade. These resident geese 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, institutional properties and large estates can attract large numbers of geese, resulting in problems such as interference with activities including golf, picnicking and swimming, and in waste buildup on land areas and in ponds.

Air Quality

The entire Washington Metropolitan Statistical Area, which includes all of Montgomery County, falls into the "serious" classification for ozone. On average over the past six years, the region has exceeded acceptable federal limits (0.12 parts per million of ozone averaged over one hour) for ozone six days per year. Environmental Protection Agency standards allow regions to exceed acceptable limits only one day per year. The EPA requires attainment of the federal standard by 1999. The Metropolitan Washington Air Quality Committee is responsible for preparing the region's air quality plans and for choosing the air pollution control measures to be implemented by the region.

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

Operations at Rockville Crushed Stone Quarry meet air quality requirements of the quarry ordinance.

Noise

The noise generated over a 24-hour period is measured as Ldn. Ldn, the sound pressure level with a penalty for nightime noise, provides a standard to assess the average noise generated over a 24-hour period. Humans experience increased levels of interference with speech and communication at an Ldn level between 55 and 65 dBA[4].

There are three main sources of nuisance noise in the Potomac Subregion: aircraft noise along the Potomac River, noise from the operating quarries, and traffic-generated noise along major roadways. Stationary noise sources are regulated differently from mobile source noise.

Aircraft-related noise continues to be a nuisance within the Potomac Subregion rather than a health problem. The majority of planes are from National Airport which use the Potomac River as a flight path. Recently completed studies by the Metropolitan Washington Airports Authority indicate that the aircraft-related noise levels are within the limitations set by the Maryland State Aviation Administration for Montgomery County. Continued advances in aviation noise reduction technology may eventually reduce this nuisance.

Noise associated with the four quarries is generally limited to truck traffic accessing the quarries. Truck traffic is restricted to certain haul routes to minimize impacts to residential communities. Occasional blasting of the rock resource is reported to be felt in local homes rather than heard. The Rockville Crushed Stone Quarry on Travilah Road will soon use the new Shady Grove Road south of MD 28 rather than Travilah Road, reducing the noise impact along Travilah Road.

General traffic volume is the most prevalent noise source due to the distribution of roads throughout the Potomac Subregion. The volumes of traffic that use the Capital Beltway (I-495) can exceed 200,000 vehicles per day in certain stretches along the Potomac Subregion boundary. For those heavily traveled portions of the Capital Beltway (I-495) and I-270, the 60 dBA Ldn contour can reach 2700 feet into residential communities along the southwestern boundary of the Potomac Subregion (see Figure 6). The noise barriers that have recently been constructed along most of the Capital Beltway (I-495) near residential areas have significantly reduced noise levels within these communities.

There are, however, a number of heavily traveled State highways and County roads that generate high noise levels that will affect existing and future residential areas.

Noise contours for all major roads were computer-generated using existing levels of traffic (see Figure 6). The noise contour map shows areas where the 60 dBA Ldn contour extends beyond the road right-of-way and rear yard setback for the given zone. The noise models available do not adequately describe the influence of noise barriers.

Noise modeling highlighted areas that have sufficient volumes of traffic in areas with denser zoning that permits housing close enough to the road to be affected. Significant impacts could occur for the roadways listed below given the number of existing and proposed residential lots within the noise impact area. The figures in parentheses indicate the distance from the road subject to noise above 60 dBA. The distances vary due to changes in traffic mix, volume, and speed.

- MD 28 from Darnestown to Shady Grove Road (108-402 feet)
- Falls Road (108-306 feet)
- River Road from Piney Meetinghouse Road to Capital Beltway (I-495) (173-279 feet)
- Democracy Boulevard from I-270 to Falls Road (179-200 feet)
- Tuckerman Lane from I-270 to Falls Road (195-300 feet)

Water and Sewer Service and Capacity

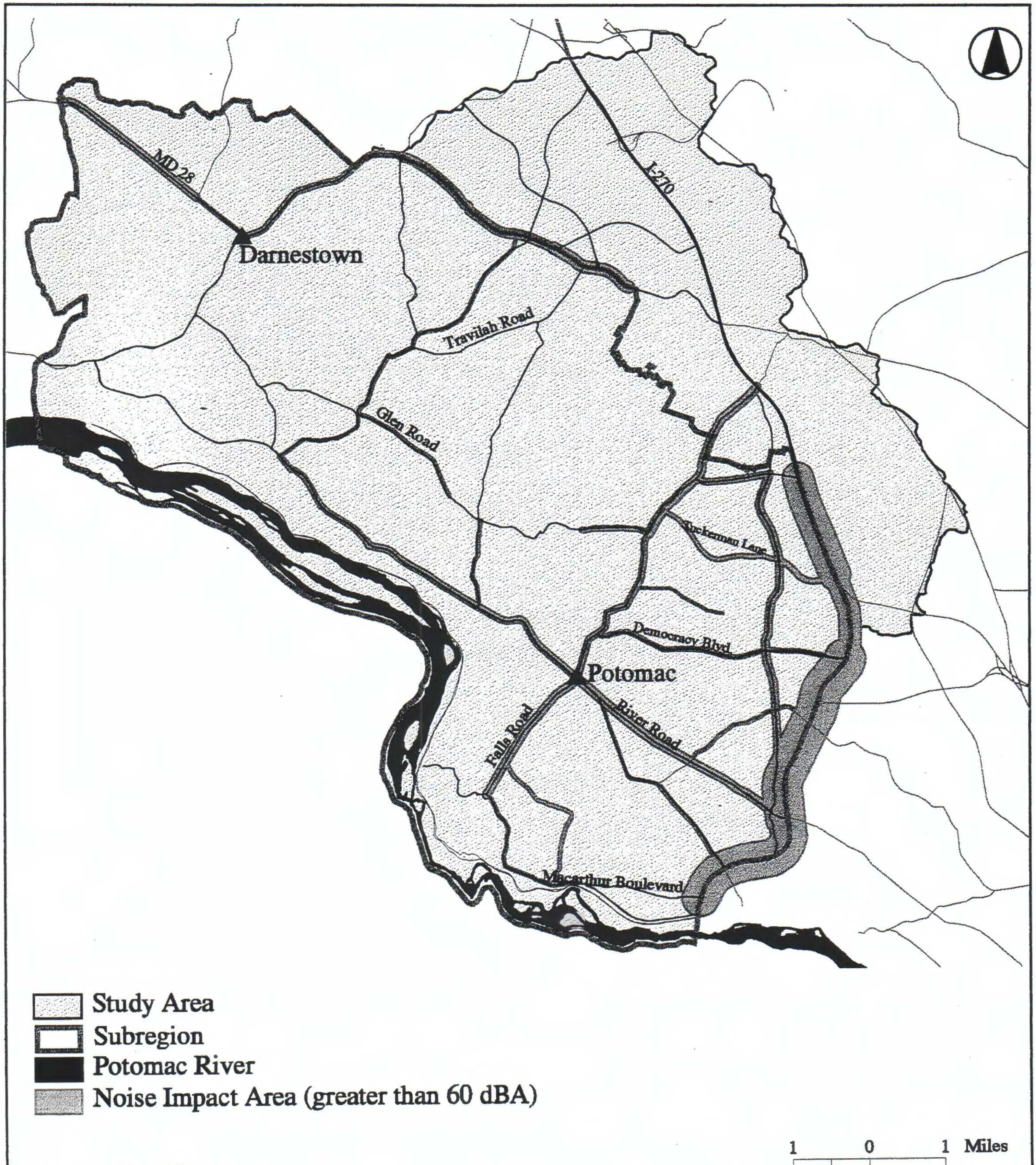
Community sewer service is provided to most of the southern and eastern portions of the Potomac Subregion[5] (see Figure 7). This service is provided via one of four sewer trunk lines: Muddy Branch, Watts Branch (including the Piney Branch sewer), Rock Run, and Cabin John. These trunk lines convey flows from the Potomac Subregion and other planning areas south into the Dulles Interceptor. The Dulles Interceptor is a very large trunk sewer that captures sewage flows from much of Montgomery County and parts of Loudoun and Fairfax counties in Virginia and discharges to the Blue Plains treatment plant in the District of Columbia where much of the region's wastewater treatment needs are met. Various regional agreements detail the average and peak flow limits each jurisdiction is allowed to discharge into this system.

[4] A measure of decibel levels, weighted (using "A" weighting) for sounds that affect the human ear.

[5] Detailed information on sewer and water service categories can be obtained from the Montgomery County Department of Environmental Protection.

Traffic Noise Impact Areas

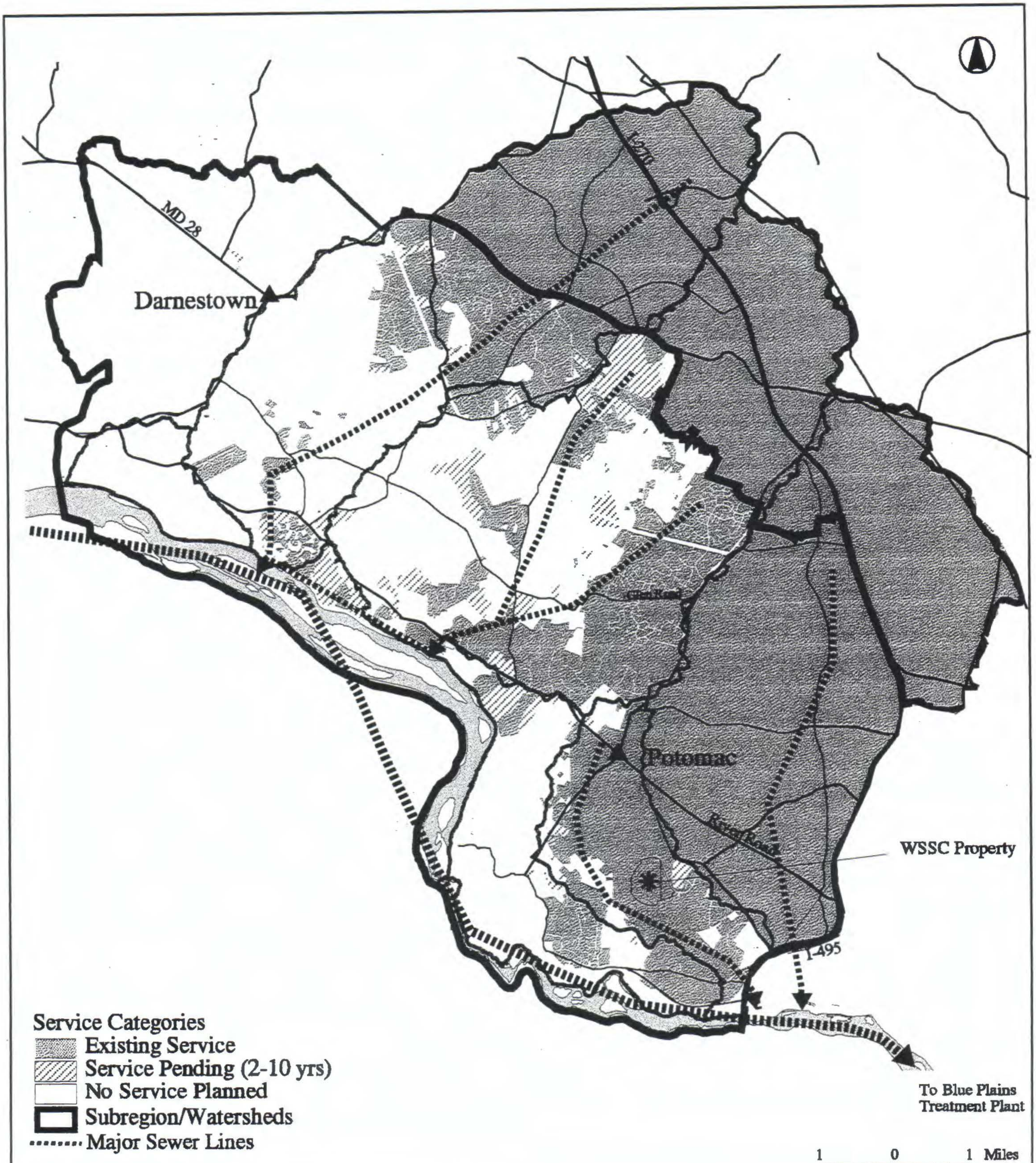
Figure 6



Source: MNCPPC, 1997

Sewer Service Areas

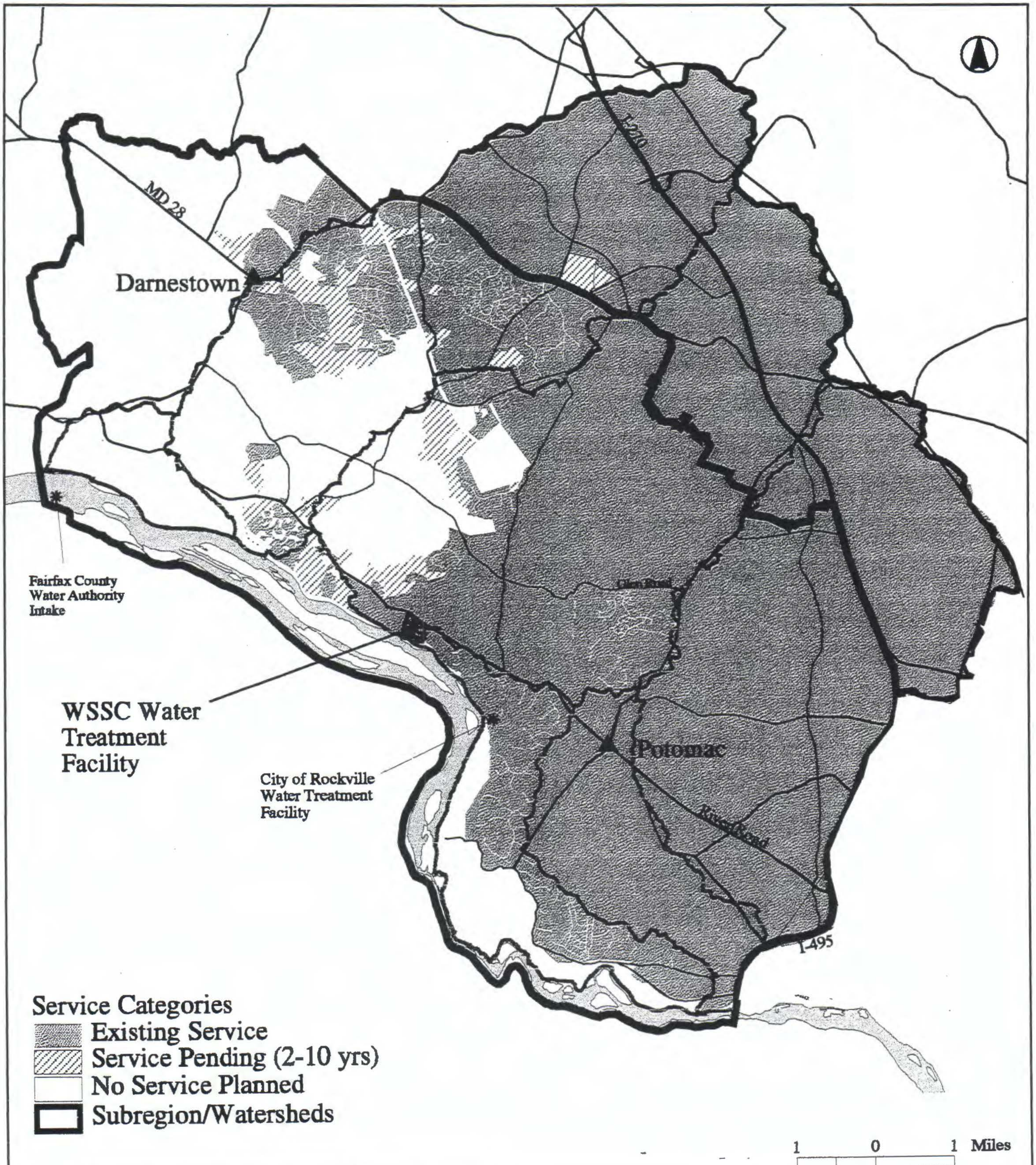
Figure 7



Source: Derived from draft Montgomery County Department of Environmental Protection, 1997

Water Service Areas

Figure 8



Source: Derived from draft Montgomery County Department of Environmental Protection, 1997

Community water service is provided to much of the Potomac Subregion by a network of water supply lines maintained by the Washington Suburban Sanitary Commission (WSSC) (see Figure 8). Raw water is taken from the Potomac River at the water treatment plant located on River Road. WSSC also has a water treatment plant located in Laurel, MD, which receives raw water from the Rocky Gorge reservoir. Together these two plants supply drinking water to the majority of Montgomery and Prince George's counties.

The city of Rockville owns and operates a water treatment facility at the southern terminus of Sandy Landing Road. This plant supplies the drinking water for the Rockville Sanitary District, which includes the city of Rockville. This plant should continue to serve the needs of the Rockville Sanitary District for the foreseeable future. The Fairfax County Water Authority also operates raw water intakes on the Virginia side of the Potomac at the confluence with Seneca Creek.

For a detailed discussion of water and sewer in the Potomac Subregion, see the Water and Sewer Status Report in the Appendix, prepared by M-NCPPC, WSSC, MCDEP, and MCDPS.

Sewer System Capacity

Within the Potomac Subregion area, the Muddy Branch and Cabin John trunk sewers can be expected to exceed designed capacities in portions of their length by the year 2010, which is within the lifetime of the upcoming master plan revision. Additionally, the WSSC portion of the Watts Branch trunk sewer downstream of the city of Rockville may need relief after the year 2020. The actual timing and techniques used to address these sewer capacity concerns will be dependent on the actions of the County Council through the Water and Sewer Plan and the WSSC capital improvement program.

The Sandy Branch pump station is located in the headwaters of the Sandy Branch watershed and collects sewage flow from the area zoned R-200/TDR-3 on the north and south side of Travilah Road at the intersection with Dufief Mill Road. This pumping station, and the Rich Branch trunk sewer to which it feeds, is approaching capacity. In reviewing two recent map amendments to the *Comprehensive Water Supply and Sewerage Plan* (Water and Sewer Plan) located within the pump station sewershed, the County Council raised its concern over the need for an analysis of the capacity problem. The Montgomery County Department of Environmental Protection (MCDEP) and WSSC are studying at the remaining capacity in these two sewerage systems to allow the area to continue developing as a receiving area for the Transfer of Development Rights (TDR) program. Should there be a need to enlarge the existing Sandy Branch wastewater pumping station or provide relief for the Rich Branch trunk sewer, the environmental and community impacts associated with these projects will be examined through the WSSC's facilities planning process.

The WSSC is currently undertaking a major facility plan to address network capacity constraints within the Rock Creek sewerage basin. A possible option under consideration is the pumping of excess flows from Rock Creek over to the Cabin John Creek sewerage basin. If selected, this option will have an impact on the extent and timing of relief sewer construction required in the Cabin John Creek basin.

The WSSC *Strategic Sewerage Study* (WSSC, 1993) identifies the Rock Run wastewater treatment plant as a critical element for the region's future sewage treatment needs in all the alternatives considered in the study. A site for the sewage treatment plant has been designated and documented in the *1980 Potomac Subregion Master Plan*. A study is underway to conduct a preliminary investigation of influent/effluent alternatives and environmental issues, to develop planting and screening schemes, and to develop a long-term implementation schedule.

Water Treatment

The WSSC Potomac water filtration plant is located on River Road. The plant's water intakes are located in the Potomac River immediately downstream of the Watts Branch. The plant provides almost all of the community water supply needs for Montgomery County.

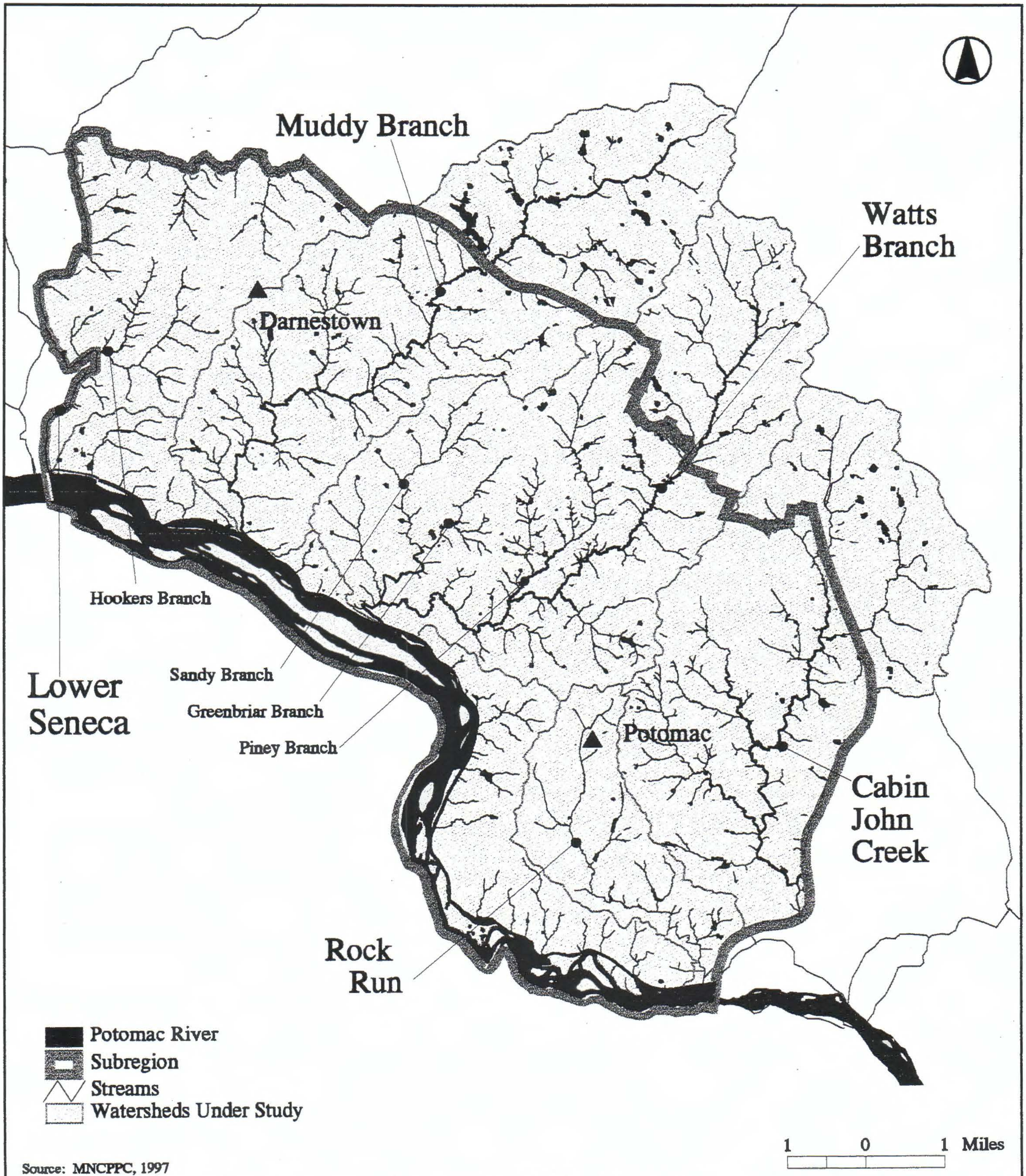
In recent years, the Maryland Department of the Environment (MDE) has expressed concerns about the release of solids filtered from the drinking water treatment process into the Potomac River. Earlier this year, the WSSC and the MDE signed a consent agreement that includes provisions for separating the filter backwash and discharging it directly back to the Potomac River. The agreement also has provisions for pumping, thickening, dewatering, and disposing of the sedimentation solids. The agreement includes a compliance schedule that requires the WSSC to build the facilities necessary to comply with the conditions of the new permit within five years from the date of issuance.

The Potomac River

As the largest body of water in Montgomery County, the Potomac River is a unique resource. The river's watershed is very large, covering portions of Pennsylvania, Virginia, West Virginia, Maryland, and all the District of Columbia (Washington Metropolitan Council of Governments [WMCOG] 1987). All the 68 square miles of the Potomac Subregion drain to the Potomac River, yet the subregion

Potomac River and Tributary Streams

Figure 9



Source: MNCPPC, 1997

constitutes less than one percent of the total watershed of the river.

Because the river is less sensitive to development than the individual tributary watersheds in the Potomac Subregion, the majority of this report focuses on the conditions of the tributary watersheds. However, the river has a definite influence on the plants and animals that are present in the Potomac Subregion.

The importance of the river is evidenced by the following designations:

- Area of Critical State Concern (Maryland Office of Planning, 1981)
- State Scenic River (Maryland Department of Natural Resources, 1991)
- Nomination for American Heritage River designation (1997)

Over the period 1977 to 1985, the Potomac River in the vicinity of the Potomac Subregion has experienced improving water quality (using phosphorus and nitrogen concentrations as a measure) (WMCOG 1987, MDE 1988). The water quality of this section of the river was characterized as good in 1994 (Garrison 1994). Wastewater treatment and stormwater quality management instituted by local jurisdictions have been credited with these improvements (WMCOG 1987). The *Countywide Stream Protection Strategy* does not report current data for the Potomac River. Sensitive areas adjoining the river are depicted on the maps of major watersheds in the sections of this chapter that follow.

The Potomac River several miles east of the Potomac Subregion (in the vicinity of Little Falls Dam), has an average annual discharge of 10,790 cubic feet per second and is the source of drinking water for the cities of Washington, D.C; Rockville, MD; Fairfax, VA; and diffuse areas served by the Washington Suburban Sanitary Commission and the Fairfax County Water Authority (James et al. 1993).

The Potomac River and the parkland bordering it provide many recreational opportunities, including boating, canoeing/kayaking, fishing, wildlife observation, and hiking and biking along the towpath of the C&O Canal. Additional recreational opportunities including picnicking and birdwatching are available at Great Falls National Park. Both parks are part of the National Park System and provide recreational opportunities for individuals who live in and outside the Potomac Subregion. In addition, the C&O Canal National Historical Park and Great Falls National Park provide habitats for the highest concentration of rare, threatened, and endangered species of plants and animals in Montgomery County.

Tributary Watersheds of the Potomac Subregion

The major streams of the Potomac Subregion include (from west to east) parts of Seneca Creek, Muddy Branch, and Watts Branch, all Rock Run, and parts of Cabin John Creek (see Figure 9). The headwater portions of Muddy Branch and Watts Branch are wholly contained in the portion of the study area outside the Subregion. In addition, portions of the Cabin John headwaters are contained in the study area, although other parts of the watershed extend out of the study area east of I-270.

The headwaters of the major streams within the study area are largely developed. The lower portions of the streams generally have less development and have steep-sided valleys and a wide floodplain. Many of the stream valleys in the Potomac Subregion are within parkland owned and regulated by government and other organizations (e.g., M-NCPPC, State of Maryland). Floodplain areas are largely undeveloped with the exception of utility lines. Wetlands are often present within the floodplain and may extend beyond floodplain boundaries.

The Department of Environmental Protection (DEP) as part of the *Countywide Stream Protection Strategy* (CSPS) developed a biological monitoring program that assessed all County streams according to the same methodology (MCDEP in cooperation with M-NCPPC, 1997). The conditions in streams of the Potomac Subregion range from good to poor (see Figure 10). Based on these assessments and projections of potential development (with existing zoning), management categories were assigned for each subwatershed (see Figure 11). For each management category, a set of management tools is identified to address the stream conditions and anticipated levels of development. The management categories and tools provide a basis for targeting interagency resources to address stream quality problems using a focused, watershed approach. The Appendix contains a detailed description of the management categories from the CSPS.

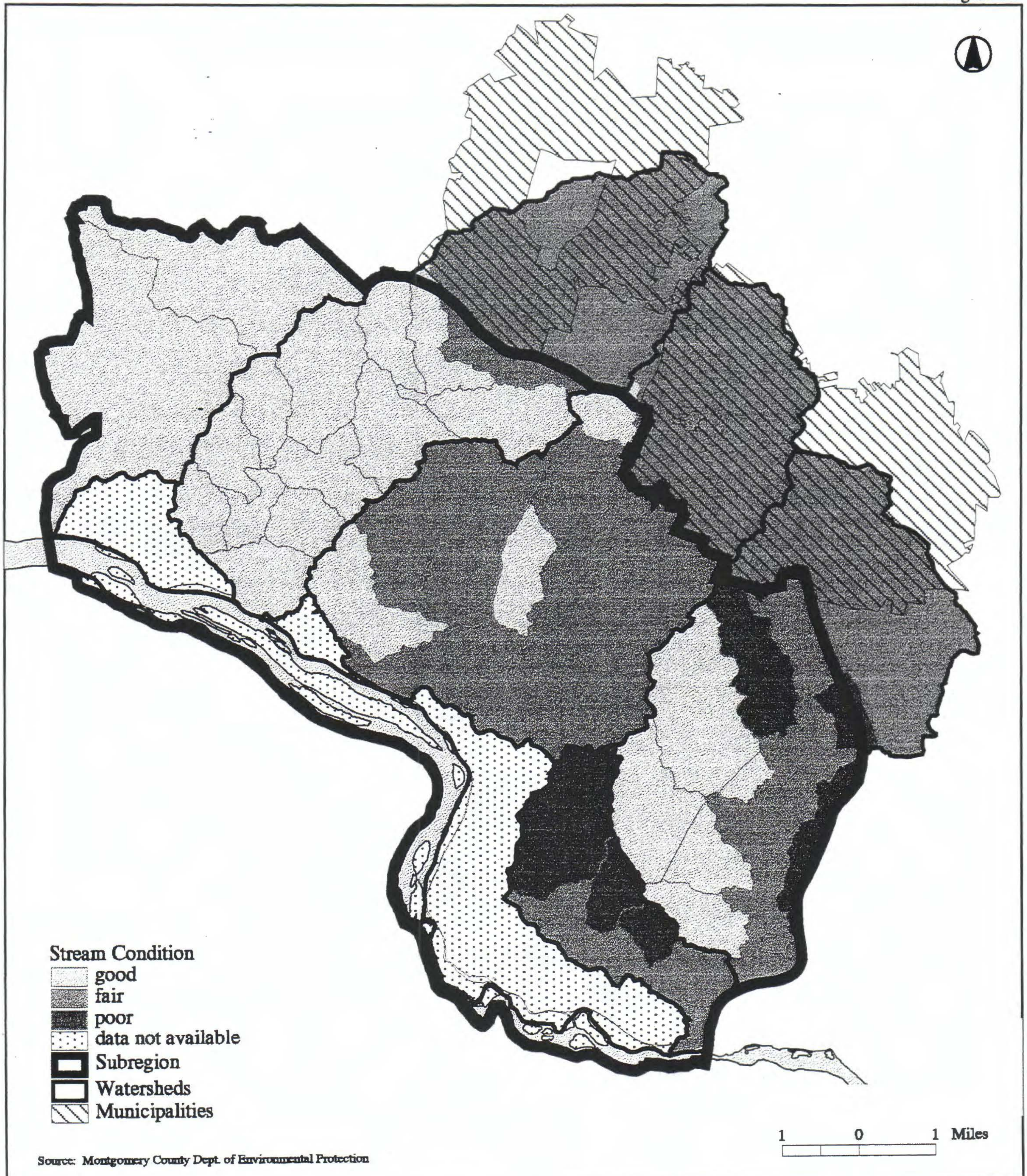
Lower Seneca

Watershed Character

Although the Seneca Creek watershed covers 128 square miles, or 27 percent of Montgomery County, the drainage area in the Potomac Subregion is only about nine square miles or 5,776 acres. Seneca Creek is the largest watershed wholly within the County. Due in part to the size of its watershed, Seneca Creek takes on the character of a small river as it approaches its confluence with the Potomac. For purposes of this report, the portion of the Seneca Creek watershed in the study area is called Lower Seneca.

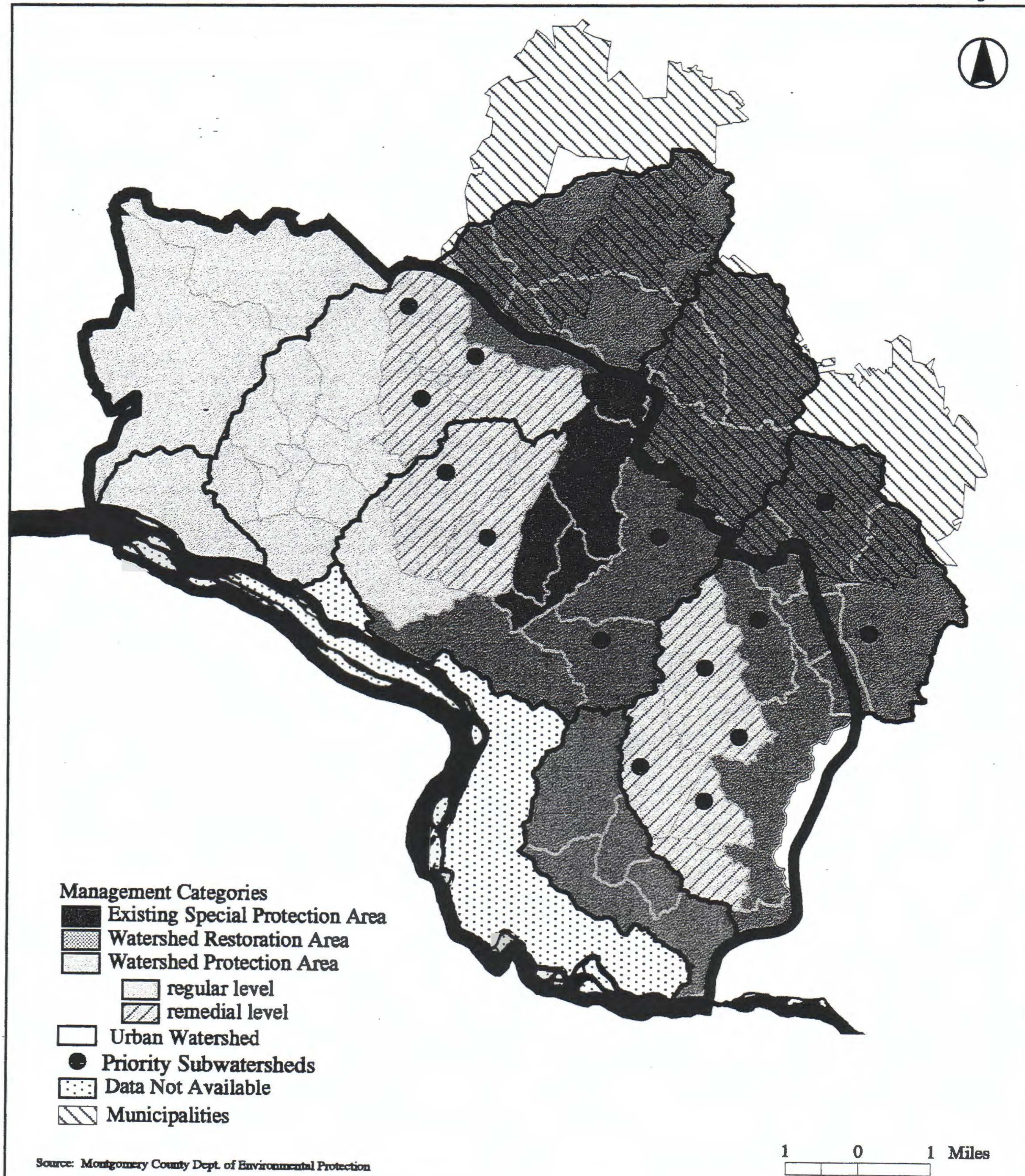
Countywide Stream Protection Strategy - Subwatershed Condition

Figure 10



Countywide Stream Protection Strategy - Management Categories

Figure 11



The Lower Seneca watershed is the most rural of the watersheds in the Potomac Subregion. The rolling landscape is dominated by farm fields and woodlots, punctuated by large-lot developments. The stream valley, which is largely within Seneca Creek State Park, contains extensive areas of mature upland and floodplain forests. Imperviousness in the portion of the watershed in the Potomac Subregion ranges from 4 to 11 percent (see Table A-4 for detailed information about subwatershed imperviousness).

Within the Potomac Subregion, the Lower Seneca watershed contains approximately 2,500 acres of forest (EA 1997a). Upland forests are predominantly oak and hickory. Tulip poplar dominates on some moist slopes and well-drained bottomlands. Wetter portions of the stream valleys support stands of sycamore, box elder, green ash, and red maple. A significant stand of eastern hemlock, rare in Montgomery County, occurs in the park just west of Berryville Road (see Figure 5). This watershed has large unfragmented stands of woodland that provide quality habitat for various wildlife species, including forest interior-dwelling birds.

Water Quality

Current Conditions

The *Countywide Stream Protection Strategy* (CSPS) characterized the portion of Seneca Creek in the Potomac Subregion as fair to good for stream habitat conditions (MCDEP 1997)(see Figure 10). Areas lower in the watershed are in better condition than the headwater sections draining urbanized areas of Shady Grove and the city of Gaithersburg.

The Appendix contains a summary table of past and present water quality monitoring (see Table A-5).

Historical Data

In 1976, a concept plan containing a summary of water quality information for Seneca Creek for a period ending in 1972 presented an overview of water quality conditions in the Seneca Creek watershed (M-NCPPC, 1976). The report concluded that Seneca Creek generally did not have water quality problems related to dissolved oxygen, pH, turbidity, temperature, nutrients (nitrates and phosphates), and biochemical oxygen demand. However, the report indicated that none of the streams in the Seneca Creek watershed met the fecal coliform standard at all times.

From 1977 to 1985, Seneca Creek experienced a statistically significant trend of degrading water quality on the basis of total suspended solids (TSS) and fecal coliform (Maryland Department of the Environment [MDE] 1988). This trend appears to have stabilized, as the levels of TSS and fecal coliform decreased significantly between 1985 and 1987 (MDE 1988). Data for subsequent years indicate slightly elevated levels of TSS and fecal coliform (MDE 1991, 1994), but do not provide sufficient information to determine if the trend is increasing or decreasing. The improved water quality is evidenced by the reported health of the benthic macroinvertebrate community. Surveys completed over the years 1989-1993 indicate good, unimpaired habitat with a moderately impaired aquatic community (MDE 1991, 1994).

Interpretation of Trends

Water quality information available for the portion of Seneca Creek in the Potomac Subregion indicates that from 1977 through 1985, decreasing water quality was documented based on total suspended sediment and fecal coliform (MDE 1988). Prior to this period, water quality was characterized as good even though all streams failed the fecal coliform standard at times (M-NCPPC 1976). There was insufficient data to evaluate trends in stream biological resource conditions.

Sensitive Areas and Wetlands

Sensitive areas are defined by the 1992 State Planning Act as streams and their buffer; 100-year floodplains; steep slopes; and habitats of rare, threatened, and endangered species. For the purposes of this report, wetlands are also considered sensitive areas and are included in the relevant maps and tables. These features generally are contained within the stream valleys and in Lower Seneca are largely within parkland (see Figure 12).

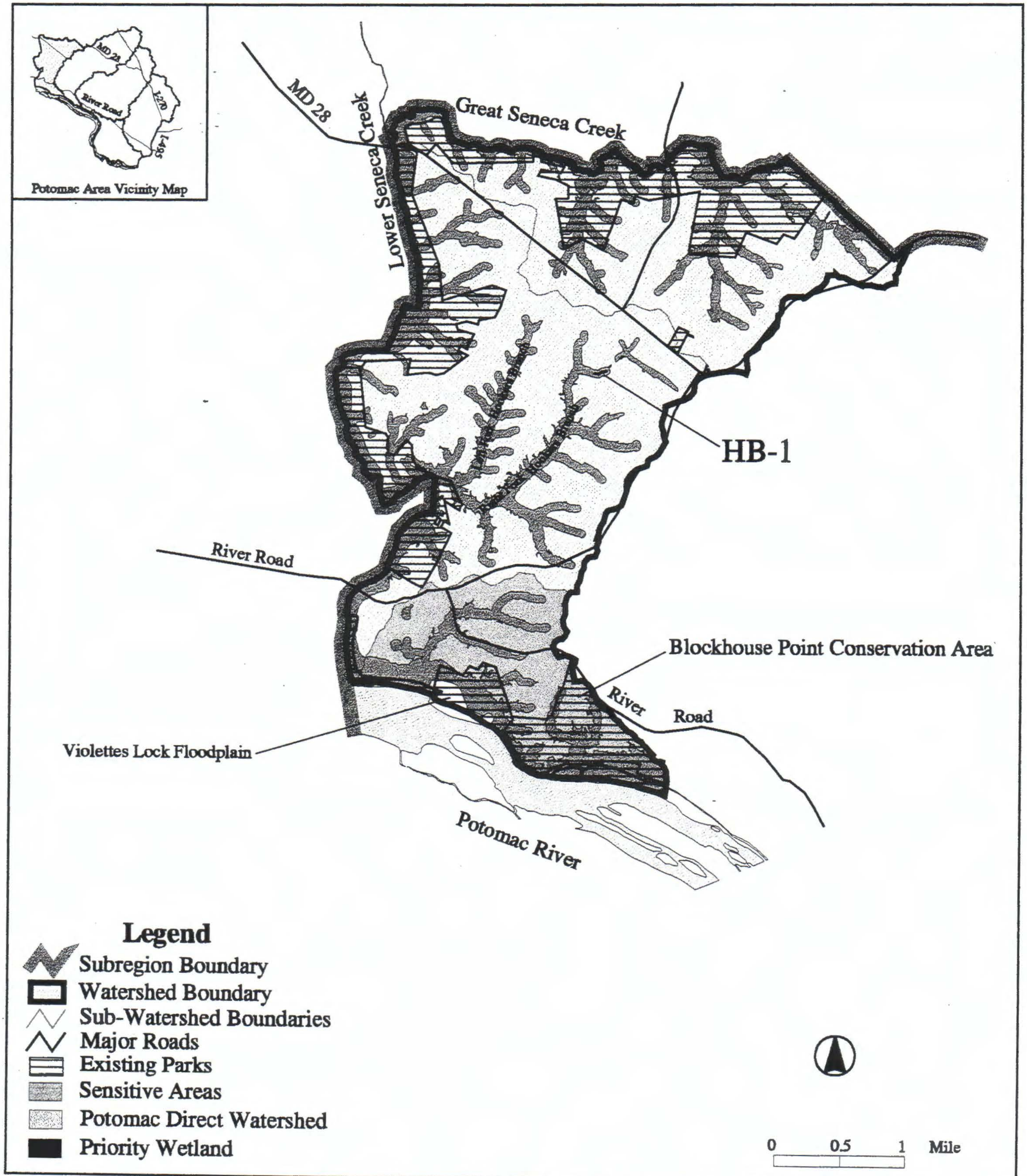
Wetlands are generally associated with the streams and floodplains in the watershed, and may extend beyond the floodplain. The Lower Seneca watershed within the Potomac Subregion has approximately 840 acres of wetlands (EA 1997a).

According to the 1981 National Wetland Inventory (NWI) maps, the dominant wetland types in the Lower Seneca watershed within the Potomac Subregion are forested, emergent, and open water wetlands. Most of the wetlands along the mainstem of Seneca Creek are located on State parkland.

Only one major tributary stream to Seneca Creek, Hookers Branch, is wholly within the study area. The Hookers Branch subwatershed contains high-quality headwater wetlands, excellent in-stream habitat, large areas of mature forest, and little fragmentation caused by roads and utilities. Of the four wetland assessment groups evaluated in the Potomac Wetlands Functional Assessment Study, only two were identified as having wetlands sufficient for scoring.

Lower Seneca Sensitive Areas

Figure 12



The headwaters of the right and left fork of Hookers Branch contain extensive areas of emergent and forested wetlands dominated by skunk cabbage (*Symplocarpus foetidus*), jewelweed, arrow arum (*Peltandra virginica*), sedges, black willow (*Salix nigra*), red maple, and spicebush. The wetland group HB1, headwater wetlands on the right fork above Meadowspring Road, was identified as a priority wetland.

Floodplain associated with the mainstem of Seneca Creek in the planning area is mostly contained within parkland. Known and estimated 100-year floodplain outside parkland includes areas associated with tributaries to the mainstem (e.g. Hookers Branch), and land between River Road and the Potomac River in the vicinity of the Bretton Woods Country Club.

Detailed floodplain studies of the Seneca Creek watershed were conducted in the late 1970s and early 1980s. In a 1983 report, CH2M-Hill (a consultant to the M-NCPPC) identified a number of structures and roadway crossings at risk of flooding and characterized the flooding problem near the confluence of Seneca Creek with the Potomac River as severe. The CH2M-Hill report confirmed the findings of an earlier study of Seneca Creek and Muddy Branch (M-NCPPC 1976), which had identified flooding problems in the same vicinity.

Muddy Branch

Watershed Character

The Muddy Branch watershed is urbanized in its headwaters, and suburban and reral in the Subregion. Substantial development occurs along the MD 28 corridor, as well as north of the Potomac Subregion in Gaithersburg. Other portions of the watershed, particularly in the southern and western areas, remain dominated by small farms and large lots, retaining a more rural character. A significant feature of this watershed is the amount of parkland present. These largely wooded areas contribute much to the rural feel of the watershed west of the PEPCO power line right of way, and serve as home to deer, wild turkey, and countless other birds, mammals, reptiles and amphibians. Larger forest blocks shelter forest interior-dwelling species.

Imperviousness in the Muddy Branch watershed ranges from 5 to 23 percent in the Potomac Subregion (see Table A-4 for additional details about subwatershed imperviousness).

Approximately 2500 acres of forest are present in this watershed within the Potomac Subregion (EA 1997a); (see Table 3). Most of this is relatively mature deciduous forest found in association with the stream valleys and adjacent uplands. Tree species include sycamore, red maple, black walnut, box elder, willow, tulip poplar, sycamore, green ash, river birch, white oak, hickories, American beech, red oak, dogwood, southern red oak (*Quercus falcata*), pin oak (*Quercus palustris*), and musclewood.

Water Quality

Current Conditions

In 1996, in support of the CSPS study, the Montgomery County Department of Environmental Protection monitored four mainstem stations between River Road and MD 28. The CSPS characterized the biological stream condition of Muddy Branch as fair in the city of Gaithersburg just north of the Potomac Subregion, with good stream conditions occurring within the Potomac Subregion (see Figure 10). The stream habitat condition mirrors the biological stream condition. Past and present water quality studies are summarized in Table A-6. Muddy Branch was included in the County's baseline monitoring in 1997 with a watershed report due to the Maryland Department of Environment in winter, 1998.

A study of the stream resource quality for the portions of Muddy Branch and its tributaries located in the city of Gaithersburg concluded that of the 10 stations evaluated, 6 scored fair, 2 scored good, and 2 scored poor (EQR 1996). The most significant feature limiting the quality of these streams was identified as uncontrolled stormwater runoff from portions of the city of Gaithersburg developed prior to the requirement for stormwater management controls.

Historical Data

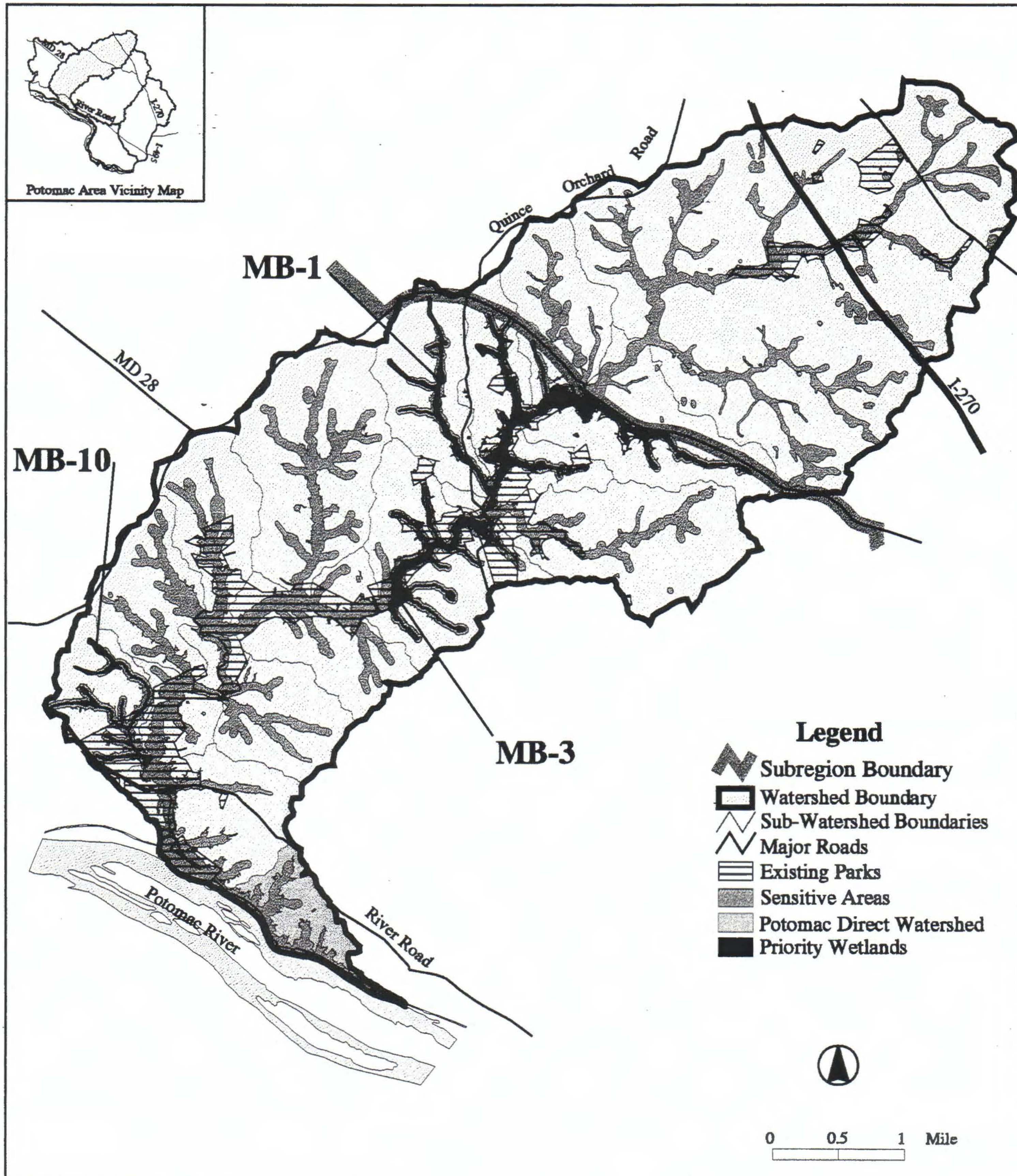
In 1976, a concept plan presented an overview of water quality conditions in the Muddy Branch watershed (M-NCPPC 1976). The plan contained a summary of water quality information for Muddy Branch for a period ending in 1972. The 1976 report concluded that Muddy Branch generally did not have water quality problems with dissolved oxygen, pH, turbidity, temperature, nutrients (nitrates and phosphates), or biochemical oxygen demand. However, this report indicated that none of the streams in the Muddy Branch watershed met the fecal coliform standard at all times.

Benthic macroinvertebrate sampling performed by the Maryland Department of Natural Resources (DNR) in 1991 at two locations on Muddy Branch (Esworthy Road and American Way) and Rich Branch, a tributary to Muddy Branch (Rich Branch Court), yielded Hilsenhoff Biotic Index (HBI) scores of excellent, good, and very good, respectively (Rivers, 1996).

Muddy Branch was categorized as having unimpaired stream habitat and a moderately impacted biological community (Maryland Department of the Environment [MDE] 1993, Garrison 1994).

Muddy Branch Sensitive Areas

Figure 13



Sensitive Areas and Wetlands

Sensitive areas are defined by the 1992 State Planning Act as streams and their buffers; 100-year floodplains; steep slopes; and habitats of rare, threatened, and endangered species. For the purposes of this report, wetlands also are considered sensitive areas and are included in the relevant maps and tables. These features generally are contained within the stream valleys and in the Muddy Branch large portions are within parkland (see Figure 13).

The Muddy Branch has approximately 719 acres of wetland areas within the Potomac Subregion (EA 1997a). The wetland areas in this watershed are often interrupted by road crossings, utility rights-of-way, and sewer line easements.

The National Wetland Inventory maps for this watershed depict forested, emergent, and open water wetlands as the dominant wetland types. The wetland assessment groups of the Muddy Branch watershed range from broad wetlands with additional areas of forest cover to narrow wetlands encroached upon by residential development and utility rights-of-way. Ten locations in the Muddy Branch watershed were evaluated for wetland function. The functional scores for the wetlands in the Muddy Branch watershed range from low to high, with the exception of the groundwater discharge function, which was in the moderate range. The variable scores reflect differences in wetland size, diversity of wetland vegetation, adjacent land use and other factors. Three wetland assessment groups were identified as priority wetlands based on the high composite scores for aquatic and wildlife habitat. They are:

- MB1 — mainstem and tributaries of Muddy Branch downstream of Darnestown Road to Rich Branch.
- MB3 — mainstem and tributaries of Muddy Branch east of Quince Orchard Road to Turkey Foot Road.
- MB10 — tributary east of Signal Tree Lane to its confluence with the mainstem of Muddy Branch.

Floodplain associated with the mainstem of Muddy Branch in the Potomac Subregion is contained within parkland. Known or probable 100-year floodplain areas outside parkland are associated with tributaries to the mainstem, and a portion of the mainstem outside the Potomac Subregion between MD 28 and Great Seneca Highway.

A detailed floodplain study of Muddy Branch identifies several flooding problems located primarily at roadway crossings with the mainstem (M-NCPPC 1976). The locations are depicted on the Water Resources Map of Montgomery County (M-NCPPC 1988).

Watts Branch Mainstem

For purposes of this report, the Watts Branch watershed is divided into four major subwatersheds (see Figure 9). The Watts Branch mainstem is the largest, flowing from the city of Rockville to the Potomac River. The Piney Branch, Greenbriar Branch, and Sandy Branch are larger tributaries that flow into the mainstem south and west of Glen Road. Descriptions of these subwatersheds begin on p. 37.

Watershed Character

Watts Branch is a watershed in transition. While much of the northern and eastern parts of the watershed have been developed for a number of years, significant portions of the northern and central watershed are currently under development . In addition, the large King Farm property in the Watts Branch headwaters in the city of Rockville is also undergoing development. The CSPS estimates that imperviousness in the upper Watts Branch watershed ranges from 22 to 33 percent, indicating a fairly intense level of development (see Appendix Table A-4 for detailed information on imperviousness). This portion of the Watts Branch watershed is beyond the boundaries of the Potomac Subregion, but has an impact on the stream within the Subregion.

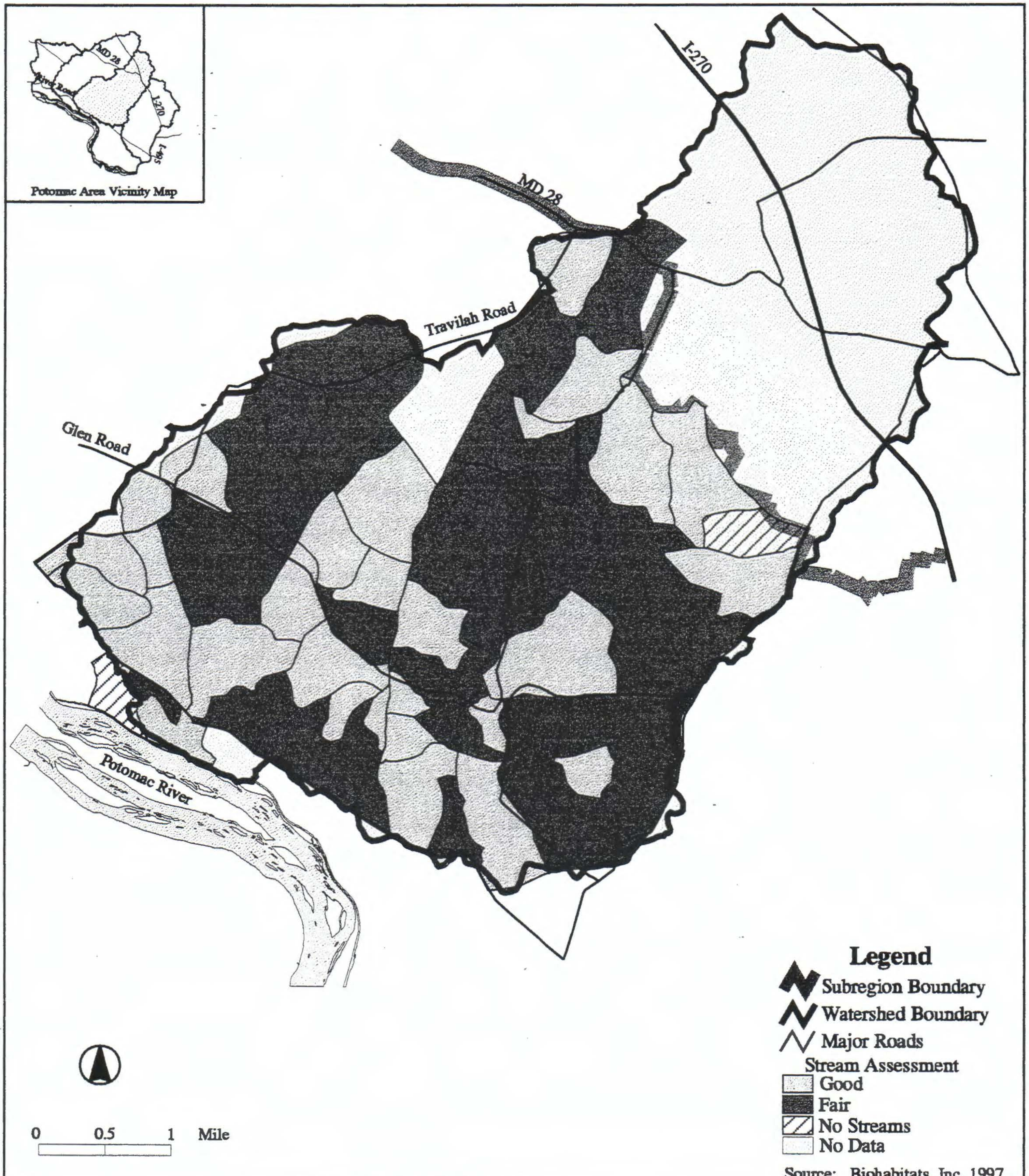
Meanwhile, the southern and western portions of the watershed remain relatively undisturbed, featuring a mix of small farms and large-lot development that has remained for many years. Current estimates reported in the CSPS for subwatersheds in this area range from 6 to 16 percent impervious.

As in the Seneca Creek and Muddy Branch basins, parkland is a central feature in the Watts Branch drainage area. Watts Branch Stream Valley Park shelters the Watts Branch mainstem and associated resources within the Potomac Subregion. Sensitive species of plants and animals are protected within the park's borders.

There are approximately 3,200 acres of forest in the Watts Branch watershed within the Potomac Subregion. These are predominantly deciduous forests, dominated by oak tree species in the uplands and by sycamore, tulip poplar, and red maple in the floodplains. Forest interior bird species occur in the lower part of the Watts Branch stream valley.

Watts Branch Rapid Stream Assessment

Figure 14



Water Quality

Current Conditions

The Watts Branch mainstem, including areas identified in the *Countywide Stream Protection Strategy* as upper Watts Branch, middle Watts Branch, and lower Watts Branch, is categorized as being in fair condition based on six water quality monitoring stations (MCDEP 1997) (see Figure 10).

In a study of Watts Branch using the rapid stream assessment technique (RSAT), Biohabitats, Inc. (1997) concluded that the overall RSAT scores for each of the catchments are in the fair to good range (see Figure 14). This was interpreted as evidence of slight to moderate levels of degradation. The sections of stream with the lowest ratings were in the most heavily developed portions of the watershed and included roadway crossings and reaches that were piped or severely eroded. Measurements of physical and chemical parameters were generally consistent with the Maryland Use I-P designation.

A study of the portion of the headwaters for Watts Branch upstream of Gude Drive was conducted as part of a large development project by Loiederman Associates (1996, 1997). The results of water quality sampling showed that all the parameters evaluated were within the normal ranges and that none exceeded the Use I-P limits. However, the benthic macroinvertebrate community present was categorized as "pollution tolerant," meaning that species sensitive to poor water quality were not present.

In 1997, a study for the city of Rockville was conducted (EA 1997b). A portion of this study included sampling fish and benthic macroinvertebrates at seven stations in Watts Branch and its tributaries in the headwater portions of Watts Branch (Scott Drive and upstream). The results of these sampling efforts were compared to reference streams identified by the Montgomery County Department of Environmental Protection. As a result, the seven stations were categorized as having marginal to suboptimal habitat conditions, with a poor macroinvertebrate community and a fair fish community (EA 1997b).

Historical Data

The water quality of Watts Branch was characterized as good in 1972 and excellent in 1973 (Gannett Fleming Corddry and Carpenter 1975) based on Montgomery County Department of Environmental Protection data on eight parameters, including temperature, dissolved oxygen, pH, BOD, nitrate, phosphate, turbidity, and total and fecal coliform. The lowest quality stream reach was the section upstream of Scott Drive in Rockville.

In 1990-1991, Maryland DNR (Gougeon 1990, Rivers 1991) and M-NCPPC (Van Ness, 1991) evaluated two stations in Watts Branch (Gregerscroft Road and Wootton Mill Park), and two stations in the lower portion of Piney Branch. Maryland DNR concluded that these streams display high water quality and diverse benthic and fish assemblages, with Piney Branch having higher water quality, and habitat suitable for trout in several of the areas evaluated. Field notes documented the limitations of physical habitat. Sixteen species of fish were recorded for the Gregerscroft station on Watts Branch, 7 species for the Wootton Mill Park station on Watts Branch, 17 species for Piney Branch upstream of Glen Road, and 9 species in Piney Branch at Glen Mill and Boswell Lane.

In 1996, Watts Branch was monitored as part of the County's baseline monitoring program with a watershed report due to the Maryland Department of the Environment in March, 1998.

Based on macroinvertebrate samples collected by Maryland DNR in 1991 at two stations in Piney Branch (Glen Road and Cutters Lane), a Hilsenhoff Biotic Index (HBI) score representative of very good conditions was indicated. Similar results were reported for samples collected at two stations on the mainstem of Watts Branch (at Gregerscroft Road and Aintree Court), although each of these stations also had early spring samples categorized as fair (Rivers, 1996).

In 1994, Watts Branch was categorized as having unimpaired stream habitat but a severely impacted biological community due to suburban runoff (Garrison 1994).

The Audubon Naturalist Society (ANS) conducted stream sampling at a station in Watts Branch (behind 10311 Glen Road) and at a station in Piney Branch (behind 11001 Glen Road) in 1994 and 1995. The results for stream habitat quality for Watts Branch and Piney Branch were representative of habitat in the marginal to suboptimal range. Similar results were reported in 1996 and 1997 in sampling efforts conducted by the ANS at three stations, one in the lower Watts Branch, and two in the upper Watts Branch at Woodley Gardens and at College Gardens. Stream habitat scores were categorized as marginal, suboptimal, and suboptimal, respectively.

Montgomery County Department of Environmental Protection monitoring (1996) of Watts Branch stream conditions in 1996 indicates that fish and benthic communities are in fair condition in upper Watts Branch and improved in the downstream areas.

Interpretation of Trends

While a considerable amount of historical information is available on the Watts Branch watershed (see Appendix,

Watts Branch Sensitive Areas

Figure 15

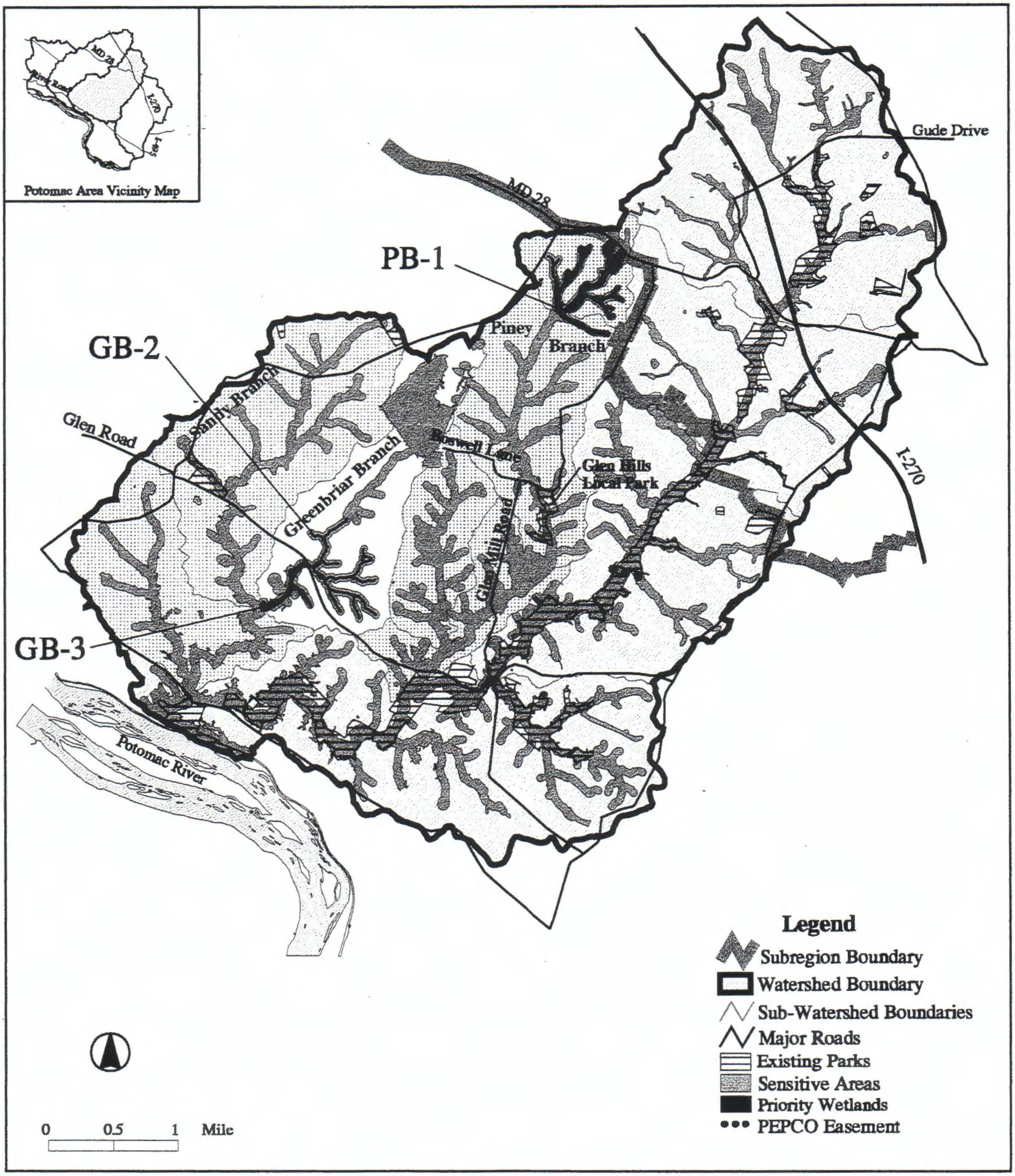


Table A-7), the existing data are neither uniform across the watershed nor sufficiently robust to support a generalized characterization of trends in stream condition. The subwatersheds of Watts Branch exhibit non-uniform characteristics that preclude extrapolating conclusions from one area to another. Monitoring at first was strictly chemical and physical. Later, biological and habitat monitoring were developed to give a more accurate picture of the conditions in the stream for various plants and animals. These two sampling methods are complementary, but are not necessarily comparable.

In the early 1970s, stream water quality in the Watts Branch watershed was regarded as good to excellent, except in portions of Rockville, where presumably urbanization was having a negative effect (Gannett Fleming Corddry and Carpenter 1975). Water quality appeared to decrease from excellent in 1976 to permissible until 1979. A water quality data gap for 1979 to 1990 precludes a discussion of that period, but the trend of degrading water quality beginning in 1977 likely continued in the portions of Watts Branch and its tributaries associated with urban development until the mid-1980s, when additional regulations to protect surface waters were adopted (e.g., Maryland stormwater regulations). It is unlikely that such a trend of degradation occurred in the portions of the Watts Branch watershed not subjected to land development activities (e.g., lower Watts Branch and its tributaries and Piney Branch). Water quality data for the period 1991 through 1997 are within normal ranges, and it is likely that the existing trend for base flow conditions would best be characterized as stable or improving.

Benthic macroinvertebrate data covers the period 1991 through 1997, but no trend is evident. Generally the macroinvertebrate data indicate stream conditions in the fair range, which agrees with the CSPS conclusions.

Fisheries data for the upper reach of Watts Branch include a survey from 1972, and a series of surveys from 1990 through 1997. It appears that this resource is on a degrading trend, with taxa richness decreasing from 22 species in the 1972-1974 period to less than a dozen species in 1997. However, many variables, such as sampling efforts, are not accounted for and therefore a degrading trend may not be representative of the entire Watts Branch watershed.

Stream habitat data for the period 1993 through 1997 are insufficient to support a characterization of any trend of the stream habitat. These survey methods have only recently been developed and were not conducted historically.

Sensitive Areas and Wetlands

Sensitive areas are defined by the 1992 State Planning Act as streams and their buffers; 100-year floodplains; steep slopes; and habitats of rare, threatened, and endangered species. For purposes of this report, wetlands also are considered sensitive areas and are included in the relevant maps and tables. These features generally are contained within the stream valleys and in the Watts Branch mainstem are largely within parkland (see Figure 15).

Wetlands in this watershed are closely associated with the stream system, with vernal pools, seeps, and other areas of standing water present. Deciduous forested wetlands are the predominant wetland type. Approximately 1,075 acres of wetland areas are present in this watershed within the Potomac Subregion (EA 1997a).

Wetlands along the Watts Branch mostly are located within parklands bordering the mainstem. The habitat value of these wetlands varies depending on the width of the park and proximity to development. Wetlands adjacent to large tracts of forest or meadow have the highest habitat value. Along the upper Watts Branch mainstem are extensive forested wetlands and vernal pools, seasonally flooded shallow depressions that provide important habitat for breeding amphibians. Along lower Watts Branch are several large wet meadows with cattails, cinnamon fern (*Osmunda cinnamomea*), swamp milkweed (*Asclepias incarnata*), dogwood, buttonbush (*Cephalanthus occidentalis*), asters, and goldenrod. The wetlands in this watershed are often fragmented by the placement of utility rights-of-ways (e.g., gas and electric, sanitary sewer, etc.).

Twenty locations in the Watts Branch watershed were evaluated for wetland function. Six were located on the mainstem of Watts Branch, six in the Piney Branch subwatershed, one in the Sandy Branch subwatershed, one in the Stoney Creek subwatershed, three in the Greenbriar Branch subwatershed and three in the Kilgour Branch subwatershed. The functional scores for wetlands in the Watts Branch watershed range from low to high, depending on the condition of the wetlands in each assessment group. KB1, for example, in the upper reaches of Kilgour Branch, has low scores due to a piped stream channel and development that filled in the historic wetland. Three of these wetland assessment groups were identified as priority wetlands based on their high composite scores for aquatic and wildlife habitat. These three Wetland assessment groups are described below (see Figure 15):

- PB1 — two headwater tributaries of Piney Branch.
- GB2 — Greenbriar Branch south of Palatine Road to Glen Road.
- GB3 — West of Glen Road to confluence with Sandy Branch

The wetland areas documented by the M-NCPPC in this watershed include forested, emergent, and open water wetlands. In-stream habitat associated with the forested, scrub-shrub, and emergent wetlands is moderately to severely stressed throughout the Watts Branch watershed. Streambank erosion, downcutting within the channel, tree loss, extensive deposition, and heavy sediment loads were observed during field investigations.

Kilgour Branch Stream Valley Park in the Kilgour Branch subwatershed contains extensive areas of mature forest with many large specimen trees. Forested wetlands, seasonally or permanently flooded, are the predominant wetland type. These wetlands are dominated by red maple, sycamore, box elder, and spicebush. A large beaver dam has flooded an area of willows and red maples, creating a large swamp and an excellent habitat for wildlife.

Floodplain associated with the mainstem of Watts Branch and its Kilgour Branch tributary is generally contained within park boundaries. However, most of the 100-year floodplain associated with the remaining tributaries to Watts Branch extends onto privately owned land. This includes Piney Branch, Sandy Branch, and Greenbriar Branch.

Several bridges located along the mainstem may be impacted by the 100-year floodplain (Greenhorn and O'Mara, Inc. 1978). These locations are depicted on the Water Resources Map of Montgomery County (M-NCPPC 1988). Flooding problems in the vicinity of the Watts Branch crossings with Wootton Parkway and Glen Road were noted in an earlier report focusing on storm runoff problems (Gannett Fleming Corddry and Carpenter 1975).

Piney Branch

Watershed Character

The Piney Branch is a developing subwatershed within the Watts Branch basin (see Figure 15). The stream conditions in Piney Branch have been determined to be of high quality. In recognition of these facts, Piney Branch has been designated a special protection area (SPA).

Special protection areas have been designated where high quality or sensitive water resources and related environmental features are threatened by proposed land uses and a higher level of protection is needed (M-NCPPC 1997). Development in these areas is subject to a requirement to prepare a water quality plan, and to provide expanded wetland buffer widths, and expanded and accelerated forest conservation requirements. Current estimates of existing imperviousness in Piney Branch range from 6 to 10 percent according to the CSPS (see Appendix Table A-4).

Forests in the Piney Branch basin are generally associated with the stream channel and adjacent slopes and include various oak species, sycamores and tulip poplars (M-NCPPC 1997).

Water Quality

Current Conditions

The Piney Branch subwatershed of Watts Branch is categorized by the CSPS as having water quality in the fair-to-good range (MCDEP 1997). Piney Branch has lower quality stream conditions in the area around Glen Hill Local Park. The entire watershed, with the exception of the uppermost reaches, was stressed by the droughts occurring in previous years as well as by sediment deposition from developments approved before special protection requirements were in force. With strict adherence to special protection area requirements for new development, the Piney Branch should recover (Van Ness, 1997).

In a study of Piney Branch using the rapid stream assessment technique (RSAT), Biohabitats (1997) concluded that the overall RSAT scores for each of the catchments is in the fair-to-good range (see Figure 14).

Historical Data

Since 1994, the Montgomery County Department of Environmental Protection has monitored the Piney Branch Special Protection Area for fish, benthic macroinvertebrates, stream habitat, and selected physical parameters. Appendix Table A-7 contains a table summarizing historical and current water quality monitoring information.

Sensitive Areas and Wetlands

Sensitive areas are defined by the 1992 State Planning Act as streams and their buffers; 100-year floodplains; steep slopes; and habitats of rare, threatened, and endangered species. For the purposes of this report, wetlands also are considered sensitive areas and are included in the relevant maps and tables. These features generally are contained within the stream valleys and inPiney Branch are largely outside parkland (see Figure 15). Floodplain associated with Piney Branch extends onto privately owned land. Protection of these areas relies on the implementation of the *Environmental Guidelines* and County floodplain regulations.

The headwaters of Piney Branch originate from several springs and seeps south of Darnestown Road, eventually flowing into two small streams, which form the right and left forks of Piney Branch. This headwater area (undeveloped at the time of this survey) has high functional value for terrestrial and aquatic life provided by the streams, wetlands and forest and by the lack of development. This area, wetland assessment group PB1, was identified as a priority wetland. Farther downstream, chains of vernal pools and small braided streams near or within the sewer line right-of-way create excellent habitat near the Piney Branch mainstem. Within the more developed areas of the Piney Branch watershed are large wet meadows and forested wetlands, dominated by cattails, rushes and sedges, or red maple and ash. The wetland areas in this watershed are often interrupted by road crossings, utility rights-of-ways, and sewer line easements. With the exception of Glen Hills Park, floodplain associated with Piney Branch extends onto privately owned land.

Greenbriar Branch

Watershed Character

Most of the upper Greenbriar Branch subwatershed is underlaid by serpentine outcrops. The soil in these areas is thin and severely limits development. In addition, the plant and animal communities that are present include species considered to be rare in the region and in some cases rare in the world.

The natural vegetation of the Greenbriar Branch watershed, as with the Watts Branch watershed as a whole, is dominated by deciduous species, specifically red and white oaks. Other tree species within this watershed include sycamore, tulip poplar, and red maple. In the upper portion of the Greenbriar Branch watershed, the influence of the serpentine soils can be observed where post oak, blackjack oak, and pitch pine become significant components of the forest.

Water Quality

Current Conditions

The Greenbriar Branch tributary to Watts Branch is identified in the *Countywide Stream Protection Strategy* as a stream in good habitat and overall fair biological condition (MCDEP 1997).

In a study of Greenbriar Branch using the rapid stream assessment technique (RSAT), Biohabitats, Inc. (1997) concluded that the majority of the RSAT scores for each of the catchments is in the good range with one catchment, the Greenbriar East tributary, receiving a fair score (see Figure 14).

Historical Data

Historical water quality information specific to the Greenbriar Branch is not available.

Sensitive Areas and Wetlands

Sensitive areas are defined by the 1992 State Planning Act as streams and their buffers; 100-year floodplains; steep slopes; and habitats of rare, threatened, and endangered species. For the purposes of this report, wetlands also are considered sensitive areas and are included in the relevant maps and tables. These features generally are contained within the stream valleys and in Greenbriar Branch are largely outside parkland (see Figure 15). Floodplain associated with Greenbriar Branch extends onto privately owned land. Protection of these areas relies on the implementation of the *Environmental Guidelines* and County floodplain regulations.

The wetland areas within this watershed are generally closely associated with the stream valley; however, wetland areas also occur outside the floodplain. Several seeps and ponds are present in the vicinity of the stream valley. The floodplain canopy and adjacent slopes are dominated by deciduous species. The understory plants vary by location.

The headwaters of Greenbriar Branch once originated on the land now occupied by the Rockville Crushed Stone Quarry. Rainwater that accumulates in the quarry now is pumped through a regulated discharge to the Sandy Branch. Greenbriar Branch now begins southwest of the power line crossing, where several seeps form long, braided channels. These wetlands are dominated by red maple, red and white oak, and hickory. The lower watershed contains two abandoned farm ponds with standing water containing emergent plants. Both ponds are surrounded by forested wetlands. The wetland assessment areas GB2 and GB3 were designated as priority wetlands based on their high scores for aquatic and wildlife habitat (see Figure 15).

The wetland areas in this watershed are moderately fragmented by road crossings, utility line rights-of-way, and sewer line easements.

Sandy Branch

Watershed Character

Sandy Branch is part of the larger Watts Branch watershed (see Figure 15). This drainage basin has been relatively undeveloped, with imperviousness ranging between six to nine percent (see Appendix Table A-4). Recent and current development is creating significant changes, especially in the headwaters areas. Serpentine soils cover much of the area, bringing with them the limitations to development and changes to native vegetation discussed in earlier sections. The forests of the Sandy Branch watershed, as with the Watts Branch watershed as a whole, are dominated by deciduous species, specifically red and white oaks. Other tree species within this watershed include sycamore, tulip poplar, and red maple.

As noted in the discussion of the Greenbriar Branch watershed the Rockville Crushed Stone Quarry discharges to the uppermost part of the Sandy Branch subwatershed. The flow in the Sandy Branch tributary nearest the quarry is significantly influenced by the flow from the pumps rather than normal rainfall events and groundwater.

Water Quality

Current Conditions

The Sandy Branch tributary to Watts Branch is separated in the *Countywide Stream Protection Strategy* report into upper Sandy Branch and lower Sandy Branch. Upper Sandy Branch is categorized as having fair stream conditions; lower Sandy Branch conditions are rated good. (MCDEP 1997).

Historical Data

The water quality of Sandy Branch, a tributary to Watts Branch, was characterized as good in 1972 and excellent in 1973 (Gannett Fleming Corddry and Carpenter 1975) based on Montgomery County Department of Environmental Protection data on eight parameters, including temperature, dissolved oxygen, pH, BOD, nitrate, phosphate, turbidity, and total and fecal coliform.

In a study of Sandy Branch using the rapid stream assessment technique (RSAT), Biohabitats, Inc. (1997) concluded that the overall RSAT scores for each of the catchments is in the fair-to-good range (see Figure 14).

Sensitive Areas and Wetlands

Sensitive areas are defined by the 1992 State Planning Act as streams and their buffers; 100-year floodplains; steep slopes; and habitats of rare, threatened, and endangered species. For the purposes of this report, wetlands also are considered sensitive areas and are included in the relevant maps and tables. These features generally are contained within the stream valleys and, in Sandy Branch, are largely outside parkland (see Figure15). Floodplain associated with Sandy Branch generally extends onto privately owned land. Protection of these areas relies on the implementation of the *Environmental Guidelines* and County floodplain regulations.

The wetlands in the Sandy Branch watershed are forested and include communities of red maple, sycamore, tulip poplar, and beech. Several small wetlands within the floodplain are covered with invasive vegetation such as Asiatic tearthumb (*Polygonum perfoliatum*) which has little value for wildlife. The headwaters of Sandy Branch have been piped and the stream flows through concrete and grass swales. Wetlands associated with these headwaters have been filled for residential development, prior to State wetland regulations.

Cabin John Creek

Watershed Character

Located in the eastern portion of the Potomac Subregion, Cabin John is the most developed watershed in the Potomac Subregion (see Figure 16). The headwaters of this stream lie outside the Potomac Subregion, as do a number of tributary streams. Approximately two-thirds of the watershed is more than 20 percent impervious, and approximately one-half the watershed is more than 25 percent impervious (MCDEP 1997). Within the Potomac Subregion, levels of imperviousness in the Cabin John Creek range from 11 to 27 percent (see Appendix Table A-4).

Stream conditions in the Cabin John Creek watershed are typical of an urbanized area, including reduced baseflow, increased channel flow velocities during stormwater runoff events, degraded water quality, and degraded instream habitat.

Forests in the Cabin John Creek watershed include a combination of deciduous and coniferous/evergreen species. Tree species present in this watershed include white oak, tulip poplar, American beech, red maple, white ash, box elder, white pine (*Pinus strobus*), pawpaw (*Asimina triloba*), mountain laurel, dogwood, viburnum, and spicebush (Shosteck 1978). Approximately 1,800 acres of forest areas are present in this watershed within the Potomac Subregion (EA 1997a).

Woodland stands of any significant size present in the Cabin John Creek watershed occur primarily in the stream valley and on the adjacent slopes within parkland. Woodland plants and wildlife, including forest interior dwelling species that require large stands of woodland, are found in these forests (see Figure 5).

Water Quality

Current Conditions

Cabin John Creek was monitored in 1996 as part of the County's baseline monitoring program. The upper Cabin John Creek was described as in fair stream condition; Buck Branch, Ken Branch, and Congressional Branch in good condition; and the Deborah Drive tributary, lower Old Farm tributary, and Capital Beltway (I-495) Branch were found to be in poor condition. The middle mainstem and lower mainstem are in fair condition.

The *Countywide Stream Protection Strategy* (DEP, 1997) categorizes Cabin John Creek as having degraded habitat areas as a result of uncontrolled stormwater from North Bethesda and Rockville. Overall, the stream resource condition in Cabin John Creek is categorized as fair to poor.

In addition, the CSPS (1997) indicated several tributaries of Cabin John Creek that appear to be capable of supporting an improving fish community, indicating that the trend of resource degradation in Cabin John Creek may be reversing.

Historical Data

A study published in 1982 by CH2M-Hill concluded that Cabin John Creek consistently exceeded Maryland water quality limits for fecal coliform over the period 1971 through 1979, but seldom exceeded State standards for dissolved oxygen, temperature, or turbidity based on the monitoring studies conducted by the Montgomery County Department of Environmental Protection.

From 1977 to 1985, Cabin John Creek has experienced a trend of degradation in stream quality on the basis of total suspended sediment loads. While this trend was reported, it was not statistically significant (Maryland Department of the Environment 1988).

A study of the aquatic resources in seven streams comprising the headwater sections of Cabin John Creek north of Montrose Road (Galli and Trieu 1994) was conducted using the Rapid Stream Assessment Technique (RSAT). This study concluded that the streams were best characterized as being in fair condition, due primarily to uncontrolled stormwater input from approximately 60 to 70 percent of the developed watershed. This resulted in widened and degraded stream channels, reduced baseflow, and lower water quality during periods of high flow. A number of restoration concepts and site-specific actions were identified and recommended, including the removal of six barriers to fish movement.

Stream survey work conducted by the Audubon Naturalist Society at one station in Cabin John Creek (mainstem of creek off Democracy Boulevard behind Locust Grove Nature Center) from 1994 to 1995 indicated stream habitat quality was in the marginal to suboptimal range.

A study of the entire Cabin John Creek watershed using RSAT was conducted between 1992 and 1995 (Galli et al. 1996), with the conclusion that stream conditions were generally fair. Eight tributary and nine mainstem stations had RSAT scores ranging from 14 to 31, with all but two of these scores in the fair range; and of the two scores outside this range, one was in the good range and one was in the poor range. The study reported that the stream habitat was limited, with approximately six percent of the length of Cabin John Creek categorized as severely eroded. Thirteen exposed sewer lines were identified; and widespread channel degradation (downcutting), excess sediment deposition, and bar formation were observed in other reaches. Barriers to fish movement were identified. Water quality was generally fair to somewhat poor. The study indicated that Cabin John Creek and its tributaries generally had good riparian habitat conditions, and good benthic invertebrate community condition. The study also recommended a number of restoration concepts and specific stream reaches suitable for restoration.

Interpretation of Trends

The circumstances outlined above, combined with the fact that much of this watershed was developed without the benefit of modern environmental regulations (MCDEP 1997), provide a ready explanation for the evident historic pattern of degraded aquatic resources. The water quality of the basin for the entire period of record (since 1971) has been plagued with fecal coliform levels in excess of Maryland water quality standards. In addition, total suspended sediments (TSS) have been an issue from the mid-1970s to the mid-1980s. Baseflow water quality is reported to have improved since the mid-1980s, but the State monitoring reports (MDE 1991, 1994) reported high bacteria, high nutrients, and high TSS, which are characteristic of a degraded resource.

Stream habitat is not a useful measure for comparing existing stream conditions to historic stream conditions because this measurement was not a standard part of stream assessments prior to about 1988.

The information on the macroinvertebrate community in the Cabin John basin is insufficient for evaluating trends in the resource.

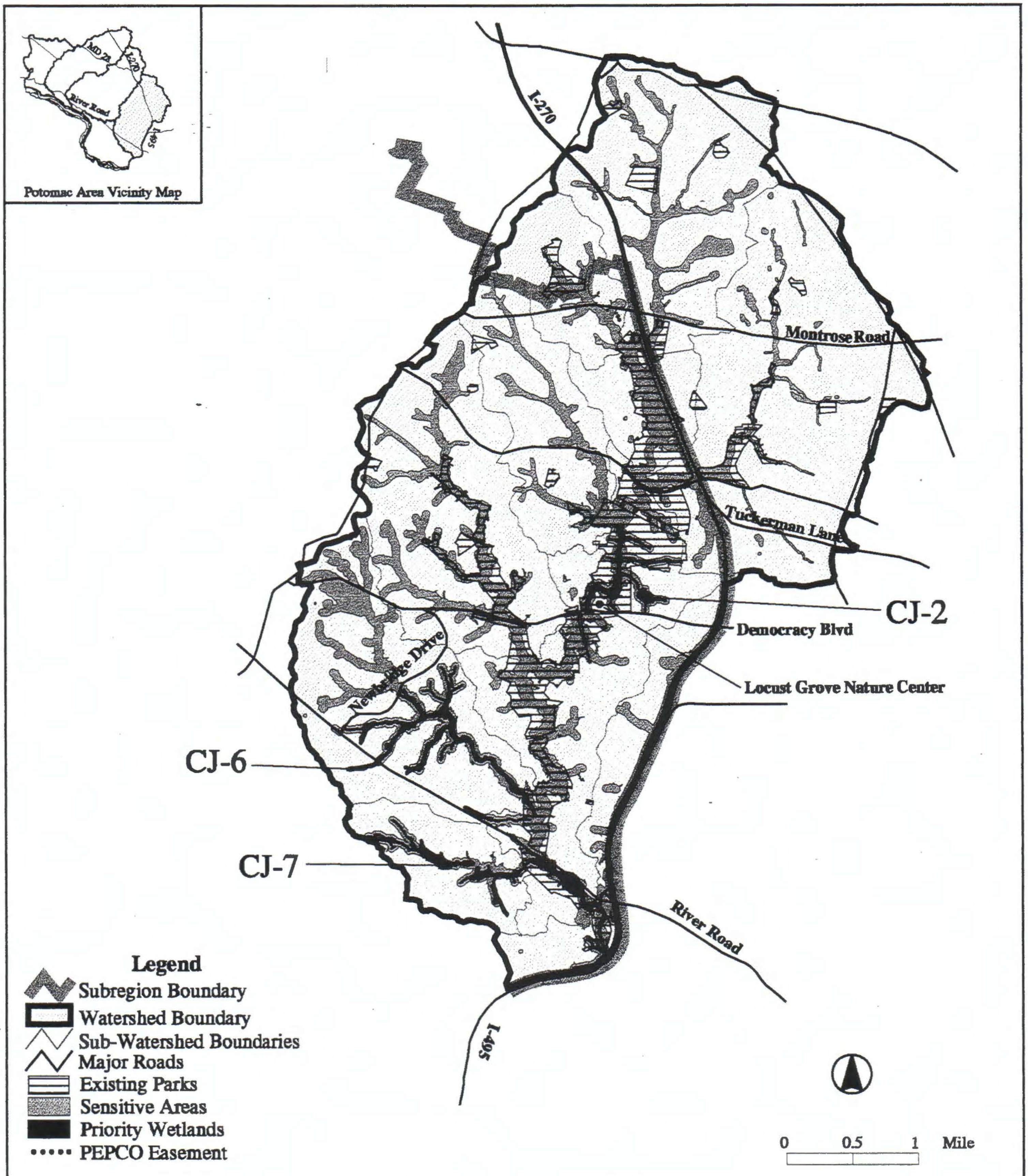
Data from fish sampling efforts conducted as early as 1899 are available for this basin and indicate that from the late 1800s to the mid-1940s, a diverse assemblage of fish was present in this watershed. Thirty years later Dietemann (1975) reported a reduced diversity overall, with only pollution-tolerant species remaining in the more developed portions of the watershed. More recently, Galli and Trieu (1993) documented 52 barriers to fish movement in this basin. Clearly, between the mid-1940s and mid-1970s, the trend was one of degradation.

Sensitive Areas and Wetlands

Sensitive areas are defined by the 1992 State Planning Act as streams and their buffers; 100-year floodplains; steep slopes; and habitats of rare, threatened, and endangered species. For the purposes of this report, wetlands also are considered sensitive areas and are included in the relevant maps and tables. These features generally are contained within the stream valleys and in the Cabin John Creek mainstem are largely within parkland (see Figure 16).

Cabin John Creek Sensitive Areas

Figure 16



The wetlands of the Cabin John Creek watershed are generally associated with the channel. The canopy of the floodplain and the adjacent slopes is dominated by deciduous species.

Although Cabin John Creek has been severely degraded by excessive stormwater flows, channel erosion, and sedimentation, the surrounding parklands serve as habitat "islands" within this densely developed area of the Potomac Subregion. Forested wetlands and vernal pools are the most common wetland types. The wetlands are associated with a canopy of red maple, tulip poplar, red oak, and beech.

The understory plant species vary by location. Approximately 760 acres of wetland areas are present in this watershed within the Potomac Subregion (EA 1997a).

Wetland types that are mapped by National Wetland Inventory are dominated by forested, emergent, and open water wetland areas in this watershed. Generally, the wetland assessment groups of the Cabin John Creek watershed occurring in parkland represented the best wetland conditions in the watershed. Throughout the watershed, the forested canopy cover was interrupted by an overwide stream channel, a high-density network of perpendicular and parallel roads and utility rights-of-way, and residential/commercial development.

Eight locations in the Cabin John Creek watershed were evaluated for wetland function, one of which was located in Buck Branch. The wetlands of the Cabin John Creek watershed generally received moderate-to-high scores for the five wetland functions evaluated. Three of these wetland assessment groups were identified as priority wetlands based on the high composite scores for aquatic and wildlife habitat. The locations of these wetland assessment groups are listed below (see Figure 16):

- CJ2— mainstem and tributaries of Cabin John Creek from PEPCO right-of-way downstream to Democracy Boulevard.
- CJ6 — tributary southeast of Newbridge Drive to confluence with mainstem.
- CJ7 — mainstem and tributaries of Cabin John Creek along south side of River Road to I-495.

Floodplain associated with the mainstem of Cabin John Creek and its Buck Branch tributary is generally contained within park boundaries. Floodplain associated with the remaining tributaries to Cabin John Creek in the planning area extend onto private land. This includes Snakeden Branch, Ken Branch, Bogley Branch, and other small tributaries.

A report on flooding in the Cabin John Creek watershed concluded that currently it is not a serious problem (CH2M-Hill 1982). The report did inventory a number of locations where flooding of property, including houses, was likely to occur. The most noteworthy location within the Potomac Subregion was the mainstem of Cabin John Creek and the Bull Run tributary in the vicinity of Bradley Boulevard.

Rock Run

Watershed Character

Rock Run is the only watershed entirely within the Potomac Subregion with the exception of the very small tributaries that flow directly into the Potomac River (see Figure 17). This watershed is noted for historic gold mining and a steep stream gradient. Evidence of the gold mining is still seen in areas of Rock Run where the stream channel was blasted with dynamite. Toxic chemicals also may have been used to separate the gold from the parent ore material.

Rock Run is a watershed with steep forested slopes adjacent to forested floodplains. Approximately 800 acres of forest areas are present in the watershed (EA 1997a). Tree species include tulip poplar, box elder, sycamore, white oak, southern red oak, dogwood, and musclewood. Virginia pine, chestnut oak, black cherry, American beech, red maple, and basswood (*Tilia americana*) are also present (Shosteck 1978). Some of the larger forest blocks may be capable of supporting forest interior dwelling bird species.

Although the village of Potomac is located in the headwaters, the Rock Run watershed has, to date, escaped many of the effects of urbanization common in watersheds developed years earlier (e.g., Watts Branch and Cabin John Creek). Much of the watershed is dominated by large lot subdivisions, with higher density residential development interspersed, especially near the Village of Potomac and in the southern portion of the watershed. Imperviousness in the Rock Run watershed is estimated by the CSPS to be in the range of 25 to 30 percent.

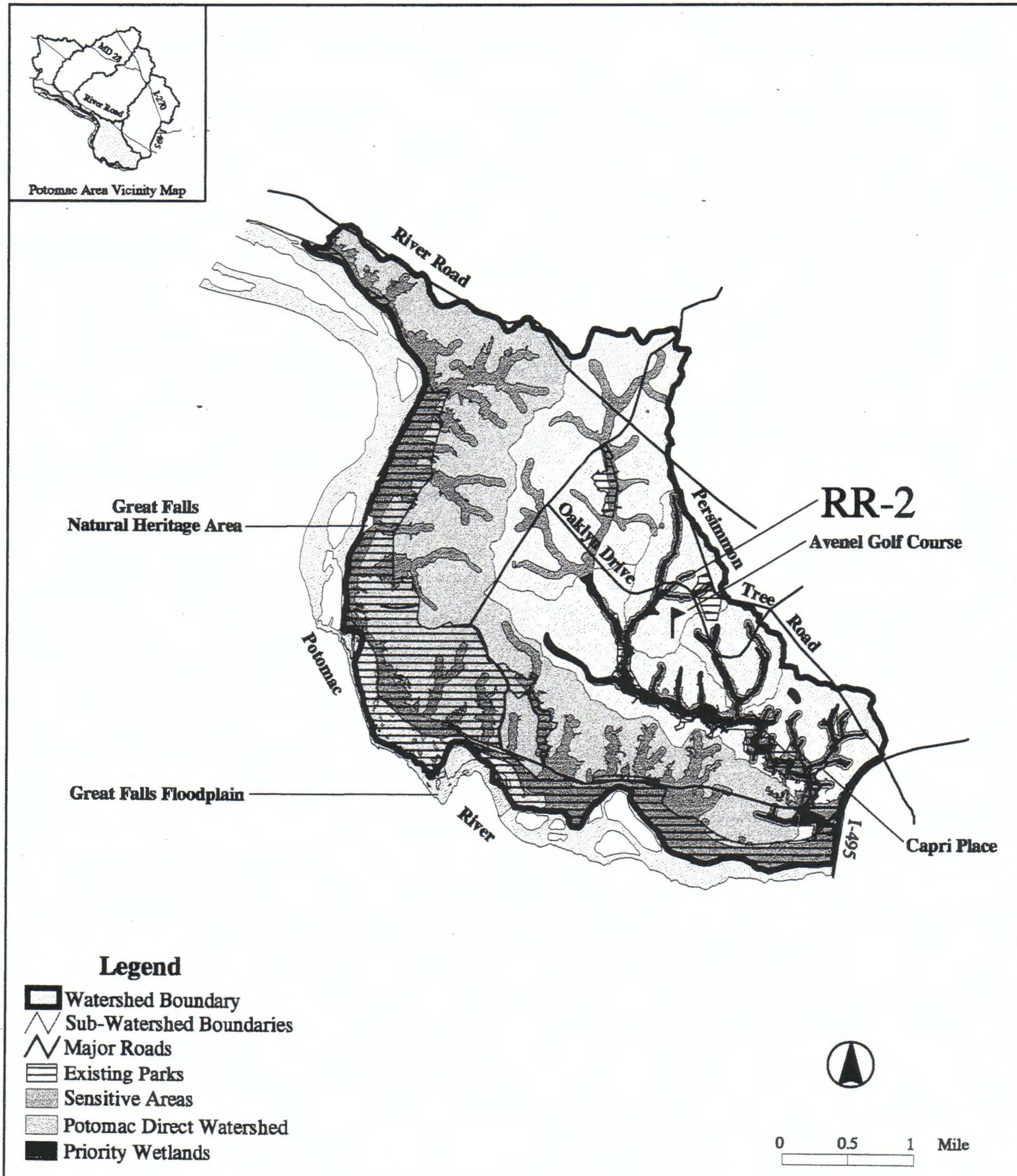
Water Quality

Current Conditions

The *Countywide Stream Protection Strategy* (MCDEP, 1997) indicates that the stream habitats in Rock Run are generally good, due in part to the forested cover remaining in and around the stream valleys of Rock Run. The macroinvertebrate community was identified as an indicator of some degree of impairment, based on low population levels. The CSPS concludes that the water quality is impaired because it does not attain the type of biological communities that are indicated by its stream habitat. Upper Rock Run has a poor overall resource condition; lower Rock Run has a fair condition overall.

Rock Run and Potomac Direct Sensitive Areas

Figure 17



Historical Data

A study conducted by CH2M-Hill (1982), concluded that Rock Run exceeded Maryland water quality criteria for fecal coliform in 1972, 1976, 1977, and 1979, while other monitored parameters (dissolved oxygen, temperature, and turbidity) were within State standards, based on the monitoring studies conducted by the Montgomery County Department of Environmental Protection. (See Appendix Table A-9 for a summary of historical and current water quality monitoring.)

A habitat assessment performed by the Audubon Naturalist Society at two stations in Rock Run in 1995 in the vicinity of MacArthur Boulevard characterized the stream habitat as suboptimal to optimal.

A study of a proposed sewer crossing in the vicinity of Capri Place found a diverse and healthy benthic community on a tributary of Rock Run.

Interpretation of Trends

Little information is available to evaluate trends in stream conditions. Water quality monitoring results indicate that the fecal coliform standard frequently (i.e., 50 percent of the time) is exceeded (CH2M-Hill 1982). The water quality of Rock Run continues to be a problem, as evidenced by the presence of good stream habitat but an impaired invertebrate community (MCDEP 1997).

Habitat conditions are characterized as good to excellent for the 1995 to 1997 time frame, with no habitat data from earlier periods. As presented above, the invertebrate community has been characterized as impaired on the basis of low invertebrate population levels.

On the basis of fish collections from 1915 and 1974, fish diversity remained excellent when fish diversity in other streams (e.g., Cabin John) was reduced. However, based on information presented in the 1996 CSPS, fish diversity has been reduced by approximately 50 percent from 1974 to the present, based on a record of 21 species in 1915; 21 species in 1974; and 11 species in 1996. Such a decrease could result from degraded water quality, or from unrelated sampling issues (reduced sampling effort, etc.).

Sensitive Areas and Wetlands

Sensitive areas are defined by the 1992 State Planning Act as streams and their buffers; 100-year floodplains; steep slopes; and habitats of rare, threatened; and endangered species. For the purposes of this report, wetlands also are considered sensitive areas and are included in the relevant maps and tables. These features generally are contained within the stream valleys and, in Rock Run, are largely outside parkland (see Figure 17).

Approximately 425 acres of wetland areas are present in this watershed within the Potomac Subregion (EA 1997a). Forested wetlands, vernal pools, and small ponds are the most common wetland types in this watershed. The wetlands occur near the mainstem and tributaries of Rock Run or at the base of steep slopes, where groundwater discharges form springs or seeps. Wetland vegetation includes tulip poplar, sycamore, box elder, white oak, dogwood, and multiflora rose.

The Rock Run mainstem has a relatively steep gradient when compared to other surface waters in the Potomac Subregion. Although this small watershed was developed prior to stormwater management regulations, it includes parkland and golf course areas that reduce the adverse impact of excessive stormwater flows on wetlands in the watershed.

Two groups of wetlands in the Rock Run watershed were evaluated for wetland function. Based on the scores for these wetland assessment groups, it can be concluded that the wetlands have functional scores in the moderate to good range. Based on the composite habitat score (sum of aquatic and wildlife habitat scores), RR2 was identified as a priority wetland area. This wetland assessment group includes the mainstem and tributaries of Rock Run from the confluence of Rock Run with the Potomac River upstream to the vicinity of Oaklyn Drive.

Floodplain associated with Rock Run is not all contained within parkland. About half the known floodplain areas extend onto privately owned land. Several areas were identified as having a potential for flooding (CH2M-Hill 1982). Most of theses areas are located in the steep headwaters of Rock Run between River Road and Falls Road.

Regulatory and Policy Framework for Environmental Planning in the Potomac Subregion

Master planning attempts to balance appropriate land uses and zoning intensities with environmental protection goals adopted by federal, State and local government. Environmental assessments are conducted during the master planning process to assure that land use and density decisions are made with knowledge of sensitive environmental resources and potential impacts. While many environmental regulations and guidelines are applied at the time of subdivision or site plan, the master plan recommends appropriate zoning and development to allow the development process to proceed more smoothly. The process avoids conflicts between the natural environment and development where possible or addresses potential impacts when other goals are judged more important.

While many environmental regulations and guidelines are applied at the time of subdivision or site plan, the master plan recommends appropriate zoning and development to allow the development process to proceed more smoothly. The process avoids conflicts between the natural environment and development where possible or addresses potential impacts when other goals are judged more important.

The information in this chapter sets forth the environmental framework established by federal, State and local laws, regulations and policy by subject area (see Table 8 for a chronology of environmental policy and regulation). This framework is reflected in the *1993 General Plan Refinement* for Montgomery County in the chapter on Environment. (Figure 18 shows the legislative guidance within the *General Plan Refinement* goals.) The information on existing environmental conditions in Chapter 1, and in the data and mapping conducted as part of the environmental study support the master plan by providing the baseline information as it relates to the legislation and policies affecting the Potomac Subregion.

Water Quality Management

The need for protecting water resources is reflected in federal, State, and local laws as well as in regulations and guidelines. The County's numerous small streams and creeks flow into the main water supply resources (i.e., Potomac and Patuxent Rivers) and the Chesapeake Bay. The State of Maryland and Montgomery County are national leaders in developing sound watershed management plans and policies.

The condition of water resources, including streams and wetlands, has been of primary environmental concern for the state of Maryland for at least the past twenty years (see Table 8). The quality of the Chesapeake Bay and its many tributaries have dramatically benefitted from environmental programs that reduce both point and some non-point sources of pollution. Clean-up of sewage plant discharges, removal of obstacles to fish passage, construction of stormwater management and stream enhancement projects have all contributed to improving water quality. At the same time, continuing increases in human population and development still create stresses on aquatic systems despite benefits that have been attained through the various water quality protection programs. Efforts in Montgomery County are coordinated with federal, State and regional programs to reduce the impact of new development and repair the impact of existing land uses and past development activity.

The Chesapeake Bay Agreement of 1983 is a commitment by the states of Maryland, Virginia, and Pennsylvania, and the District of Columbia, and the Environmental Protection Agency to restore and protect the Chesapeake Bay. In 1987 the same parties agreed to a 40 percent reduction of phosphorus and nitrogen loadings to the Bay. In 1992 the Bay partners agreed to develop "tributary strategies"— watershed based plans to reduce nitrogen and phosphorous entering the Bay. Maryland's tributary strategies are an addition to the historic Chesapeake Bay Agreement, to address the problems of excess nutrients and their impacts on the living resources. The Middle Potomac tributary strategy, includes urban watershed, agriculture, and wastewater/point source work groups. While no policies have been adopted that directly affect the Potomac Subregion, many approaches are being developed:

- Nutrient Trading
- Maryland's Smart Growth Initiative
- Total Maximum Daily Loadings (TMDLs)
- Pasture/Manure Management
- Riparian (stream) Buffers
- Education and outreach programs

Chronology of Environmental Policy and Regulatory Actions

Table 8

• The Federal Water Pollution Control Act of 1948 regulates dumping and disposal into navigable waters.

• The Water Quality Act of 1965 created ambient water quality standards for interstate waters.

• The Maryland Sediment Control Act of 1970 requires sediment control at construction sites and has been used to require stormwater management.

• The Maryland Environmental Policy Act of 1973 declares that State policy give the highest public priority to the protection, preservation, and enhancement of the State's diverse environment.

• The 1972 Federal Clean Water Act and 1977 and 1981 amendments, provide guidelines for preservation of fishable and swimmable waters of the U.S.

• The Chesapeake Bay Agreement of 1983 is a commitment by the states of Pennsylvania, Maryland, and Virginia, the District of Columbia, and the Environmental Protection Agency to restore and protect the Bay through correcting existing pollution problems and avoiding new ones.

• 1983 — Section 208 of the State Water Quality Management Plan by the State, in compliance with that section of the federal Clean Water Act.

• 1983 — Montgomery County issues stormwater management regulations for water quality and quantity control.

• 1983 — Montgomery County Planning Board approves stream buffer guidelines (updated in 1993) to protect stream valleys from physical development using environmental buffers and conservation easements.

• 1987 — The Chesapeake Bay Agreement of 1987 established a goal of reducing by 40 percent the nutrient input to the Chesapeake Bay.

• 1989 — The Maryland Non-Tidal Wetlands Act controls development in wetlands outside the tidal waters of the Chesapeake Bay.

• The State Planning Act of 1992, in which one of the seven visions given, states that stewardship of the Chesapeake Bay is to be considered a universal ethic. The planning act also requires implementation of the sensitive areas element, including 100-year floodplains, streams and their buffers, habitats of threatened and endangered species, and steep slopes.

• 1992 — The Chesapeake Bay Agreement requires a 40 percent reduction from the 1985 level in controllable nutrient loads of nitrogen and phosphorus to the Bay by the year 2000. The State initiates the tributary strategies program to customize nutrient reduction plans for different subwatersheds. Montgomery County has two tributary plans (Middle Potomac and Patuxent) that will focus on a combination of urban and agricultural non-point source best management practices (BMPs) to reduce pollution from runoff.

• 1992 — County Forest Conservation Law provides for tree preservation and planting in new developments; forest is protected with conservation easements.

• 1993 — General Plan Refinement contains fourteen environmental goals; three are protection and improvement of water quality; conservation of County waterways, wetlands, and sensitive parts of stream valleys; and comprehensive stormwater management to minimize sedimentation.

• 1994 — Special Protection Area (SPA) law requires certain developments to prepare a water quality plan and monitor the site before and after development to determine if the objectives of the water quality plan are met.

• 1995 — Montgomery County enacts regulations for special protection areas to implement the SPA law, including performance standards that are intended to maintain baseflow, wetland and aquatic habitat functions, and groundwater recharge.

• 1995 — Montgomery County Council designates the Piney Branch subwatershed of the Watts Branch a special protection area.

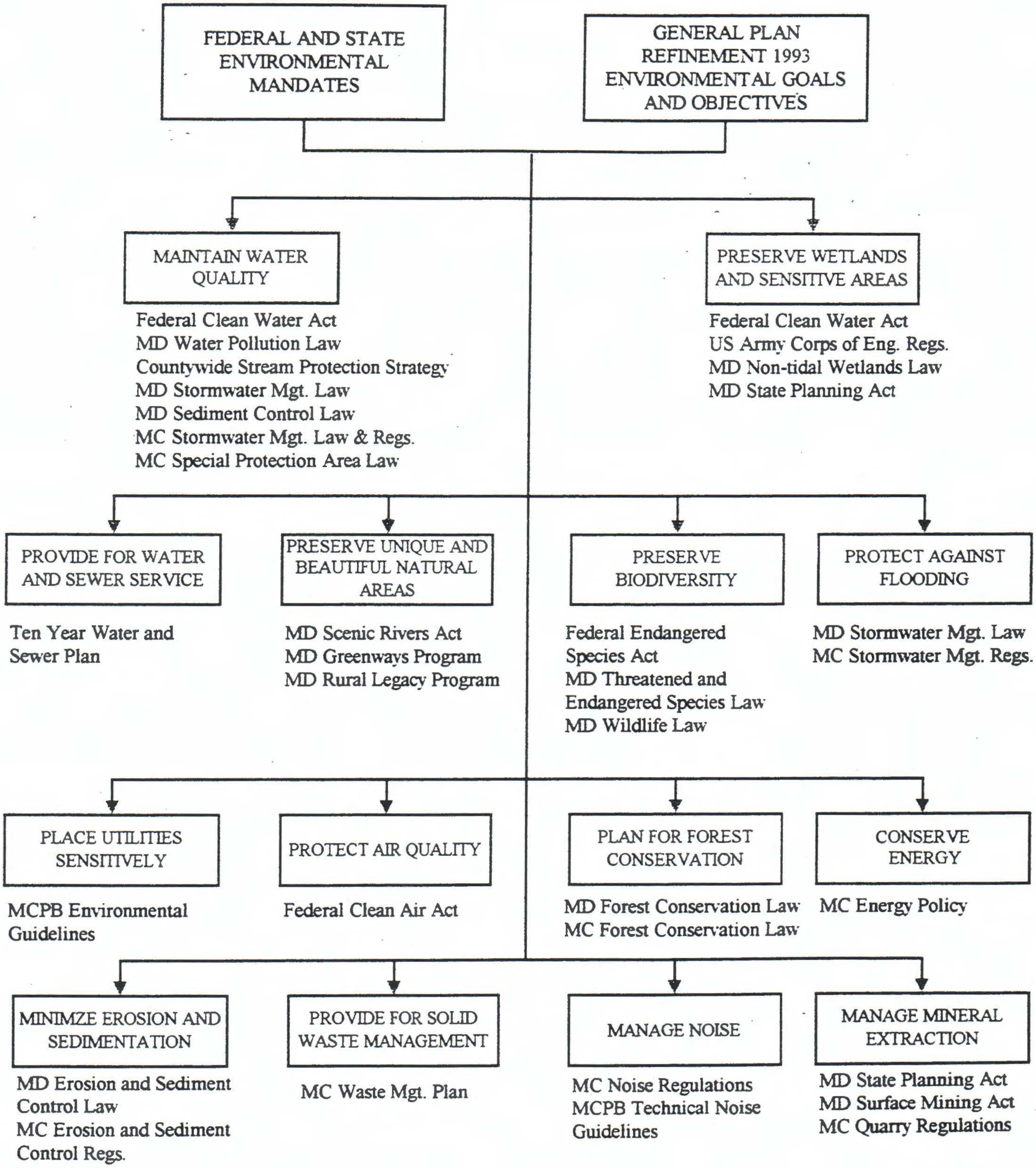
• 1996 — *Middle Potomac Tributary Strategies Annual* Report defines an intergovernmental approach to improving conditions in the Maryland portion of the middle Potomac watershed (includes parts of Montgomery, Prince George's and Frederick Counties). This report is updated annually.

• 1997 — Planning Board *Environmental Guidelines* revised to include a chapter on special protection areas.

• 1997 — *Countywide Stream Protection Strategy* assesses water quality conditions Countywide on a consistent biological basis, develops management categories, and prepares a list of priority subwatersheds that will be periodically updated.

Environmental Policy Sources To Guide Master Planning

Figure 18



The Clean Water Act created the Total Maximum Daily Load (TMDL) approach to water quality management. The TMDL approach establishes a maximum limit for a pollutant or other quantifiable parameter which is causing water quality impairment in a specific subwatershed. Maryland is in the process of developing a TMDL program. Because the purpose and the process of the tributary strategies are identical to the purpose and the process of the TMDL approach, the tributary strategies will form the basis for the establishment of TMDLs for the Chesapeake Bay.

Although no loading limits have been set for the Potomac Subregion, Maryland Department of the Environment plans to require TMDLs for nutrients and suspended sediments in the Bay-wide TMDL. The master planning process will consider the State's initial findings when they are available. As of the date of this report, the schedule for application of TMDLs to the Potomac Subregion has not been finalized.

Montgomery County has aggressively pursued efforts to protect streams, rivers, wetlands and other directly related sensitive features. Montgomery County Code subsection 19-61 provides for the protection of a geographic area where existing water resources or other environmental features directly related to those water resources are of high quality and unusually sensitive and where the proposed land uses would threaten the quality of preservation. These areas, known as special protection areas (SPAs), are designated through area master plans, watershed plans, the *Comprehensive Water Supply and Sewerage System Plan*, or by resolution of the County Council. The County Executive and the Planning Board have implemented Executive Regulations and *Environmental Guidelines*, respectively, to implement the Special Protection Area law. In the Potomac Subregion, the Piney Branch watershed has been designated a special protection area by the County Council because of its high water quality and the potential for degradation by future development in the watershed.

Development projects on property in special protection areas undergo additional water quality review as part of the development process. A water quality plan is prepared to determine how specific water quality protection goals can be met through stormwater management and protection of environmental buffers around streams and wetlands. Water quality is monitored before and after the development to assess the extent to which the goals are met.

The *Countywide Stream Protection Strategy* (CSPS) was developed by the Montgomery County Department of Environmental Protection and M-NCPPC to provide an overall assessment of County stream conditions. The CSPS ranks Countywide stream conditions (excellent, good, fair, and poor) based on biological assessments. Prior to 1980, stream quality was analyzed based solely on chemical and physical parameters. Until the CSPS effort was undertaken, biological data was limited.

The CSPS assigns a management category that recognizes the sensitivity of the stream condition and the projected imperviousness levels, and determines the potential for maintaining that level. The CSPS identifies broad management goals for the preservation, protection, and restoration of streams, along with management tools that can be applied to effectively meet those goals. The CSPS helps agencies identify, target, and budget specific watershed-based resource protection initiatives, and serves as a useful technical tool. The CSPS also identifies priority subwatersheds where instability in the stream condition indicates that action is needed to address immediate problems.

The CSPS is a dynamic effort by the County to provide updated water quality information, management information and priorities. The document is planned to be updated once every five years, incorporating new data on stream conditions.

This report includes CSPS information available at the time of publication on stream conditions, management categories, and priorities. For the most current information, check the CSPS update.

Stormwater Management

The Department of Permitting Services administers the County's stormwater management regulations, as well as the sediment and erosion control regulations, to protect stream quality and downstream areas from the impacts of upstream development. All new development is required to submit plans complying with these regulations during the development review (subdivision) process.

Floodplain Management

Floodplain management includes a full range of tools, programs, and policies. County agencies have been working together to deal with some of the major problems associated with changes in watershed hydrology and stream impacts as a result of urbanization. To address severe flooding problems, the Department of Park and Planning, in concert with the Department of Permitting Services (DPS), restricts development and construction activity in the 100-year floodplain on major streams throughout the County. Additionally, the Department of Park and Planning has a nationally recognized stream valley park system that provides flood and stream quality protection and recreational use. Increased water flows and velocities during heavy storm events result from continued development in the watersheds. These increases are at least partially controlled through the County's stormwater management law and regulations. Decreases in stream base flow due to the replacement of groundwater recharge areas with impervious surfaces is also recognized as a serious problem.

Since the early 1990s, the DPS has been the designated lead agency for administering the County floodplain regulations and coordinating the National Flood Insurance Program (see Table 9).

The DPS is the County agency designated to receive and act on proposals for encroachments in floodplains. DPS requires localized flooding studies where necessary to determine the impact of a particular development on flooding, as well as to establish floodplain boundaries where no data exists. DPS also updates and maintains floodplain data that originally is prepared by M-NCPPC.

The M-NCPPC and the Washington Suburban Sanitary Commission are the custodians of large multi-purpose dams in Montgomery County. The County's Department of Public Works and Transportation (DPWT) is responsible for managing State and County roads and responding to flooding issues at road crossings.

On-site sewerage systems are prohibited in the 100-year floodplain by County and State regulations administered by the Department of Permitting Services.

Mineral Resources

Recognizing that mineral resources are non-renewable, the State of Maryland has directed local governments to address the protection of potential extraction sites. Article 66B of the Annotated Code of Maryland is the source of authority for mineral resources planning for local jurisdictions. "The mineral resource plan element shall be incorporated in any new plan adopted after July 1, 1986, for all or any part of a jurisdiction . . . containing at a minimum; identification of undeveloped land with known mineral resources, a post-excavation land use plan, and a balance of mineral resource extraction with other land uses so as not to preempt mineral resources extraction. This element should be reviewed by the Department of the Environment for consistency with the goals of the State."

In response, Montgomery County has developed a floating Mineral Resource Zone, designed to be used in areas that are known to have deposits but are not yet developed and have the potential for future extraction. However, it is unlikely that any of the Potomac area quarries will expand their operations to neighboring properties. In the case of the three small quarries in the Cabin John Creek watershed, they were surrounded by residential properties, parkland, roads, and institutional uses long before the adoption of the State planning requirements.

In 1992, the Montgomery County Council adopted a comprehensive revision of the Quarry Ordinance (Chapter 38, *MCC*). More restrictive than the State Surface Mining law, it requires licensing for all quarry operations and regulates issues such as noise, air quality, water quality, blasting, setbacks, hours of operation, and truck traffic. Part of the requirements of both State and local government for quarries is a reclamation plan. This typically includes stabilization of slopes, restoration of a hydrologic regime and plans for possible reuse.

Floodplain and Stormwater Management Responsibilities Table 9

RESPONSIBILITY	AGENCY
Evaluation of impact of land use changes as part of master plan effort	M-NCPPC
Delineation of floodplain	DPS, M-NCPPC
Park development planning, stream valley acquisition (including floodplains)	M-NCPPC
Protection of floodplains in proposed subdivision site plans, zoning map amendments, urban redevelopment	M-NCPPC, DPS, DPWT
Maintenance of large multi-purpose dams	M-NCPPC, WSSC
Maintenance of small stormwater management structures	M-NCPPC, DEP, HOA
Review of encroachment applications and detailed floodplain analyses and floodplain regulations	DPS
Flood insurance program	FEMA, MDE, DPS
Health Regulations	DPS, MDE
Review of sediment control and stormwater management plans	DPS
Overall program for approval, operation, and maintenance of stormwater management facilities. (Treatment and control of stormwater runoff from developed areas into stream valleys, including floodplains.)	DPS, DEP

M-NCPPC — Maryland-National Capital Park and Planning Commission
DEP — Department of Environmental Protection
DPS — Department of Permitting Services
DPWT — Department of Public Works & Transportation
WSSC — Washington Suburban Sanitary Commission
MDE — Maryland Department of the Environment
FEMA — Federal Emergency Management Agency
HOA — Homeowners Association

State Smart Growth Initiatives

The Maryland Economic Development, Resource Protection, and Planning Act of 1992 ("Planning Act of 1992") requires comprehensive plans prepared by local governments to include the following seven "visions" designed to encourage economic growth, limit sprawl development, and protect natural resources:

1. Development is concentrated in suitable areas.
2. Sensitive areas are protected.
3. In rural areas, growth is directed to existing population centers and resource areas are protected.
4. Stewardship of the Chesapeake Bay and the land is a universal ethic.
5. Conservation of resources, including a reduction in resource consumption, is practiced.
6. To assure the achievement of 1 through 5 above, economic growth is encouraged and regulatory mechanisms are streamlined.
7. Funding mechanisms are addressed to achieve these visions.

In Montgomery County, the *General Plan Refinement* (1992) has been accepted by the State as meeting this requirement.

To strengthen these policies to support development targeted to areas of the State with existing infrastructure, the Maryland legislature recently enacted a series of laws to encourage smart growth and neighborhood conservation. This legislative package includes incentives for workers to relocate near their places of work, a job creation tax credit for small businesses in Smart Growth Areas, incentives to clean up and redevelop contaminated brownfields sites, and funding for acquisition of land to protect the State's rural legacy.

The most important new policy established under the Smart Growth umbrella is the requirement that State money for infrastructure be directed to existing towns and cities and other designated Smart Growth areas. The State is attempting to reverse the subsidy of sprawl by targeting highway, water, sewer, and other building and infrastructure funds to existing developed areas that already have the transportation, housing, and infrastructure capacity to support increased use. This program does not limit where counties can allow development, but it does prevent the use of State taxpayer dollars to support development in inappropriate areas.

Within Montgomery County, all areas within the Capital Beltway (I-495) are automatically designated as Smart Growth priority funding areas. In 1998 the County will designate additional priority funding areas that meet State requirements for sewer service, planned density, and access to existing infrastructure. Parts of the Potomac area will likely be included in these final Smart Growth areas. The Potomac master planning process will be coordinated with the Smart Growth area designation process to ensure that appropriate areas are included as priority funding areas.

Sensitive Areas Protection and Biodiversity

The Planning Act of 1992 establishes criteria that must be included in local government comprehensive plans such as Montgomery County's General Plan. Among the criteria to be incorporated are the Seven Visions for the State and the preparation of a "Sensitive Areas" element.

Implementation of the Sensitive Areas element is intended to protect streams and their buffers, one-hundred year floodplains, steep slopes, and the habitats of threatened or endangered species, as well as any particular resource the locality deems appropriate.

Of the environmental goals, objectives, and strategies developed for the General Plan in response to the Seven Visions, Objectives 2, 4, and 6 particularly relate to the protection of environmentally sensitive areas:

> **Objective 2**: Preserve natural areas and features that are ecologically unusual, environmentally sensitive, or possess outstanding natural beauty.
>
> **Objective 4**: Conserve County waterways, wetlands, and sensitive parts of stream valleys to minimize flooding, pollution, sedimentation, and damage to the ecology and to preserve natural beauty and open space.
>
> **Objective 6**: Preserve and enhance a diversity of plant and animal species in self-sustaining concentrations.

Local area master plans such as the Potomac Master Plan "are adopted as amendments to the General Plan" and "are expected to conform to the General Plan" (General Plan Refinement, Goals and Objectives, 1993). To reflect the priorities established in the Planning Act and the General Plan, master plans consider the presence and amount of sensitive areas in their land use proposals. One approach to protecting sensitive areas is direct acquisition and conservation as parkland.

Another approach to identifying and managing sensitive areas is to incorporate their protection within proposed site plans for residential, commercial, and industrial development. During the development review process the *Environmental Guidelines* for Development are applied to each development proposal. These guidelines recommend specific protection measures for sensitive areas such as establishing undisturbed stream buffers, protecting wetlands and establishing wetland buffers, maintaining areas of steep slopes and highly erodible soils, conserving trees within development sites and implementing County stormwater management and sediment/erosion control standards.

In addition to protection provided by the guidelines, wetlands in Montgomery County are regulated by federal and State statutes. Federal regulation of wetlands was established through Section 404 of the Clean Water Act and subsequent court cases defining wetlands as "waters of the U.S." In Maryland, federal and State environmental agencies share responsibility for issuing or denying permits to dredge, fill or otherwise disturb wetlands. The proposed disturbance also must meet the more stringent requirements of the Maryland Non-tidal Wetlands Act. This act established a minimum 25 foot buffer between the edge of the an area disturbed by construction and the wetland boundary. The Maryland Department of the Environment also administers State wetlands and water quality certification permits.

Federal and State environmental agencies also assist Montgomery County with wetland functional assessment studies, review of environmental and land use information contained within master plans, and regulatory review of proposed development. The Potomac Subregion Wetland Functional Assessment Study, recently completed by M-NCPPC and EA Engineering, Science & Technology, represents a cooperative effort by local and State government to develop a simple, field-based wetland assessment method and to use the method within the subwatersheds in Potomac. The method evaluates wetlands for five functions: groundwater discharge, flood attenuation, sediment/nutrient retention, aquatic habitat, and wildlife habitat (see Appendix for a detailed discussion of the methodology).

Preservation of habitats of endangered species is also required by State and federal law. For several years the M-NCPPC has contracted with the Maryland Department of Natural Resources, Wildlife and Heritage Division, to conduct surveys for rare, threatened, and endangered species and high-quality native habitats on selected parklands in Montgomery County. The result of these surveys has been the identification of six areas on parkland in the Potomac Subregion which contain rare, threatened, or endangered species. Surveys by M-NCPPC have identified additional areas containing rare, threatened or endangered species on park property.

Determinations regarding which species are rare, threatened, or endangered may be made either by the U.S. Fish and Wildlife Service (federal RTE species) or the Maryland Department of Natural Resources Heritage and Biodiversity Conservation Program (State RTE species). The State list includes "watchlist" species which, although not officially listed as endangered or threatened, have been identified as species in need of conservation due to declining or restricted populations.

Concern over the decline and disappearance of rare, threatened, and endangered species of plants and animals is part of a broader concern for the preservation of biological diversity.

Biological diversity encompasses the variety of living species, variations within species, and the variable composition of biological communities. Biological diversity can be examined at different levels of organization, including genetic, species, ecosystem, and landscape scales (Scott *et al.*, 1993).

Good biological diversity is believed to contribute to ecosystem stability, provides the genetic raw material to adapt to changing environmental conditions, preserves natural resources for potentially valuable future uses, and enhances the quality of life for many County residents. In addition, planning for the preservation of biological diversity now may help preclude the need to undertake expensive and controversial endangered species restoration plans in the future.

In recent years, preservation of biological diversity has become a goal of governments and conservation organizations. Approaches to preservation of biodiversity include the identification and acquisition of unique or representative natural communities by public agencies or private foundations; identification and protection of unique or representative natural communities on existing public lands, and land-use planning which recognizes the value of biological diversity.

Forest Conservation

Forest conservation helps retain the natural beauty of the community and protects dependent ecosystems. Trees cleanse the air and water runoff, provide shade to ameliorate summer temperatures, and provide cover and food for a variety of wildlife. Since 1992, Montgomery County has been requiring forest conservation as part of applications for land disturbance and development. The County Forest Conservation law is required by and modeled after the Maryland Forest Conservation Act of 1991. Forest conservation recognizes the benefits of forest and trees in our increasingly urbanized environment and requires preservation and reforestation as part of the development process.

Guidance for the planting of street trees, establishment of new forests, and protection of existing forests during the area master planning process comes from the *General Plan Refinement* Goals and Objectives, approved and adopted in 1993. Specifically, Strategy F under Objective 4 is to "plant and retain trees and other vegetation near streams" and

Strategy E under Objective 6 is to "minimize forest fragmentation to protect habitat continuity." Objective 8, which is to "increase and conserve the County's forests and trees" applies to forest and tree conservation. Strategies under Objective 8 are:

- Identify and designate forest preservation and tree planting areas.
- Ensure forest land conservation, tree planting, and related maintenance in all new development.
- Provide for increased tree cover and maintenance in urban and suburban areas and along transportation rights-of-way.
- Encourage private and public landowners to protect existing trees and to plant additional environmentally appropriate and native trees on their properties.

Preservation of urban forest and trees often is intended to meet the needs of people as much as the environment. Frequently woods in developed areas are isolated, invaded by exotic vegetation, and in poor health. Some individual trees are worthy of preservation, but they can be difficult to save given site and layout constraints. The forest conservation law encourages retention of existing trees wherever possible, as well as appropriate maintenance to keep them viable. Street trees, which enhance neighborhoods and buffer road noise, are an important part of the urban landscape.

Air Quality Policies and Regulations

Air quality improvement is a regional effort. The entire Washington Metropolitan Statistical Area, which includes all Montgomery County, falls into the serious classification for ozone. The Environmental Protection Agency (EPA) requires attainment of the federal standard by 1999. The Metropolitan Washington Air Quality Committee is responsible for approval of the air pollution control measures to be implemented by the region and for preparing the region's air quality plans.

Although there are various forms of air pollution, the major health concern in this region is ozone. Ozone is formed in the lower atmosphere when nitrogen oxides (NOx) and volatile organic compounds (VOC) react in the presence of sunlight and heat. Factors affecting ozone formation include pollutant concentrations in the air, wind velocity, temperature, and sunlight. Ozone typically forms on hot, sunny, windless days. Adverse impacts of ozone include vegetation damage and health effects such as coughing and chest pains, irritation of the eyes and throat, breathing difficulties, and greater susceptibility to infection.

Control measures target two sources of NOx and VOC: mobile and stationary sources. Mobile sources are generally internal combustion engines in on-road vehicles. Stationary sources cover a wide range of structures such as smoke stacks and gaseous industrial exhaust. Other contributors are lawn and garden equipment, varnishes and solvents.

In July 1997, EPA adopted more stringent standards for acceptable ozone levels. While these new standards could make it more difficult for the Washington region to meet ozone reduction goals, EPA will allow up to the year 2010 to achieve them. In the interim, EPA continues to require the region to attain current ozone standards by 1999.

In addition, EPA has adopted new standards to control very small (2.5 microns or less) atmospheric particulates. These are some of the most damaging to human health because they penetrate and remain in the deepest passages of the lungs. The main offenders in this area are industrial and residential combustion and diesel fuel exhaust. It will take several years to monitor these particulates to determine whether the Washington region will be in non-attainment for this pollutant. If designated non-attainment, the region will have until at least the year 2012 to achieve the standards for very small particulates.

To achieve air quality attainment goals, development needs to concentrate in areas served by public infrastructure and transit as stated in the General Plan. Other policies include promotion of transit, trip mitigation measures, cluster and mixed use development, carpool lanes, etc. The main approach used in master planning is to reinforce and implement the General Plan by emphasizing access to transit, bikeways, and sidewalks.

Noise Regulation

In Montgomery County, local government agencies have the authority to control the effects of two generalized sources of noise: stationary sources which affect nearby properties; and mobile (i.e., transportation-related) sources emanating from public linear rights-of-way. The Montgomery County Noise Ordinance regulates stationary noise sources from private property such as heating and air conditioning units, construction activity, and neighborhood noise disturbances. The Noise Ordinance is administered by the Montgomery County Department of Environmental Protection, Office of Environmental Policy and Compliance. The Noise Ordinance sets maximum permissible decibel limits based on land use and time of day. Violations of this ordinance are punishable by law.

Since 1983, the Montgomery County Park and Planning Department's *Staff Guidelines For The Consideration Of Transportation Noise Impacts In Land Use Planning And Development* have been used to develop staff recommendations to the Planning Board on reducing mobile source impacts on sensitive receptors. This document was developed to assure consistency in master plan and regulatory review recommendations on noise compatibility, and to promote greater understanding of noise compatible site design. Unlike the regulations in the county Noise Ordinance, the staff noise guidelines are intended to be considered proactively as an integral part of the land use planning and regulatory review process, and are tailored to be consistent yet flexible to allow a balanced achievement of all significant land use and site design objectives.

The staff noise guidelines include reasonable noise level goals for the entire County, ranging from a maximum acceptable noise ceiling of 65 dBA, to a goal of 55 dBA to protect the peaceful rural environment in estate and agricultural areas. Along freeways and within the urban core (principally high density areas within and just outside the Capital Beltway (I-495)), a noise guideline of 65 dBA was determined to be achievable and appropriate given the high ambient noise levels, and traffic volumes. In the suburban "ring" around the urban core, a 60 dBA level was determined to be an achievable goal given lower ambient levels and greater opportunity for cost-effective noise mitigation. In the rural areas of the County where ambient noise levels are much lower and lot sizes are larger, the 55 dBA level guideline is applied.

To achieve these goals, the guidelines identify several measures to reduce traffic noise problems for affected properties, which include:

- Noise compatible land use (typically done at master plan or rezoning)
- Noise compatible site design, distancing sensitive uses/receptors from the source
- Blocking the path from source to receiver
- Acoustical treatment of buildings

These measures are typically applied at one of two opportunities. The first is the master plan process. The master plan identifies where noise impacts may occur and examines potential options for noise compatible land uses, or alternatively, suggests zoning categories that allow sensitive land uses (residential) to be clustered, set back or otherwise buffered from high noise levels. The second opportunity is during the regulatory review process when noise mitigation techniques can be applied to individual properties undergoing staff review.

Water Supply and Sewerage

The *Montgomery County Comprehensive Water Supply and Sewerage Systems Plan* governs the provision of water and sewer service throughout the County. The goal of the plan is to systematically extend water and sewerage systems in concert with other public facilities along the corridors as defined in the General Plan, to accommodate growth only in areas indicated by adopted master or sector plans. In addition, the Water and Sewerage Systems Plan considers other adopted or proposed policies of various agencies affecting land use, including guidelines for the administration of the Adequate Public Facilities Ordinance.

For all properties in the County, the plan designates one of six water and/or sewer staging categories that are primarily based on master plan development staging strategies and/or capital program infrastructure staging. The authority to adopt and amend the Water and Sewerage Systems Plan resides with the County Council. The County Executive administers the plan through MCDEP in cooperation with M-NCPPC and WSSC.

The approved and adopted *Master Plan for the Potomac Subregion, May 1980* envisions sewer service within the master planning area to be expanded based on a staging sequence. Presently, most of the master planning area designated as sewer stages I, II, and III have or are approved to receive community sewer service (see Figure 7). This generally includes areas with zoning densities R-200 and greater, as well as RE-1, RE-2C and RE-2. The intent of the Master Plan was to allow stages I, II, and III to develop first and use available capacity within the conveyance system and at the Blue Plains treatment plant. The remainder of Potomac was designated as sewer stage IV, the last stage to be opened to development using community sewer service. The Master Plan anticipated that stage IV would use any remaining capacity within the system if it could be served by logical, economical, and environmentally acceptable extensions from the sewerage system serving stages I, II, and III properties. The Potomac Master Plan is one of two master plans[6] in the County that recommends community sewer service to the RE-2 Zone. This recommendation represents a substantial departure from the Water and Sewer Plan's general policies for the provision of community service throughout the County.

The 1980 Potomac Master Plan recommends comprehensive water and sewer service area map amendments for the Water and Sewer Plan that will place properties in the appropriate service area categories

[6]The approved and adopted *Fairland Master Plan* designates a portion of Fairland Recreation Park that is zoned RE-2 for sewer service in order to serve park facilities.

consistent with the policies of the Water and Sewer Plan and the recommendations of the Master Plan. The 1980 Master Plan makes no such recommendations and instead relies on sewer staging. Properties that require immediate community water and sewer service must be in categories S(Sewer) 1 or 3, and W(Water) 1 or 3, indicating the highest priorities for community service, to proceed with the development process. (Category 2 is not used in Montgomery County.) Categories 4 and 5 represent areas that will receive community service in the next four through ten year period, indicating a need for major service extensions or capital improvements. Categories W6 and S6 represent areas where there is no planned service.

To minimize the effects of development on the Piney Branch stream system, the County Council has adopted the Piney Branch Sewer Restricted Access Policy as an amendment to the Water and Sewer Plan. This policy restricts the ability of properties in the Piney Branch Watershed to connect to the sewer. For details of this policy, refer to the Appendix.

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Appendix

Environmentally Sensitive Areas

The sensitive areas mapped for purposes of this report were prepared with some limitations on both the information available and the level of effort associated with preparing the computerized Geographic Information System (GIS) coverages. The sensitive areas mapped in Figures 12-17 and reported in Tables 3 and 4 consist of the combination of several types of areas, many of which overlap (see Table A-1). Sensitive areas are defined by the State Planning Act of 1992, which includes areas considered sensitive by the local government. For purposes of this report, wetlands and wetland buffers are added to the list defined by the legislation of 100-year floodplains, streams and their buffers, steep slopes, and habitats of rare, threatened, or endangered species. Since a comprehensive understanding of the locations of habitats of rare, threatened or endangered species is not mapped, this information was not included in the tables or maps.

The range of acreage and percentages used for stream buffers represent the highs and lows for buffer width applied consistently along the entire stream length. Slopes were not used directly to determine the buffer width as they would be when looking at individual sites. Steep slope acreages and percentages are based on a computerized analysis of the topography to determine areas with slopes greater than 25 percent. Floodplains were mapped in two different ways: a) existing M-NCPPC maps of floodplains, based on ultimate development for most mainstems and some tributary streams were used for the Subregion floodplain map where the M-NCPPC maps were available; and b) where stream areas were not covered by the existing M-NCPPC floodplain maps, such as in headwater areas and along smaller tributaries, maps of floodplain soils were used. The soils maps are less accurate than the M-NCPPC floodplain maps, but they provide floodplain information in areas not covered by the M-NCPPC maps. Wetlands coverage includes a combination information from DNR wetlands guidance maps, National Wetlands Inventory maps and hydric soils from the 1995 *Soil Survey of Montgomery County*.

All these coverages were overlaid to obtain a single map (used in Figures 12-17) of sensitive areas that includes the outside boundaries of all the areas covered by a 150-foot stream buffer and the steep slopes, floodplains, wetlands, and wetland buffers as established in the *Environmental Guidelines*. This coverage is approximate and only to be used for master planning purposes. Detailed planning for specific areas or for site planning requires more refined mapping and field investigation.

Wetlands Functional Assessment Methodology

For the Potomac Subregion Wetland Functional Assessment Study, M-NCPPC staff and EA Engineering, Science & Technology collected information in the field about the location, quality and function of wetlands in six watersheds. The protection of wetlands is an important goal for Montgomery County, as stated in the General Plan Refinement (1993). By identifying and assessing wetlands early in the master planning process these sensitive areas may be considered when designating land uses.

A wetlands functional assessment protocol was developed by M-NCPPC and approved by the Maryland Department of the Environment to allow analysis of wetlands functions based on information obtained from field observations. This modified method incorporates field-based wetlands functional indicators from *A Method for the Assessment of Wetland Function* (1995), prepared by Fugro East, Inc. for the MDE and indicators drawn from the Biohabitats *Wetland Functional Assessment Protocol,* (1996). The functional assessment method is a tool to evaluate and compare groups of wetlands.

For the purpose of the study, wetlands were grouped into assessment groups. The groups are designated by stream and numbered from the headwaters downstream (e.g., WB1, Watts Branch; PB3, Piney Branch). Each group contains wetlands which have a high degree of hydrologic interaction. Typical boundaries for each group include: road crossings with extensive embankments and culverts, significant inflows from tributary streams or other factors which influence hydrologic interaction (e.g., dams and reservoirs.)

The assessment method uses indicators to evaluate wetlands function. These indicators include: presence of seeps, springs or standing water, wetland size, topographic position of wetland, diversity of vegetation types, physical evidence of overbank flows, etc. In the absence of long-term research to quantify wetlands functions within the study area, the indicators allow the assessor to evaluate the functional capacity of wetlands.

Sensitive Resources

Table A-1

	Water-shed	Parkland(1)		Wetlands(2)				Steep Slopes(3)				Floodplain(4)				Floodplain Soils(5)				100-ft Stream Buffer(6)				150-ft Stream Buffer(6)			
				In Watershed		In Parkland		In Watershed		In Parkland		In Watershed		In Parkland		In Watershed		In Parkland		In Watershed		In Parkland		In Watershed		In Parkland	
	Acres	Acres	%(7)	Acres	%(7)	Acres	%(8)	Acres	%(7)	Acres	%(8)	Acres	%(7)	Acres	%(8)	Acres	%(7)	Acres	%(8)	Acres	%(7)	Acres	%(8)	Acres	%(7)	Acres	%(8)
Potomac Subregion																											
Potomac River(9)	3,394	346	10	3,145	93	346	11	58	2	11	19	3,394	100	346	10	813	24	319	39	309	9	176	57	492	14	182	37
Lower Seneca	5,776	1,493	26	843	15	457	54	358	6	150	42	507	9	404	80	592	10	381	64	915	16	400	44	1,338	23	586	44
Rock Run	3,210	273	9	424	13	128	30	125	4	55	44	166	5	78	47	173	5	81	47	440	14	120	27	607	19	149	24
Direct Tributaries	5,283	1,972	37	1,071	20	835	78	776	15	382	49	657	12	572	87	371	7	350	94	975	18	576	59	1,392	26	783	56
Cabin John Creek	7,654	1,030	13	761	10	297	39	471	6	182	39	373	5	254	68	352	5	245	70	1,076	14	383	36	1,553	20	517	33
Muddy Branch	7,732	1,297	17	719	9	401	56	506	7	214	42	359	5	337	94	439	6	355	81	1,140	15	444	39	1,638	21	602	37
Watts Branch	10,332	680	7	1,075	10	303	28	532	5	85	16	658	6	309	47	474	5	246	52	1,649	16	325	20	2,364	23	422	18
Headwaters																											
Cabin John Creek	4,138	199	5	248	6	40	16	NA	NA	NA	NA	104	3	58	56	125	3	45	36	NA	NA	NA	NA	NA	NA	NA	NA
Muddy Branch	4,899	167	3	654	13	59	9	NA	NA	NA	NA	126	3	49	39	205	4	42	21	NA	NA	NA	NA	NA	NA	NA	NA
Watts Branch	3,961	271	7	402	10	120	30	NA	NA	NA	NA	156	4	100	64	147	4	84	57	NA	NA	NA	NA	NA	NA	NA	NA

(1) GIS coverage of existing Parkland, M-NCPPC 1997.

(2) GIS coverage of Wetlands, EA 1997. Includes data from NWI wetlands maps, DNR wetlands guidance maps, M-NCPPC planimetric GIS coverage of streams, riparian areas within 15 feet of a stream, and hydric soils from 1995 *Soil Survey of Montgomery County*.

(3) GIS coverage of Slopes interpreted from 1993-1995 aerial topography, M-NCPPC 1997. Steep slopes defined as slopes greater than 25% per 1997 M-NCPPC *Environmental Guidelines*.

(4) GIS coverage of M-NCPPC 100-year floodplain maps (ultimate land use), EA 1997. Coverage for Muddy Branch and Seneca Creek limited to main stem. Potomac River based on FEMA data. River floodplain extends beyond CSPS subshed and is accounted for under in the appropriate watersheds.

(5) GIS coverage of floodplain soils from 1995 *Soil Survey of Montgomery County*, EA 1997.

(6) Stream buffer size ranges from a minimum of 100 feet to a maximum of 150 feet for Use I streams, depending on adjacent slopes, as set forth in 1997 M-NCPPC *Environmental Guidelines*.

(7) Percent of watershed area.

(8) Percent of sensitive resource.

(9) Area defined by CSPS subwatershed, includes the Potomac River and islands in the river. See Figure 9 for subwatershed boundaries.

- Groundwater Discharge was a function driven by wetland size, since most of the wetland assessment groups exhibited wetland hydrology and were associated with streams.

- Floodflow Attenuation functional value was determined in large measure by the presence or absence of overbank flooding. Most of the wetland assessment groups in the developed watersheds exhibited a high frequency of overbanking (presumably due to stormwater flows), while less developed areas exhibited less evidence of frequent overbanking.

- Nutrient Removal/Sediment Retention scores were not largely determined by a single indicator, instead these scores were based upon the predominance of steep slopes, the wetland water regime, and the shape of the wetland outlet.

- The Aquatic Habitat function was determined by wetland size, land use, and the degree of fragmentation of the wetland assessment group. Large wetlands with little fragmentation scored higher than small wetlands adjacent to residential areas. However, these small wetlands are often important vernal pool reproductive sites for locally rare species.

- Wildlife Habitat scores were higher for large wetlands with a broad and uninterrupted character. Smaller wetlands adjacent to developed lands scored lower.

The wetland assessment group scores for the wetlands of the Potomac Subregion ranged widely. The ranges for each wetland function are presented in Table A-2.

Fish Species of the Potomac Subregion

The *Countywide Stream Protection Strategy* (MCDEP, 1997) lists fish collected in each watershed in Montgomery that were identified during the monitoring program (see Table A-3). While this information is based on a limited number of samples, it indicates the diversity of species for each watershed. The information will be updated through the *CSPS* as additional data is collected. Consult the most current copy of the *CSPS* for updated information.

Countywide Stream Protection Strategy Management Categories

The CSPS developed five categories that were based first on the existing stream quality and imperviousness combined with predominant land use. The Special Protection Area and Regular Protection Area were included as management approaches (along with a remedial protection approach) under a more general Watershed Protection category. Two management categories were added to deal with the special conditions in agricultural and urban areas. The categories in the CSPS include:

Watershed Preservation Areas

- Stream condition is EXCELLENT.

- Projected land use is not expected to put significant stress on resource and projected imperviousness is generally less than 10 percent of the subwatershed area.

- Areas are generally protected by very low density zoning or parkland.

Watershed Protection Areas

- Stream condition is EXCELLENT or GOOD

- Existing and/or planned land use results in development patterns with imperviousness above 10 percent and protection of the resources from development impacts is necessary.

- Different management levels are applied based on the level and type of protection deemed necessary to protect the resource:

  Special level — Due to the sensitivity of the resource and the magnitude of change between existing and planned development, some level of enhanced watershed management is necessary beyond typical environmental guidelines and sediment control and stormwater permitting requirements.

  Regular level — Standard existing protection measures are expected to adequately protect the resource from existing and/or projected land use. Development activity is not expected to significantly increase impervious area over what already exists and accompanying Development Review requirements and stormwater controls would provide adequate mitigation.

  Remedial level — Stream condition is good or excellent but problems are observed, usually in the habitat condition, that are attributable to previous land use impacts. Habitat conditions may be on the verge of or in the process of deteriorating, but stream biological integrity has not yet deteriorated to fair or poor conditions requiring more comprehensive restoration efforts. The remedial level may be used in conjunction with a special level of protection, where existing habitat problems exist and projected land uses

Wetland Assessment Group Functional Scores

Table A-2

WAG Number*	Groundwater Discharge (3.33 Max.)	Floodflow Attenuation (3.00 Max.)	Nutrient Removal/ Sediment Retention (3.40 Max.)	Aquatic Habitat (3.30 Max)	Wildlife Habitat (3.20 Max.)
Muddy Branch					
MB 1	3.33	2.25	2.60	2.00	2.80
MB 2	2.33	2.00	2.60	1.50	1.40
MB 3	3.33	2.25	2.60	2.00	3.20
MB 5	3.33	2.25	2.40	2.00	2.40
MB 6	3.33	2.25	2.60	2.00	2.60
MB 7	2.33	2.00	2.40	1.50	2.20
MB 8	2.33	1.50	2.20	1.66	1.60
MB 9	3.33	2.25	2.60	2.16	2.40
MB 10	3.33	1.75	2.20	2.33	2.80
MB 11	2.33	1.50	2.20	1.80	1.20
Cabin John					
CJ1	3.33	2.50	2.40	2.33	2.00
CJ2	3.33	2.50	2.40	2.33	2.60
CJ3	3.33	2.50	2.20	2.00	2.80
CJ4	3.33	2.50	2.40	2.00	2.60
CJ5	3.33	2.25	2.60	2.33	2.00
CJ6	3.33	2.50	2.60	2.33	2.60
CJ7	3.33	2.50	2.40	2.33	2.60
BB1	2.33	2.25	2.40	1.83	2.00
Rock Run					
RR1	3.33	2.50	2.60	2.33	2.00
RR2	3.33	2.25	2.40	2.33	2.60
Watts Branch					
WB1	2.33	2.50	2.20	2.00	1.80
WB2	2.33	2.75	2.20	2.00	1.80

Wetland Assessment Group Functional Scores

Table A-2

WAG Number*	Groundwater Discharge (3.33 Max.)	Floodflow Attenuation (3.00 Max.)	Nutrient Removal/ Sediment Retention (3.40 Max.)	Aquatic Habitat (3.30 Max)	Wildlife Habitat (3.20 Max.)
WB2A	2.33	2.25	2.20	2.30	1.60
WB3	1.33	2.25	2.00	1.83	1.90
WB4	2.66	2.25	2.00	2.16	1.60
PB1	2.33	0.00	2.00	2.60	2.10
PB2	2.33	2.25	2.00	2.00	1.40
PB2A	2.66	2.75	2.20	1.60	1.60
PB3	2.66	2.66	2.00	2.33	1.80
PB4	2.33	2.75	2.40	2.16	1.60
SB1	1.00	2.25	2.40	2.00	1.80
SC1	1.33	1.75	2.20	2.08	1.50
GB1	2.33	2.50	2.40	2.00	1.60
GB2	2.33	2.75	1.40	2.60	2.60
GB3	2.33	0.00	2.40	2.60	2.60
KB1	2.33	2.75	1.40	1.20	0.20
KB2	2.33	2.75	2.40	2.00	2.10
Seneca Creek					
HB1	2.66	1.75	1.40	2.50	2.60
HB3	2.66	2.50	1.40	2.16	2.20
Potomac-Direct					
P1	2.33	2.75	2.75	2.16	2.40

***Watersheds:**

MB Muddy Branch
CJ Cabin John
BB Bucks Branch
RR Rock Run
WB Watts Branch
PB Piney Branch
SB Sandy Branch
SC Stony Creek
GB Greenbriar Branch
KB Kilgour Branch
HB Hookers Branch
P Potomac-Direct

Fish Species Collected in Various Watersheds[1]

Table A-3

Species [2]		Great Seneca Creek	Muddy Branch	Watts Branch	Cabin John Creek	Rock Run	Potomac Direct
American Eel	*Anguilla rostrata*	X	X	X	X		
Banded Killifish	*Fundulus diaphanus*		X				
Black Crappie	*Pomoxis nigromaculatus*			X			
Blacknose Dace	*Rhinichthys atratulus*	X	X	X	X	X	X
Bluegill Sunfish	*Lepomis macrochirus*	X	X	X	X		
Bluntnose Minnow	*Pimephales notatus*	X	X	X			
Brown Bullhead	*Ameiurus nebulosus*			X			
Central Stoneroller	*Campostoma anamalum*	X	X	X	X		
Common Carp	*Cyprinus carpio*				X		
Common Shiner	*Notropis cornutus*	X		X	X		
Creek Chub	*Semotilus atromaculatus*	X	X	X	X	X	X
Creek Chub Sucker	*Erimyzon oblongus*	X					
Cutlips Minnow	*Exoglossum maxillingua*	X		X	X	X	X
Eastern Mudminnow	*Umbra pygmaea*	X					
Eastern Silvery Minnow	*Hybognathus regius*	X					
Fallfish	*Semotilus corporalis*	X	X		X		
Fantail Darter	*Etheostoma flabellare*	X	X	X		X	X
Golden Redhorse	*Moxostoma erythrurum*		X		X		
Golden Shiner	*Notropis chrysoleucas*	X		X	X		
Goldfish	*Carassius auratus*				X		
Green Sunfish	*Lepomis cyanellus*	X	X		X	X	X
Greenside Darter	*Etheostoma biennioides*	X	X	X			
Northern Hogsucker	*Hypentelium nigricans*	X	X	X			
Largemouth Bass	*Micropterus salmoides*	X		X	X		
Longear Sunfish	*Lepomis megalotis*		X				
Longnose Dace	*Rhinichthys cataractae*	X	X	X	X	X	X
Margined Madtom	*Noturus insignis*	X				X	X

Fish Species Collected in Various Watersheds[1] (Continued) Table A-3

Species [2]		Great Seneca Creek	Muddy Branch	Watts Branch	Cabin John Creek	Rock Run	Potomac Direct
Mosquito Fish	*Gambusia holbrooki*		X				
Mottled Sculpin	*Cottus bairdi*	X	X				
Potomac Sculpin	*Cottus girardi*	X	X	X	X		
Pumpkinseed Sunfish	*Lepomis gibbosus*	X	X	X	X		
Rainbow trout	*Oncorhynchus mykiss*			X			
Redbreast Sunfish	*Lepomis auritus*	X	X	X	X		
River Chub	*Nocomis micropogon*	X					
Rock Bass	*Ambloplites rupestris*	X					
Rosyside Dace	*Clinostomus funduloides*	X	X	X	X	X	
Satinfin Shiner	*Notropis analostanus*		X	X			
Silverjaw Minnow	*Ericymba buccata*	X	X	X	X		
Smallmouth Bass	*Micropterus dolomieu*	X	X	X	X		
Spotfin Shiner	*Notropis spilopterus*	X	X	X			
Spottail Shiner	*Notropis hudsonius*	X					
Swallowtail Shiner	*Notropis procne*	X	X	X	X		
Tessellated Darter	*Etheostoma olmstedi*	X	X	X	X	X	X
Warmouth	*Lepomis gulosus*		X				
White Sucker	*Catostomus commersoni*	X	X	X	X	X	X
White Crappie	*Pomoxis annularis*	X					
Yellow Bullhead	*Ameiurus natalis*	X	X			X	X

(1) **Source:** CSPS. 1997. Montgomery County's Countywide Stream Protection Strategy (Draft). Montgomery County Department of Environmental Protection and Maryland-National Capital Parks and Planning Commission. 21 April 1997.

(2) Contact MCDEP for detailed information on the sampling results.

are expected to increase imperviousness significantly. In these areas it is particularly important to address existing channel instability so that stream reaches will be able to withstand small incremental impacts associated with change in land use. The remedial level under Watershed Protection Areas differs from Watershed Restoration areas by being applied as limited spot improvements to areas with good or excellent stream condition. Watershed Restoration areas have fair or poor stream condition and require more comprehensive restoration efforts.

Watershed Restoration Areas

- Stream condition FAIR or POOR.
- Contributing drainage generally has less than 55 percent ultimate impervious area.
- Significant areas of natural stream channel still exist.
- Most land abutting the stream is in conservation easements or public ownership.

Urban Watershed Management Areas

- Designation based on recognition that certain existing and planned land uses have a detrimental and unavoidable effect on subwatershed hydrology, stream habitat, water quality, and aquatic life that limits the potential for restoration.
- Stream condition is POOR.
- Land use generally consists of intense development (e.g. Central Business Districts, major commercial areas).
- Contributing drainage generally has 55 percent or greater ultimate impervious area and system presently does not support viable biological community.
- Significant portion of the drainage area is piped or channelized and habitat restoration is generally infeasible.

Agricultural Watershed Management Areas

- Stream condition is GOOD, FAIR, or POOR.
- Agriculture is the predominant land use.
- Some level of impairment is reflected in the monitoring data, as indicated by a resource condition of good, fair, or poor. (Excellent agricultural subwatersheds would fall into the Watershed Preservation Area management category).
- The Montgomery Soil Conservation District would be the lead agency for developing management approaches and tools for Agricultural Watershed Management Areas.

Calculating Existing Subwatershed Imperviousness

Existing imperviousness was obtained from the *Countywide Stream Protection Strategy*. The CSPS used the information from the County's geographic information system (GIS). The information was entered into digital format from aerial photos by the Research and Technology Center of the M-NCPPC Montgomery County Department of Park and Planning.

The GIS information that represented current conditions reflected those conditions present in the study area in the period 1993-1995 (different parts of the study area were photographed at different times, see Figure A-1). There has been a relatively small amount of development in the study area since 1990 due to sewer limitations, so that land use conditions reflected by the planimetric data were assumed to closely represent present existing conditions. That is, existing planimetric data were used to characterize existing conditions with respect to land uses and land cover.

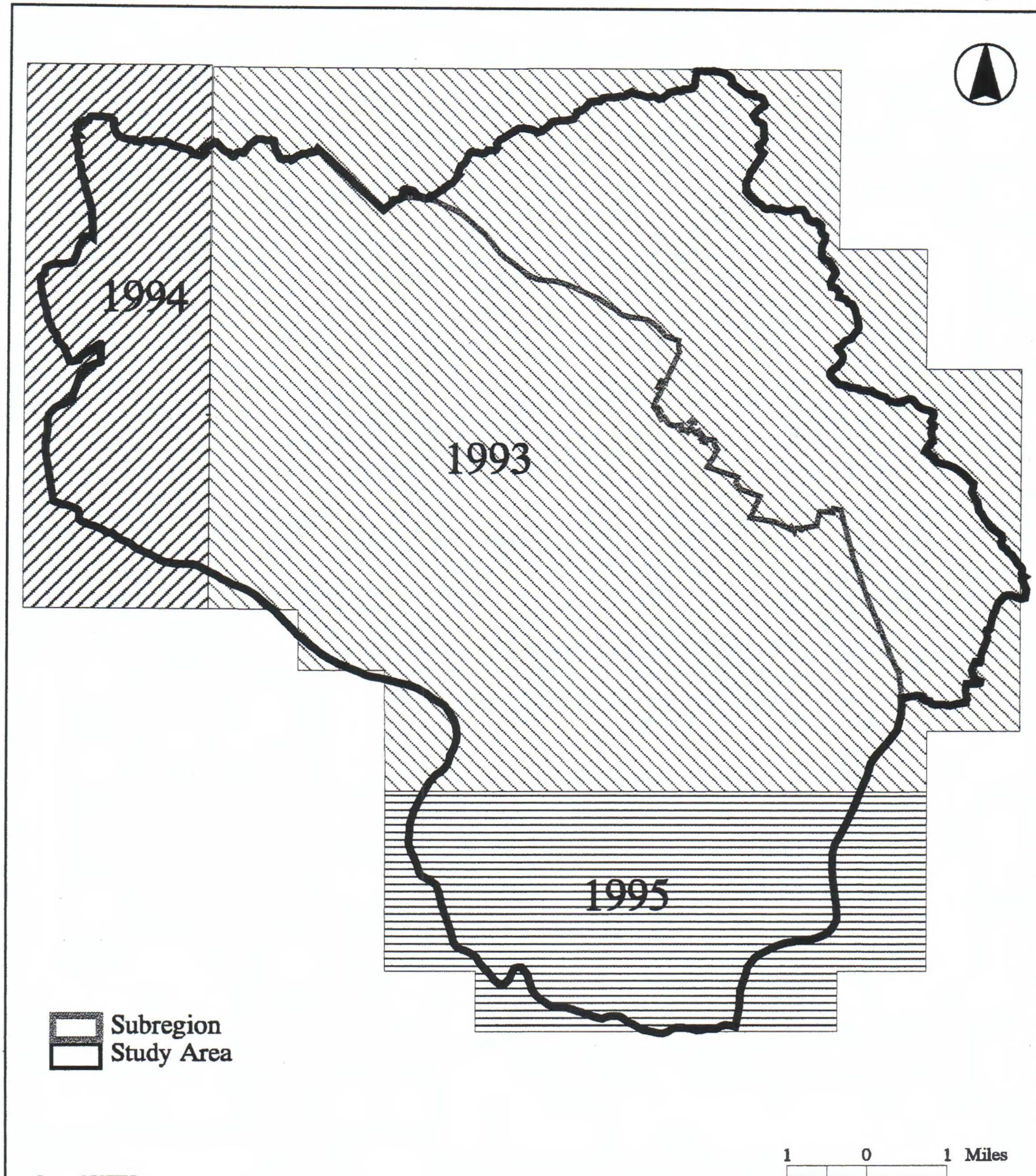
GIS was used to measure all paved surfaces and building rooftops that are shown in the planimetric layers for each subwatershed. These layers include all features that are considered to be impervious surfaces except for sidewalks and driveways for single-family detached houses. (See below for the estimated impervious surface area attributable to sidewalks and residential driveways.)

In order to calculate the area of driveways not already accounted for, the building, road/street, and parking layers were evaluated and an approximate count obtained of the number of buildings (primarily residential single-family detached in subdivisions; rear yard structures assumed to be sheds and the like were not counted) for which a driveway existed but did not appear in the planimetric layer. This number was then multiplied by the average area for a driveway in each subwatershed, which was obtained from the required front-yard setback for the predominant residential zones within the watershed multiplied by an assumed width of 15 feet.

Sidewalks are a feature in the GIS data that are shown as lines and not as polygons. The area of sidewalks was determined by multiplying the length (taken from the planimetric layer) by an assumed width of 4 feet.

Potomac Study Area Aerial Photograph Acquisition Dates

Figure A-1



Source: MNCPPC

Potomac Study Area Subwatersheds

Figure A-2

Summary of Percent Impervious Area(1)

Table A-4

Sub-watershed Number	Sub-watershed Name	Watershed Name	Percent Existing Impervious Area
6	South Germantown	Great Seneca Creek	11(+)
7	Lower Great Seneca	Great Seneca Creek	4 (+)
8	Upper Muddy and Decoverly Tributary	Muddy Branch	36/27 (#)
9	Route 28 Tributary	Muddy Branch	19
10	Lakes Tributary	Muddy Branch	33
11	Quince Orchard Knolls	Muddy Branch	20
12	Potomac Grove Tributary	Muddy Branch	23
13	Mainstem Above Turkey Foot	Muddy Branch	10
14	Dufief Tributary	Muddy Branch	19
15	North Potomac	Muddy Branch	8
16	Query Mill Tributary	Muddy Branch	7
17	Darnestown Tributary	Muddy Branch	8
18	Farmlands Tributary	Muddy Branch	9
19	Mainstem Above River Road	Muddy Branch	5
20	Esworthy Area	Muddy Branch	9
21	Riverwood Area	Muddy Branch	5
22	Pennyfield Tributary	Muddy Branch	22
23	Upper Watts and Research Boulevard	Watts Branch	33/26 (#)
24	Rockville - Lakewood	Watts Branch	22
25	Upper Piney Branch	Watts Branch	10
26	Middle Piney Branch	Watts Branch	6
27	Middle Watts Branch	Watts Branch	16
28	West Piney Branch	Watts Branch	8
29	Lower Piney Branch	Watts Branch	7
30	Lower Watts Branch	Watts Branch	11
31	Greenbriar Branch	Watts Branch	6
32	Upper Sandy Branch	Watts Branch	8
33	Lower Sandy Branch	Watts Branch	9

Summary of Percent Impervious Area[1] (Continued)

Table A-4

Sub-watershed Number	Sub-watershed Name	Watershed Name	Percent Existing Impervious Area
34	Upper Mainstem	Cabin John Creek	27
35	Old Farm Branch and Lower Old Farm	Cabin John Creek	27
36	Bogley Branch	Cabin John Creek	20
37	Mainstem	Cabin John Creek	19
38	Snake Den Branch	Cabin John Creek	20
39	Buck Branch including Buck Branch A	Cabin John Creek	18
40	Middle Mainstem	Cabin John Creek	27
41	Ken Branch including Ken Branch A	Cabin John Creek	12/13
42	Congressional Country Club Tributary	Cabin John Creek	11
43	Beltway Branch	Cabin John Creek	Incomplete
85	Lower Mainstem	Cabin John Creek	Incomplete
44	Upper Rock Run	Rock Run	25 - 30%*
45	Lower Rock Run	Rock Run	25 - 30%*
46	Avenel North	Rock Run	25 - 30%*
47	Avenel South	Rock Run	25 - 30%*
48	Direct 6	Potomac Direct	2
49	Direct 5	Potomac Direct	No Data
50	Direct 4	Potomac Direct	15 - 25%*

(1) Source: *Montgomery County's Countywide Stream Protection Strategy (Draft)*. Montgomery County Department of Environmental Protection and Maryland-National Capital Park and Planning Commission. April 1997. Percentages are based on actual ground cover from aerial photography.

(+) Sub-watershed boundaries are not exactly as in *Montgomery County's Countywide Stream Protection Strategy (Draft)*.

(#) Sub-watershed divided into two smaller sub-watersheds by *Montgomery County's Countywide Stream Protection Strategy (Draft)*.

* Ranges as provided by *Montgomery County's Countywide Stream Protection Strategy (Draft)*.

In addition to the GIS layers for paved features (buildings, driveways, roads, streets and parking, cultural, and sidewalks) the impervious contribution of nonpaved land cover was calculated, based on the assumption that these surfaces also contribute to surface water runoff for some precipitation events. Remaining nonpaved land was categorized as either forested or nonforest-nonpaved. Nonforest-nonpaved land includes lawn, pasture, and crop fields and is referred to as meadow. Forest cover is assigned an imperviousness factor of one percent; nonforest green cover is assigned a factor of three percent. A one percent imperviousness factor for forest cover has been used in other studies that focus on land use imperviousness (Northern Virginia Planning District Commission, 1980; Galli, 1983; CH2M Hill, 1982). For nonforested green cover, a wider range of imperviousness factors have been used (i.e., 0 to 7 percent). The CSPS uses three percent imperviousness factor for nonforested green cover because it is roughly the middle of the range of values that have been used in other studies and it reflects the greater benefits of forest cover compared to meadow or grass cover on streams.

Determination of Significant Forest Blocks

Identification of significant forest blocks in the Potomac Subregion is based on criteria established by the Chesapeake Bay Critical Area Commission (1986). These criteria were developed in response to concerns about the declining populations of many native breeding birds which are associated with large, relatively undisturbed blocks of mature forest. The Chesapeake Bay Critical Area Commission's report suggests that upland forest blocks of 100 acres or more and riparian (streamside) forests which are 300 feet wide or wider may serve as habitat for forest interior dwelling birds. The report goes on to note that these criteria should serve as a general guideline; forest interior birds may be found in some smaller forest areas.

Based on these recommendations, staff measured forest blocks and riparian corridors on the GIS forest layer created for the Potomac Subregion Environmental Report. Upland blocks in excess of 100 acres and riparian corridors 300 feet wide or more were delineated and identified as "significant forest blocks." These areas have the greatest potential to provide habitat for forest interior bird species.

Confirmation that these areas are serving as forest interior areas for birds can only be accomplished by conducting breeding bird surveys. The Chesapeake Bay Critical Area Commission suggests that breeding bird surveys, which identify at least four forest interior bird species or at least one sensitive species as "probable" or "confirmed" breeders in a given forest area, should confirm that area as a forest interior (see Table A-5).

List of Forest Interior Dwelling Bird Species — Table A-5

Common Name	Scientific Name
Flycatcher, Acadian	*Empidonax virescens*
*Hawk, red-shouldered	*Buteo lineatus*
Ovenbird	*Seiurus aurocapillus*
*Owl, barred	*Strix varia*
Parula, northern	*Parula americana*
*Redstart, American	*Setophaga ruticilla*
Tanager, scarlet	*Piranga olivacea*
Vireo, red-eyed	*Vireo olivacea*
Vireo, yellow-throated	*Vireo flavifrons*
Warbler, black-and-white	*Mniotilta varia*
*Warbler, hooded	*Wilsonia citrina*
*Warbler, Kentucky	*Oporornis formosus*
Warbler, prothonotary	*Prothonotaria citrea*
*Warbler, Swainson's	*Limnothlypis swainsonii*
*Warbler, worm-eating	*Helmitheros vermivorus*
*Waterthrush, Louisiana	*Seiurus motacilla*
Whip-poor-will	*Caprimulgus vociferus*
Woodpecker, hairy	*Picoides villosus*
Woodpecker, pileated	*Dryocopus pileatus*

* Denotes species especially sensitive to disturbance

Sources: Chesapeake Bay Critical Area Commission (1986). A Guide to the Conservation of Forest Interior Dwelling Birds in the Critical Area. Guidance Paper No. 1; 15pp. Maryland Ornithological Society. 1982.

Maryland and D.C. Breeding Bird Atlas Project Handbook, 1983-1987. Supplement to Maryland Birdlife, Vol. 38, 1982; 20pp.

Note: Determination of breeding status should be according to the criteria set forth by the Maryland Ornithological Society (1982).

Potomac Subregion Sewer and Water Status Report

Prepared by M-NCPPC with the Assistance of:

Montgomery County Department of Environmental Protection
Washington Suburban Sanitary Commission
Montgomery County Department of Permitting Services

Overview

Community sewer service in the Potomac Subregion is provided via one of four sewer trunk lines: Muddy Branch, Watts Branch, Rock Run, and Cabin John. These trunk lines direct flows from the Potomac Subregion and other planning areas south into the Potomac (Dulles) Interceptor. The Dulles Interceptor is a very large diameter main that captures sewage flows from much of Montgomery County and parts of Loudoun and Fairfax Counties in Virginia. The Dulles Interceptor discharges to the Blue Plains treatment plant in the District of Columbia where much of the region's treatment needs are met. Various regional agreements detail the average and peak flow limits each jurisdiction is allowed to discharge into this system.

The *Approved and Adopted Master Plan for the Potomac Subregion, May 1980* envisions sewer service within the master plan area to be expanded based on a staging sequence. As with all master plans, the extension of community water and sewer service to achieve the desired zoning densities are implemented through the *Comprehensive Water Supply and Sewerage Systems Plan*. The water and sewer plan is administered by the Montgomery County Department of Environmental Protection. It sets the policies upon which community water and sewer service is extended. The master plan recommendations and the water and sewer plan are coordinated to avoid conflicts in policy.

Presently, most of the master plan area designated as sewer stages I, II and III have or are approved to receive community sewer service. This generally includes areas with zoning densities R-200 and greater, as well as RE-1, RE-2C and RE-2. The intent of the master plan was to allow stages I, II, and III to develop first and use available capacity within the conveyance system and at the Blue Plains treatment plant. The remainder of the Potomac Subregion was designated as sewer stage IV, the last stage to be opened to development. The master plan anticipated that stage IV would use any remaining capacity within the system if it could be served by logical and economical extensions from existing sewers. The Potomac Subregion is one of two planning areas[7] in the county that recommends community sewer service to the RE-2 Zone.

County Council Actions on Sewer Service

In the Potomac Subregion, properties included in the fourth and final sewer stage were opened to the consideration of development using community sewer service on a case-by-case basis by action of the Planning Board in July 1987. That action included recommendations to exclude certain stage IV areas in the western part of the master plan area from receiving sewer service. In addition, the County Council has placed further restrictions on the availability of sewer within stage IV. For areas designated as stage IV, the master plan recommends extending service to only those areas that can be served by logical, economical and environmentally acceptable extensions from the sewerage system constructed to serve stages I, II and III. Under this guidance and limitations imposed by the County Council, only a portion of the entire stage IV area has developed on sewer which will be discussed later in this document. Development with septic systems generally cannot occur at the zoned density due to poor hydraulic conductivity and shallow soils, resulting in failed percolation tests.

Sewer Service in the Sandy Branch/Greenbriar Branch Basins

The County Council's approval of sewer service for the Palatine of Potomac project in March 1988 opened the possibility of development within the upper portions of these watersheds (upstream of Glen Road) using community sewer service. The County subsequently received many requests for water and sewer category changes, accounting for as much as fifty percent of the land in the upper portions of these basins. At MCDEP's request, WSSC initiated a sewer facility study to examine service alternatives for this area. The Council endorsed an option in the 1991-1996 WSSC Capital Improvement Program (CIP) that served the Greenbriar Branch basin by a grinder pump and low-pressure sewer system; the Sandy Branch basin would be served by a gravity system feeding into the proposed Glen Road pumping station and force main.

However, the County Council raised concerns about the amount of traffic that would be generated in the area should development supported by community sewer service occur. Of concern was the network of small roads that do not meet current County codes for safety and that were also part of the ongoing Rural/Rustic Roads Task Force. In 1988, the Council decided to defer all category change requests within these basins except for those areas zoned R-200/TDR-3, pending the results of a traffic study.

The traffic study brought about a number of conflicts with County transportation and land use policy. Mainly, the study found that development within this basin could be accommodated with safety improvements to the area roads with minor intersection improvements. At the same time, the County was considering adopting the recommendations of the Rural/Rustic Road Task Force which included a proposed designation for Glen Road. Road improvements recommended in the study were in conflict with the recommendations of the Rustic Roads Task Force. The Council Transportation and Environment Committee (T&E Committee) recommended denial of all category change applications within the basins, except again for those areas zoned R-200/TDR-3, until this conflict could be resolved.

Subsequently, the Council chose to delete the previously approved CIP projects necessary to support development in the basin from the 1992-1997 WSSC CIP. The Council

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[7] The approved and adopted *Fairland Master Plan* designates a portion of Fairland Recreation Park that is zoned RE-2 for sewer service in order to serve park facilities.

further directed the Planning Board to examine the land use, infrastructure, environmental and fiscal impacts of providing sewer service to this area as part of a master plan amendment process. With the exception of the Palatine property, which was already approved for service, and a number of smaller properties immediately abutting the Palatine project sewerage system, which were considered to have a minimal effect on traffic, the Council chose not to act on all other water and sewer category change requests in the RE-2 Zone of these basins effectively denying those requests. The Department of Park and Planning staff is now in the initial stages of the master plan process, and these considerations, among others will be part of that process.

Sewer Service in the Piney Branch Basin

In the upper portions of the Piney Branch watershed, the extension of the community sewerage systems was required in order to achieve the land use recommendations in the master plan and the adopted zoning densities. Sewer service presented a problem because of the long extension up the Piney Branch from the Watts Branch trunk sewer. The Piney Branch is a Use I-P stream with unusually good water quality. The trunk sewer traverses sewer stage IV areas zoned RE-1 and RE-2. In 1991, the Council chose to maintain the trunk sewer in the WSSC CIP, but also chose to adopt a restricted access policy for the Piney Branch sewerage system in the Water and Sewer Plan, citing the following concerns:

- potential environmental degradation resulting from build out at the maximum zoned density,
- disagreement with regard to the master plan recommendations for sewer service to stage IV areas zoned RE-1 and RE-2,
- category changes previously approved in the lower part of the basin, and
- the need to serve the upper portions of the basin.

This policy effectively limits service in the stage IV areas of the Piney Branch basin to those properties that immediately abut the Piney Branch Trunk Sewer. The policy has been tested many times by property owners' category change requests and has been upheld by the Council. The restricted access policy also restricts sewer service from some R-200 and RE-1 zoned property designated as sewer stages I and II. This issue has been brought to the attention of the Council who will likely review this as part of the master plan revision. Within the Piney Branch basin, properties not eligible for connection to the sewer must rely on septic systems.

Sewer Service in Other Stage IV Areas

Outside the areas identified in the preceding discussions on the Sandy Branch, Greenbriar Branch, and Piney Branch basins, the County Council has generally upheld the concept of community sewer service for stage IV areas where such service is consistent with master plan recommendations.

Soils Constraints

Generally, soils west of Interstate 270 have moderate to severe limitations for septic percolation tests. The entire Potomac Subregion is constrained due to a number of factors including high clay content, shallow bedrock, and high water table. This results in lower housing yields than would be expected to occur if community sewer service were available. In parts of the Sandy Branch, Greenbriar Branch, and Piney Branch basins, extremely shallow bedrock can result in little to no development potential.

The Department of Park and Planning is anticipating close coordination with WSSC, MCDEP and the MCDPS, Wells and Septic Unit, to better understand the limitations of the soils and any existing or potential health concerns associated with failing septic systems. This effort will identify the development yields that could be realized using septic systems given soil types, topography and other environmental features to the extent possible with existing data. Should the provision of sewer service to a particular area warrant investigation, these meetings may provide the master planning process with a preliminary determination of potential environmental impact to streams and water quality due to construction impacts and the potential for long-term cumulative impacts of development. Discussion will also occur regarding the success of mitigation of these impacts on water resources.

Sewer System Capacity

The *Montgomery County Future Sewer Capacity Constraints Report*, April 1996, by WSSC, identifies those sewer systems that will be over capacity given current population forecasts. Within the Potomac Subregion, the Muddy Branch and Cabin John trunk sewers can be expected to exceed design capacities in portions of their length by the year 2010; certainly within the lifetime of the upcoming master plan revision. The need for their replacement and/or relief should be acknowledged in the master plan revision. Additionally, the Watts Branch may need relief beyond 2020. Given the public concern toward environmental and economic impacts during the recent city of Rockville wastewater conveyance study for the King Farm, facility planning may be required in this basin. The actual timing and techniques used to address these sewer capacity concerns will be dependent on the actions of the County Council through the Water and Sewer Plan and the

WSSC capital improvement program, as well as the master planning process.

The WSSC is currently undertaking a major facility plan to address capacity constraints within the Rock Creek sewerage basin. A possible option under consideration is pumping excess flows from Rock Creek over to the Cabin John sewerage basin. If selected, this option will impact on the extent and timing of relief sewer construction required in the Cabin John basin.

The master plan may consider County policy regarding the decisions made about the Rock Run wastewater treatment plant. The WSSC Strategic Sewerage Study (Greeley and Hansen, 1993) identifies this facility as a critical element for the regions treatment needs in all the alternatives considered in the study. Although a site for the treatment plant has been designated and documented in the current master plan, a consultant study is underway to conduct a preliminary investigation of influent/effluent alternatives and environmental issues, develop planting and screening schemes, a long-term implementation schedule, and establish a WSSC presence on the site. The master plan will need to recognize the proposed location of the plant.

Water Treatment Issues

The WSSC Potomac water filtration plant is located on River Road with water intakes located downstream of the Potomac River's confluence with Watts Branch. The plant provides ninety percent of the bi-county's community water supply needs. The plant will continue to supply future water supply needs of the sanitary district for most of future anticipated growth.

In recent years the Maryland Department of the Environment (MDE) has expressed concerns about the release of sedimentation basin solids into the Potomac River. Earlier this year, the WSSC and the MDE signed a consent agreement that includes provisions for separating the filter backwash and discharging it directly back to the Potomac River. The agreement also has provisions for pumping, thickening , dewatering, and disposal of the sedimentation solids under certain river conditions. The agreement includes a compliance schedule which requires the WSSC to complete the facilities necessary to comply with the conditions of the new permit within 4.5 years from the date of issuance. The release permit is pending.

Detailed Discussion of Analysis Areas

Analysis Area 1 - The Darnestown Triangle

This area is located in the Muddy Branch watershed bounded by MD 28 to the north, Turkey Foot Road to the west, and Jones Lane to the east. The 1980 master plan recommended that this portion of the Potomac Subregion remain in the R-200 Zone without community sewer service. Development of lots at full density, i.e. half acre lots, is unrealistic using on-site septic systems. This was understood when the 1980 master plan was prepared. The purpose of this recommendation was to maintain a variety of lot sizes, larger than typically realized in R-200 developments using sewer, in order to preserve the large lot character of the existing developed areas. In this area, the requirement to provide an adequate septic absorption trench area on each lot was used as a tool to lower densities.

This particular policy has been problematic for development in this area. In the R-200 Zone there is an expectation by the development community that sewer service will be provided. Sewer service to R-200 Zones is supported in the policies of the *Comprehensive Water Supply and Sewerage Systems Plan* (the Water and Sewer plan) and the Executive Regulation for on-site wastewater disposal systems. The Water and Sewer plan has a general policy to place zones of one-half acre and more dense in a service area category for community water and sewer. It does recognize that a local master plan has the ability to modify this general policy as has been done in the Potomac Subregion. Outside the Potomac Subregion, incidences of non-sewered R-200 zones are limited and usually associated with rural villages within the rural zone or agricultural preserve.

The Montgomery County Department of Permitting Services, Well and Septic Section has expressed concerns about this portion of the Potomac Subregion. The basis of their concern is that there is an expectation from developers to develop on lots closer to a half acre in size within the R-200 Zone. County well and septic officials cite the attempts of developers to "squeeze" approved septic systems onto the smallest lots possible leaving little or no room for house amenities such as decks or pools and limiting the space available to construct utilities. Typically, it is the Permitting Services and Environmental Protection departments that receives the complaints when a septic system limits the ability of a homeowner to make reasonable modifications to a house. Although the master plan is clear that the use of septic is being used to maintain large lots, pressure to get the maximum yield under the zone using septic continues to create problems for County agencies. The Council has asked that the master plan process review the policies for this area.

Analysis Area 2 - Sandy Branch Pump Station (WWPS) and Rich Branch Trunk Sewer

The Sandy Branch pump station collects sewage flow from the area zoned R-200/TDR-3 on the north and south side of Travilah Road at the intersection with Dufief Mill Road. Capacity at this pumping station and the Rich Branch trunk sewer to which it feeds are approaching capacity. In reviewing two recent map amendments to the Water and

Sewer Plan located within the pump station sewershed, the Council requested an analysis of the capacity problem. The MCDEP and WSSC are looking closely at the remaining capacity left in these two sewerage systems to allow the TDR area to continue developing. Should there be a need to enlarge the existing Sandy Branch WWPS or provide relief for the Rich Branch trunk sewer, there will be environmental and community impacts associated with these projects.

The Sandy Branch pump station is located in the headwaters of the Sandy Branch watershed. In the late 1980s, it was anticipated that the Sandy Branch watershed would be served by the Glen Road pump station (deleted from the CIP as previously noted). The Glen Road pump station could have also served the area presently served by the Sandy Branch pump station, precluding the need for the pump station and the need to relieve the Rich Branch Trunk Sewer.

Upgrades to either the existing Sandy Branch pump station or the Rich Branch trunk sewer would serve existing development and also allow the TDR zones to develop to their fullest potential. The upgrade alternatives will be the subject of a facility plan that will be used by WSSC to recommend appropriate CIP projects to address the identified sewage transmission problems.

Analysis Area 3 - Sandy Branch and Greenbriar Branch

This area is generally defined as being bounded by Travilah Road to the north, Glen Road to the south, and Piney Meetinghouse to the east. It includes the Rockwell Crushed Stone Quarry site and properties to the south and west of the quarry. This basin was to be served by the Glen Road pump station. A limited number of category changes were approved for development on grinder pumps and a pressure sewer. It was anticipated that portions of the Palatine development that drain by gravity to the Sandy Branch would ultimately connect to the Glen Road WWPS. However, the Council deleted the pumping station and force main from the WSSC CIP. The category change approved for the Palatine project allowed the development to move forward using grinder pump systems in the event an area-wide sewerage system is not provided. The remainder of the basin has been slow to develop due to severe septic system limitations.

The approved Potomac Master Plan currently recommends service to the RE-2 Zone in stage IV if it can be logically and economically extended from the existing sewer system. Service to this basin would require program size lines and would need County Council approval. A sewer facility plan was developed in the late 1980s by WSSC. If sewer service to this area is to be evaluated, it will be desirable to update this earlier study.

Although the current RE-2 Zone supports sewer service, a decision to increase density could have potential water quality impacts to both Use I-P streams. As determined by the preliminary results of the County's stream monitoring efforts, streams in this area of the County have fair to good water quality and will need to be evaluated for the impacts expected from any increased development in this basin. The present water quality of Sandy Branch should be taken into consideration prior to decisions about changes in zoning densities and sewerage system extensions.

Analysis Area 4 -Piney Branch Basin

After considerable debate over environmental impact, the County Council in the late 1980s chose to extend a gravity sewer line up the Piney Branch stream system to serve the sewer stages I and II properties located in the upper reaches of the basin between Boswell Lane and MD 28. These included properties zoned R-200/TDR-3, R-200, and RE-1. These same environmental issues were raised again in the early 1990s when the Council considered replacing the gravity trunk sewer with a pumping station and force main. The trunk sewer was retained in the WSSC CIP, but to minimize the effects of development on the stream system, the Council restricted the ability of properties in the basin to connect to the sewer. County Council Resolution 12-486 details the Piney Branch Sewer Agreement which includes the Piney Branch Restricted Access Policy. This policy was crafted to restrict connections to the line based on the following:

Properties with Right of Connection to the Piney Branch

1. Properties with sewer approval prior to December 3, 1991.
2. Transferable development rights (TDR) receiving areas without approval prior to December 3, 1991.
3. Connections requested for public health reasons.
4. Properties directly abutting the Piney Branch sewer main or sewer right-of-way.

Properties Restricted from Access to the Piney Branch Sewer

1. Properties that do not directly abut, but could drain by gravity to the sewer with a new tributary non-program size main to make the connection.

This policy, enacted in 1991, has been successfully upheld throughout the previous six years of amendments to the Water and Sewer Plan. Recently, however, the Executive brought to the Council a number of category change requests for properties in the Piney Branch watershed and within stages I and II of the master plan. Service to these properties is consistent with the master plan but not consistent with the restricted access policy and therefore, went to the Council with a recommendation to deny by reviewing agencies. An argument was made that these properties should have been allowed to connect to the Piney Branch sewer at the inception of the policy since they were included in sewer stages I and II in the master plan, the difference being that these properties were not zoned as TDR receiving areas as were the larger tracts: Traville, Piney Glen, Willows of Potomac and Conklin/Ward properties. At the request of the Council, MCDEP prepared an evaluation of the restricted access policy on development in the Piney Branch basin for the T&E Committee. The T&E Committee recommended maintaining the existing policy pending a review of the basin as part of the master plan update.

The Councils action in March 1997 essentially upheld the restricted access policy, with one exception. Citing special circumstances the Council approved a narrowly-focused amendment to the restricted access policy to allow sewer service for the RE-1-zoned Cavanaugh Property. The Council acted to deny all the other sewer stage I and II area category change requests. To date this is the only amendment to the restricted access policy. The Council feels that other properties in the Piney Branch basin may warrant further consideration and have instructed the Planning Board to examine this as part of the master plan revision.

Water Quality Monitoring Summary Tables

The following tables (Tables A-6 through A-10) summarize the results of historical and current water quality monitoring for the streams within the Potomac Subregion. The results are necessarily simplified, and more detail about the results of some of the studies appear in the text of Chapter 1. These tables convey the basic information about the type, time, source, methodology and generalized results for various sections of streams arranged in chronological order by type of monitoring.

Summary of Lower Seneca Stream Monitoring

Table A-6

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Seneca Creek Mainstem
Macro-invertebrates	1989-1991	MDE July 1993	surber or kicknet[4]	MD RBP[5]	unimpaired, moderately impaired, impaired; narrative[6]	generally moderately impaired, showing little WQ impact; good
	1991-1993	MDE 1994	surber or kicknet	MD RBP	unimpaired, moderately impaired, impaired; narrative	moderately impaired community; good
Fish	1972-1974	Ragan & Dietemann 1976	seine & electro-shock[7]	compare to historical data	narrative	no change from earlier survey, good condition, diverse habitat
Chemical and Physical Water Quality	pre-1972	MNCPPC 1976	not specified[8]	compare to MD standards[9]	excellent/good/fair/poor	overall good; good for DO, pH, turbidity, temperature, nutrients or BOD; all streams failed the fecal coliform standard at times
	1969-1973	MCDEP 1973	Not specified; data summary	9 parameters	excellent/good/fair/poor	good
	1970-1973	MCDEP 1974	standard	compare to MD standards, reference stream, prof. judgement	excellent/good/fair/poor	good/good
	1974-1975	MCDEP 1976	standards	see MCDEP 1974	excellent/good/fair/poor	good/good
	1976	MCDEP 1977	standards	WQI Rating	bad/poor/permissible/good/ excellent	permissible (intermediate)
	1977	MCDEP 1978	standards	WQI Rating	bad/poor/permissible/good/ excellent	permissible (intermediate)
	1978	MCDEP 1979	standards	WQI Rating	bad/poor/permissible/good/ excellent	permissible (intermediate)
	1979	MCDEP 1980	standards	WQI Rating	bad/poor/permissible/good/ excellent	permissible (intermediate)

Summary of Lower Seneca Stream Monitoring (Continued)

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Seneca Creek Mainstem
Chemical and Physical Water Quality	1980	MCDEP 1981	standards	WQI Rating	bad/poor/permissible/good/ excellent	permissible (intermediate)
	1969-1973	MDE 1974	not specified	compare to MD standards, 9 parameters	excellent/good/fair/poor	consistently good
	1974-1975	MDE 1976	not specified	compare to MD standards, 9 parameters	excellent/good/fair/poor	consistently good
	1976	MDE 1977	not specified	compare to MD standards, 9 parameters	bad/poor/permissible/good/ excellent	consistently good
	1977	MDE 1978	not specified	compare to MD standards, 10 parameters	bad/poor/permissible/good/ excellent	permissible, improved over previous year
	1978	MDE 1979	not specified	compare to MD standards, 10 parameters	bad/poor/permissible/good/ excellent	permissible, improved over previous year
	1979	MDE 1980	not specified	compare to MD standards, 10 parameters	bad/poor/permissible/good/ excellent	permissible
	1980	MDE 1981	not specified	compare to MD standards, 10 parameters	bad/poor/permissible/good/ excellent	permissible, degraded relative to previous year
	1977-1985	MDE 1988	trend data	compare to MD standards	increasing trend, no trend, decreasing trend	decreasing quality based on total suspended sediment and fecal coliform

Summary of Lower Seneca Stream Monitoring (Continued)

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Seneca Creek Mainstem
Chemical and Physical Water Quality	1989-1991	MDE 1993	trend data	compare to MD standards; macro-invertebrate community indicates good water quality	excellent/good/fair/poor	good; elevated bacterial nutrient, and suspended sediment levels
	1972	Ragan & Dietemann 1976		9 parameters	excellent/good/fair/poor	good
	1985	MWCOG 1987	various	modified ICPRB 1979 [10]	excellent/good/fair/poor	good; fecal coliform exceed standards
	1985-1987	MDE April 1988	trend data	compare to MD standards	narrative	good, meets Class I standards, fecal coliform levels decreasing
	1989-1991	MDE July 1991	trend data	compare to MD standards	excellent/good/fair/poor	generally good, bacteria, nutrients and TSS are slightly elevated due to runoff; clearly impacted by development & agriculture
	1991-1993	MDE 1994	trend data	compare to MD standards	excellent/good/fair/poor	good; slightly elevated bacteria, nutrient and TSS

Notes:

1. Method or equipment used to collect the referenced sample information in the field.
2. Approach to analyze collected information following a standard or identified methodology.
3. Stream condition characterization attempts to provide the range of possible characterizations included in the methodology used. In some instances, no standard terminology is used.
4. Surber and kicknet samplers are devices used to quantitatively and qualitatively, respectively, collect macro invertebrates in shallow riffle areas of streams.

Summary of Lower Seneca Stream Monitoring (Continued)

5. Maryland Rapid Bioassessment Protocol (Primrose 1991) is a quick and cost-effective standardized methodology for evaluating aquatic resources based on the EPA's methodology (Plafkin et al. 1988).
6. Narrative descriptions are often provided in the referenced sources. In some cases, they are a broad summary of the results of other methods, while in other cases, the basis for the characterization is not clear.
7. Seine and electro-fishing are two common methods used for fish sampling.
8. No information on sampling method provided in referenced source.
9. Comparison of measured water quality parameter values to published standards for Maryland Use I designated waters.
10. Modified method used by the Interstate Commission on the Potomac River Basin.

Summary of Muddy Branch Stream Monitoring

Table A-7

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Muddy Branch Mainstem
Macro-invertebrates	1991	Rivers 1996	various[4]	HBI[5]	narrative[6]	excellent to good at three locations
	1993	MDE 1993	various	not specified	narrative	moderately impacted
	1994	Garrison/ MDE 1994	various	not specified	narrative	moderately impacted
	1991-1993	MDE 1994	surber[7]	Md. RBP	narrative; unimpaired/moderately impaired/impaired	good-fair; moderately impacted community
	1996-1997	MCDEP	Mont. Co. Protocols kicknet[11]	IBI	good-fair	good-fair
Fish	1972-1974	Ragan & Dietemann 1976	seine & electro-fishing[8]	compare to historical data	narrative	good condition, diverse habitat, excellent species diversity
	1996-1997	MCDEP	Mont. Co. Protocols [11]	IBI	fair-poor	good-fair
Chemical and Physical Water Quality	pre-1972	MNCPPC 1976	various	compare to MD standards[9]		good for DO, pH, turbidity, temperature, nutrients or BOD; all streams failed the fecal coliform standard at times
	1969-1973	MCDEP 1973	Not specified; data summary	9 parameters	excellent/good/fair/poor	poor
	1970-1973	MCDEP 1974	standard	compare to MD standards, reference stream, prof. judgement	poor/good	poor/good

Summary of Muddy Branch Stream Monitoring (Continued)

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Muddy Branch Mainstem
Chemical and Physical Water Quality	1974-1975	MCDEP 1976	standards	see MCDEP 1974	excellent/good/fair/poor	good/good
	1976	MCDEP 1977	standards	WQI Rating		permissible (intermediate)
	1977	MCDEP 1978	standards	WQI Rating	excellent/good/permissible/ poor/bad	permissible (intermediate)
	1978	MCDEP 1979	standards	WQI Rating	excellent/good/permissible/ poor/bad	good
	1979	MCDEP 1980	standards	WQI Rating	excellent/good/permissible/ poor/bad	permissible (intermediate)
	1980	MCDEP 1981	standards	WQI Rating	excellent/good/permissible/ poor/bad	permissible (intermediate)
	1969-1973	MDE 1974	not specified	compare to MD standards, 9 parameters	excellent/good/fair/poor	poor
	1974-1975	MDE 1976	not specified	compare to MD standards, 9 parameters	excellent/good/permissible/ poor/bad	poor to good
	1976	MDE 1977	not specified	compare to MD standards, 9 parameters	excellent/good/permissible/ poor/bad	good
	1977	MDE 1978	not specified	compare to MD standards, 10 parameters	excellent/good/permissible/ poor/bad	permissible

Summary of Muddy Branch Stream Monitoring (Continued)

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Muddy Branch Mainstem
Chemical and Physical Water Quality	1978	MDE 1979	not specified	compare to MD standards, 10 parameters	excellent/good/permissible/poor/bad	good
	1979	MDE 1980	not specified	compare to MD standards, 10 parameters	excellent/good/permissible/poor/bad	permissible
	1980	MDE 1981	not specified	compare to MD standards, 10 parameters	excellent/good/permissible/poor/bad	permissible, improved relative to previous year
	1991-1993	MDE 1994	trend data	compare to MD standards	excellent/good/fair/poor	good; high nutrient and TSS
	1972	Ragan & Dietemann 1976	grabs	9 parameters	excellent/good/fair/poor	good
	1996-1997	MCDEP	Mont. Co. Protocols[11]	DO, pH, Cond, Water Temp, TSS, Air Temp	Narrative	met Use I criteria
Stream Habitat Quantitative and Qualitative	1993	MDE 1993	various	Md RBP	unimpaired, moderately impaired, impaired, narrative	good

Summary of Muddy Branch Stream Monitoring (Continued)

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Muddy Branch Mainstem
Stream Habitat Quantitative and Qualitative	1994	Garrison /MDE 1994	various		unimpaired, moderately impaired, impaired, narrative	good
	1996	EQR 1996	various	Modified RSAT[10]	excellent/good/fair/poor	10 stations in Gaithersburg, 2 scored good, 6 scored fair and 2 scored poor
	1997	DEP and MNCPPC 1997	Mont. Co. Protocol[11]	Rapid Habitat Assessment	excellent/good/fair/poor	fair (headwaters) to good (mainstem and tributaries)

Notes:

1. Method or equipment used to collect the referenced sample information in the field.
2. Approach to analyze collected information following a standard or identified methodology.
3. Stream condition characterization attempts to provide the range of possible characterizations included in the methodology used. In some instances, no standard terminology is used.
4. Various unspecified standard methods used to collect information, depending on date of survey work.
5. Index of Biotic Integrity, as outlined in the CSPS (1997), pg 16.
6. Narrative descriptions are often provided in the referenced sources. In some cases, they are a broad summary of the results of other methods, while in other cases, the basis for the characterization is not clear.
7. Surber and kicknet samplers are devices used to quantitatively and qualitatively, respectively, collect macro invertebrates in shallow riffle areas of streams.
8. Seine and electro-fishing are two common methods used for fish sampling.
9. Comparison of measured water quality parameter values to published standards for Maryland Use I designated waters.
10. Modified Rapid Stream Assessment Technique is a method developed by Washington Council of Governments (1992).
11. Montgomery County Water Quality Monitoring Program Stream Monitoring Protocols. 1997.

Table A-8 Summary of Watts Branch Stream Monitoring

Parameter Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Watts Branch Subwatersheds			
						Upper Watts	Lower Watts	Piney Branch	Mainstem
Macro-invertebrates	1991 (Spring/ Summer)	MD DNR	D-net, 90 sec.[4]	Modified RBP III[5]	Excellent/good/fair /poor	Taxa Richness: 8-12 Total EPT: 30-32 Total Dipteran: 1-64 (Fair to Good)	Taxa Richness: 7-15 Total EPT: 20-46 Total Dipteran: 0-82 (Fair to Good)		
	1991	M-NCPPC Parks	D-Net	Modified RBP III	Excellent to fair				
	1991-1993	MDE 1994	surber[6]	not specified	narrative; unimpaired moderately impaired; impaired				fair-poor; severely impacted community, habitat unimpaired
	1993 (Spring/ Summer/ Fall)	Audubon Naturalist Society	Not given in source[7]	Modified RBP II[8]	excellent/good/fair/ poor		Taxa Richness: 5-14 Total EPT: 1-6 Total Dipteran: 4-26 (Fair to Good)	Taxa Richness: 6-11 Total EPT: 3-4 Total Dipteran: 1-68 (Fair)	
	1994 (Spring/ Summer/ Fall)	Audubon Naturalist Society	Not given in source	Modified RBP II	excellent/good/fair/ good		Taxa Richness: 7-14 Total EPT: 2-3 Total Dipteran: 17-34 (Fair)	Taxa Richness: 7-11 Total EPT: 2-3 Total Dipteran: 15-25 (Fair)	
	1995 (Winter/ Spring/ Summer/ Fall)	Audubon Naturalist Society	Not given in source	Modified RBP II	excellent/good/fair/ poor		Taxa Richness: 17-18 Total EPT: 5 Total Dipteran: 17-47 (Fair)	Taxa Richness: 11-14 Total EPT: 4-9 Total Dipteran: 4-38 (Fair)	

Summary of Watts Branch Stream Monitoring (Continued)

Parameter Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Watts Branch Subwatersheds			
						Upper Watts	Lower Watts	Piney Branch	Mainstem
Macro-invertebrates	1996 (Winter/ Spring/ Fall)	Audubon Naturalist Society	Not given in source	Modified RBP II	excellent/good/fair/ poor	Taxa Richness: 2-16 Total EPT: 0-6 Total Dipteran: 6-47 (Fair)	Taxa Richness: 1-6 Total EPT: 0-12 Total Dipteran: 5-26 (Poor)	Taxa Richness: 3 Total EPT: 5 Total Dipteran: 1 (Poor)	
	1996-1997	Loiderman	Rapid Bioassess-ment; kicknet	HBI[9]	excellent/good/fair/ poor	Fair; Characterize d as pollution tolerant community			
	1997	EA	Kicknet	RBP[10]	excellent/good/fair/ poor	poor invertebrate community at 6 stations			
	1997 (Winter)	Audubon Naturalist Society	Not given in source	Modified RBP II	excellent/good/fair/ poor	Taxa Richness: 2 (Fair) Total EPT: 0 Total Dipteran: 26 (Poor)			
	1996 (Spring)	MCDEP	Mont. Co. Protocol	IBI	mostly good 3 subsheds in fair	Fair	Lower Sandy fair-good, rest fair	West Piney & Upper Piney good, rest fair	Fair
Habitat, Qualitative	1993 (Spring/ Summer/ Fall)	Audubon Naturalist Society	Visual	RBP	excellent/good/fair/ poor		Embedded-ness: Good Stream Cover: Good Habitat Assessment : (Good)	Embedded-ness: Good Stream Cover: Good Habitat Assessment: (Good)	

Summary of Watts Branch Stream Monitoring (Continued)

Parameter Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Watts Branch Subwatersheds			
						Upper Watts	Lower Watts	Piney Branch	Mainstem
Habitat, Qualitative	1994 (Spring/ Summer/ Fall)	Audubon Naturalist Society	Visual	RBP	excellent/good/fair/ poor		Embedded-ness: Fair to Excellent Stream Cover: Good Habitat Assessment: 36-42 (Good)	Embedded-ness: Poor to Excellent Stream Cover: Good Habitat Assessment: 26-44 (Fair to Good)	
	1995 (Winter/ Spring/ Summer/ Fall)	Audubon Naturalist Society	Visual	RBP	excellent/good/fair/ poor		Embedded-ness: Fair Stream Cover: Good Habitat Assessment: 35-39 (Fair to Good)	Embedded-ness: Fair to Excellent Stream Cover: Good Habitat Assessment: 27-40 (Good)	
	1996 (Winter/ Spring/ Summer/ Fall)	Audubon Naturalist Society	Visual	RBP	excellent/good/fair/ poor	Embedded-ness: Good Stream Cover: Fair Habitat Assessment: 42 (Fair to Good)	Embedded-ness: Good to Excellent Stream Cover: Fair Habitat Assessment: 39-41 (Fair)		
	1994-1996	MCDEP	Mont. Co. Stream Protocols	Rapid Habitat Assess-ment; also, see Protocols	good/with some fair habitat areas	Fair	Fair	Good	Fair
	1996-1997	Loiderman	not specified	not specified	excellent/good/fair/ poor	fair			
	1997	Biohabitats	Stream Survey	RSAT[11]	excellent/good/fair/ poor	good to fair	good to fair	good to fair	good to fair

Summary of Watts Branch Stream Monitoring (Continued)

Parameter Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Watts Branch Subwatersheds			
						Upper Watts	Lower Watts	Piney Branch	Mainstem
Habitat, Qualitative	1997	EA	Visual	RBP	optional/suboptimal/marginal/poor	6 stations ranging from marginal to suboptimal			
	1997 (Winter)	Audubon Naturalist Society	Visual	RBP	excellent/good/fair/good	Embedded-ness: Fair to Good Stream Cover: Fair Habitat Assessment: 41 (Fair)			
Fish	1972-1974	Ragan & Dietemann 1976	seine & electro-fishing[12]	species diversity[13]	narrative				overall good diversity, eastern portions in urban area have reduced diversity
	1990 (Fall)	MD DNR	Not given in source	Not given in source	excellent/good/fair/poor	Taxa Richness: 6 (Fair)	Taxa Richness: 16-17 (Good to Excellent)	Taxa Richness: 9 (Fair)	
	1990	MD DNR	Electo-fishing	Not specified	excellent to good	Taxa Richness: 7	Taxa Richness: 16	Taxa Richness: 9-17	
	1993 (Spring/ Summer/ Fall)	Audubon Naturalist Society	Dipnet	Not given in source	excellent/good/fair/poor		Taxa Richness: 1-2 (Poor to Fair)		
	1995 (Spring)	Audubon Naturalist Society	Dipnet	Not given in source	excellent/good/fair/poor		Taxa Richness: 1 (Poor)		
	1994-1997	MCDEP	Protocols	IBI	excellent/good/fair/poor	Fair to Good	Good	Fair to Good	Fair to Good
	1997 (Spring)	EA	Electro-fishing		Fair	6 stations, fair for fish			

Summary of Watts Branch Stream Monitoring (Continued)

Parameter Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Watts Branch Subwatersheds			
						Upper Watts	Lower Watts	Piney Branch	Mainstem
Chemical and Physical Water Quality	1972	MCDEP (1974)	Grab[14] samples	9 parameters	excellent/good/fair/ poor			good	Good (Location unknown)
	1972-1973	MCDEP (1974)	Grab samples	9 parameters	excellent/good/fair/ poor				Good/ Excellent
	1969-1973	MCDEP (1973)	Not specified	9 parameters	excellent/good/fair/ poor			good	Good
	1972-1974	Ragan & Dieteman (1976)		9 parameters	excellent/good/fair/ poor				Excellent
	1974	MCDEP (1975)	Grab samples	9 parameters	excellent/good/fair/ poor				Excellent (Location unknown)
	1975	MCDEP (1976)	Grab samples	9 parameters	excellent/good/fair/ poor				Excellent (Location unknown)
	1976	MCDEP (1976)	Grab samples	9 parameters	excellent/good/fair/ poor	permissible	permissible	permissible	Excellent (Location unknown)
	1977	MCDEP (1978)	Grab samples	9 parameters	excellent/good/ permissible/fair/ poor			permissible	permissible
	1977	MCDEP (1976)	Grab samples	9 parameters	excellent/good/fair/ poor	permissible	permissible	permissible	Permissible (Location unknown)
	1978	MCDEP (1976)	Grab samples	9 parameters	excellent/good/fair/ poor	permissible, improved relative to previous year	permissible	good	Permissible (Location unknown)
	1979	MCDEP (1976)	Grab samples	9 parameters	excellent/good/fair/ poor	permissible	permissible	permissible	Permissible (Location unknown)

Summary of Watts Branch Stream Monitoring (Continued)

Parameter Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Watts Branch Subwatersheds			
						Upper Watts	Lower Watts	Piney Branch	Mainstem
Chemical and Physical Water Quality	1979	MCDEP (1980)	Grab samples	9 parameters	excellent/good/ permissible/fair/ poor			permissible	permissible
	1980	MCDEP (1981)	Grab samples	9 parameters	excellent/good/ permissible/poor			permissible	permissible
	1991-1993	MDE 1994	trend data	compare to MD standards	excellent/good/fair/ poor	permissible, degraded relative to previous year	permissible, degraded relative to previous year	permissible, improved relative to previous year	good
	1993	Audubon Naturalist Society	Temp/pH meter[15]	2 parameters	excellent/good/fair/ poor				
	1994	Audubon Naturalist Society	Temp/pH meter	2 parameters	excellent/good/fair/ poor				
	1995	Audubon Naturalist Society	Temp/pH meter	2 parameters	excellent/good/fair/ poor				
	1996	Audubon Naturalist Society	Temp/pH meter	2 parameters	excellent/good/fair/ poor				
	1996-1997	Loiderman	Grab samples	6 parameters	narrative	consistent with Use I designation			
	1996-1997	Biohabitats	various standard equipment	6 parameters	generally consistent with Use I designation	good	good	good	good
	1997	EA	+Hydrolab	5 parameters	narrative	consistent with Use I designation			
	1997	Audubon Naturalist Society	Temp/pH meter	2 parameters	excellent/good/fair/ poor	fair	good	good	fair
	1994-1997	MCDEP	Mont. Co. Protocols[16]	See protocols	within Use I criteria	consistent with Use I designation			

Summary of Watts Branch Stream Monitoring (Continued)

Notes:

1. Method or equipment used to collect the referenced sample information in the field.
2. Approach to analyze collected information following a standard or identified methodology.
3. Stream condition characterization attempts to provide the range of possible characterizations included in the methodology used. In some instances, no standard terminology is used.
4. D-net for 90 seconds, refers to the collection of invertebrates using a D-frame dip net for a period of 90 seconds. The effort (90 seconds of sampling) standardizes this qualitative sampling technique.
5. Modified RBP III refers to EPA's Rapid Bioassessment Protocol, level III (Plafkin et al. 1988), which uses genus level invertebrate analysis.
6. Surber and kicknet samplers are devices used to quantitatively and qualitatively, respectively, collect macro invertebrates in shallow riffle areas of streams.
7. Information on sampling methodology not provided in source document.
8. Modified RBP II refers to EPA's Rapid Bioassessment Protocol, level II (Plafkin et al. 1988), which uses family level analysis of the invertebrate community.
9. Index of Biotic Integrity, as per Montgomery County Stream Monitoring Protocols (Van Ness, et al, 1997).
10. Maryland Rapid Bioassessment Protocol (Primrose 1991) is a quick and cost-effective standardized methodology for evaluating aquatic resources based on the EPA's methodology (Plafkin et al. 1988).
11. Modified Rapid Stream Assessment Technique is a method developed by Washington Council of Governments (1992).
12. Seine and electro-fishing are two common methods used for fish sampling.
13. Species diversity evaluates the relationship between the number of species present and the number of individuals present.
14. Grab samples consist of a sample (s) collected at a specific point in time.
15. Meters used to measure one or more water quality characteristics, including temperature, dissolved oxygen pH, conductivity, etc.
16. Montgomery County Stream Monitoring Protocols (Van Ness, et al, 1997).

Summary of Cabin John Stream Monitoring

Table A-9

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Cabin John Subwatersheds			
						Old Farm Creek	Booze Creek	Thomas Branch	Cabin John Mainstem
Macro-invertebrates	1989-1991	MDE July 1991	surber[4]	Md RBP	unimpaired; moderately impaired; impaired; narrative				good
	1991-1993	MDE 1994	surber		unimpaired; moderately impaired; impaired; narrative				fair; habitat unimpaired; biological community severely impaired
	1992-1995	Galli et al 1996	not given	RSAT[5]; verbal rating[6]	excellent/good/fair/ poor	3.9-fair	1.2-poor	3.6-fair	one minor trib was rated 7-excellent, generally good to fair condition
	1996	MCDEP	Mont. Co. protocols	IBI as per protocols	excellent/good/fair/ poor	fair to poor	poor	poor	fair to poor
Fish	1899-1944	multiple, *in:* Dietemann 1975	not listed	diversity & abundance[7]	narrative				good; 23 sp., minimal diff. among studies over time
	1974	Dietemann 1975	seine, electro-fishing[8]	diversity & abundance, compared to historic data	narrative				fair to good; 18 sp., most in upper reaches, only pollution tolerant species collected in lower reaches
	1972-1974	Ragan & Dietemann 1976[9]	seine & electro-shock	species diversity compared to historic conditions	narrative				species diversity has been reduced to fair to good; most species collected were found in the headwaters, diversity is very low in lower reaches

Summary of Cabin John Stream Monitoring (Continued)

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Cabin John Subwatersheds			
						Old Farm Creek	Booze Creek	Thomas Branch	Cabin John Mainstem
Fish	1996	MCDEP	Mont. Co. protocols	IBI as per protocols	excellent/good/fair/ poor	fair	poor	poor	good
	1993	Galli and Trieu 1994	field survey	RSAT	excellent/good/fair/ poor	good			fair, with a few areas classified as good
Chemical and Physical Water Quality	1969-1973	MDE 1974	not specified	compare to MD standards, 9 parameters	excellent/good/fair/ poor		poor		
	1969-1973	MCDEP 1973	not specified; data summary	9 parameters	excellent/good/ fair/poor		poor		poor
	1970-1973	MCDEP 1974	standard	compare to MD standards, reference stream, prof. judgement	excellent/good/fair/ poor				poor due to public sewer overflow
	1974-1975	MCDEP 1976	standards	see MCDEP 1974	excellent/good/fair/ poor				fair/poor
	1976	MCDEP 1977	standards	WQI Rating	excellent/good/ permissible/poor/bad				permissible
	1977	MCDEP 1978	standards	WQI Rating	excellent/good/ permissible/poor/bad				permissible
	1978	MCDEP 1979	standards	WQI Rating	excellent/good/ permissible/poor/bad				permissible
	1979	MCDEP 1980	standards	WQI Rating	excellent/good/ permissible/poor/bad				permissible
	1980	MCDEP 1981	standards	WQI Rating	excellent/good/ permissible/poor/bad				permissible

Summary of Cabin John Stream Monitoring (Continued)

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Cabin John Subwatersheds			
						Old Farm Creek	Booze Creek	Thomas Branch	Cabin John Mainstem
Chemical and Physical Water Quality	1974-1975	MDE 1976	not specified	compare to MD standards, 9 parameters	excellent/good/ permissible/poor/bad		poor		
	1976	MDE 1977	not specified	compare to MD standards, 9 parameters	excellent/good/ permissible/poor/bad		fair to poor		
	1977	MDE 1978	not specified	compare to MD standards, 10 parameters	excellent/good/ permissible/poor/bad		permissible		permissible
	1978	MDE 1979	not specified	compare to MD standards, 10 parameters	excellent/good/ permissible/poor/bad		permissible, improved relative to previous year		permissible
	1979	MDE 1980	not specified	compare to MD standards, 10 parameters	excellent/good/ permissible/poor/bad		good		good
	1980	MDE 1981	not specified	compare to MD standards, 10 parameters	excellent/good/ permissible/poor/bad		good		permissible, degraded relative to previous year
	1971-1979	CH2M Hill 1982	standard	meet MD Class I water standards[10]	narrative		meets standards except fecal/pH		fair to good, except for fecal coliform, pH
	1977-1985	MDE 1988	not specified	compare to MD standards	increasing trend, no trend, decreasing trend				trend of degrading water quality based on TSS

Summary of Cabin John Stream Monitoring (Continued)

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Cabin John Subwatersheds			
						Old Farm Creek	Booze Creek	Thomas Branch	Cabin John Mainstem
Chemical and Physical Water Quality	1985-1987	MDE April 1988	not specified	compare to MD standards	narrative				good, meets Class I standards
	1989-1991	MDE July 1991	trend data	compare to MD standards	excellent/good/fair/ poor				fair; high bacteria, nutrient and TSS
	1989-1991	MDE 1993	trend data	compare to MD standards	excellent/good/fair/ poor				high bacterial, nutrient, and suspended sediment levels; benthic macro inverte-brate community indicate good water quality
	1991-1993	MDE 1994	trend data	compare to MD standards	excellent/good/fair/ poor				fair; high bacteria, nutrient and TSS
	1993	Galli and Trieu 1994	field survey	RSAT	excellent/good/fair/ poor	fair			good-fair
	1992-1995	Galli et al 1996	TDS, substrate fouling	RSAT; verbal rating	excellent/good/fair/ poor	good/ poor	poor/poor	fair/poor	fair/poor
	1996	MCDEP	Mont. Co. protocols		met Use I standards				
Habitat Condition Qualitative and Quantitative	1993	Galli and Trieu 1994	field survey	RSAT	excellent/good/fair/ poor	fair to good			fair
	1994-1995	Audubon Naturalist Society	field survey	Mont. Co. Monitorin g Methods[11]	excellent/good/fair/ poor				marginal to suboptimal
Habitat Condition Qualitative and Quantitative	1992-1995	Galli et al 1996	TDS, substrate fouling	RSAT; verbal rating	excellent/good/fair/ poor	fair	fair	fair	fair

Summary of Cabin John Stream Monitoring (Continued)

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Cabin John Subwatersheds			
						Old Farm Creek	Booze Creek	Thomas Branch	Cabin John Mainstem
	1996	DEP and MNCPPC 1997	Mont. Co. protocols	Mont. Co. protocols	optional - poor	good	good	fair	good to poor

Notes:

1. Method or equipment used to collect the referenced sample information in the field.
2. Approach to analyze collected information following a standard or identified methodology.
3. Stream condition characterization attempts to provide the range of possible characterizations included in the methodology used. In some instances, no standard terminology is used.
4. Surber samplers are devices used to quantitatively collect macro invertebrates in shallow riffle areas of streams.
5. Modified Rapid Stream Assessment Technique is a method developed by Washington Council of Governments (1992).
6. Verbal rating is a subjective summary of a number of objective indices for a particular stream.
7. Species diversity evaluates the relationship between the number of species present and the number of individuals present.
8. Seine and electro-fishing are two common methods used for fish sampling.
9. It appears that the same data were presented in Dietemann 1975 and Ragan & Dietemann 1976. No specific confirmation was found.
10. Comparison of collected water quality to water quality standards established for the State of Maryland's Use I designated surface waters.

Table A-10

Summary of Rock Run Stream Monitoring

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Rock Run Mainstem
Macro-invertebrates	1991-1992	Dewberry and Davis	Surber and Seine, 4 stations	Diversity and Abundance	narrative	good condition, pollution-tolerant invertebrates dominate
	1996	MCDEP	Mont. Co. Protocols	Mont. Co. IBI	excellent/good/fair/ poor	poor; invertebrates impaired by water quality
Fish	1912	McAtee & Weed 1915, in Dietemann 1975	Not listed	Diversity and abundance[5]	narrative	excellent; 21 species collected
	1974	Dietemann 1975	seine, electro-fishing[6]	Diversity and abundance, comparison to historic data	narrative	excellent; 21 species (some different from 1912); minimal land use change from 1912 sample
	1996	MCDEP	Mont. Co. Protocols	IBI as in protocols	excellent/good/fair/ poor	Upper - Poor Lower - Fair
	1972-1974	Ragan & Dietemann 1976	seine & electro-shock	species diversity compared to historic conditions	narrative	excellent species diversity
Chemical and Physical Water Quality	1971-1979	CH2M Hill 1982	standard	comparison with MD Class I water standards[7]	narrative	pH violations were 6 of 122 readings, none after 1972; fecal coliform exceeded standards in more than 50% of readings
	1970-1973	MCDEP 1974	standard	compare to MD standards, reference stream, prof. judgement	excellent/good/fair/ poor	good/excellent
	1974-1975	MCDEP 1976	standards	see MCDEP 1974	excellent/good/fair/ poor	good/excellent
	1976	MCDEP 1977	standards	WQI Rating	excellent/good/ permissible/poor/bad	good
	1977	MCDEP 1978	standards	WQI Rating	excellent/good/ permissible/poor/bad	permissible (intermediate)

Summary of Rock Run Stream Monitoring (Continued)

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Rock Run Mainstem
Chemical and Physical Water Quality	1978	MCDEP 1979	standards	WQI Rating	excellent/good/ permissible/poor/bad	good
	1979	MCDEP 1980	standards	WQI Rating	excellent/good/ permissible/poor/bad	permissible (intermediate)
	1980	MCDEP 1981	standards	WQI Rating	excellent/good/ permissible/poor/bad	good
	1969-1973	MDE 1974	not specified	compare to MD standards, 9 parameters	excellent/good/fair/ poor	good
	1974-1975	MDE 1976	not specified	compare to MD standards, 9 parameters	excellent/good/fair/ poor	good to excellent
	1976	MDE 1977	not specified	compare to MD standards, 9 parameters	excellent/good/fair/ poor	good to excellent
	1977	MDE 1978	not specified	compare to MD standards, 10 parameters	excellent/good/fair/ poor	good
	1978	MDE 1979	not specified	compare to MD standards, 10 parameters	excellent/good/fair/ poor	permissible, degraded relative to previous year
	1979	MDE 1980	not specified	compare to MD standards, 10 parameters	excellent/good/fair/ poor	good
	1975	MNCPPC	not specified; data summary	5 parameters	excellent/good/fair/ poor	excellent
	1972	Ragan & Dietemann 1976	grabs	9 parameters	excellent/good/fair/ poor	excellent
	1980	MDE 1981	not specified	compare to MD standards, 10 parameters	excellent/good/ permissible/poor/bad	permissible

Summary of Rock Run Stream Monitoring (Continued)

Parameters Studied	Year of Data Collection	Source	Sampling Method[1]	Analysis Method[2]	Stream Condition Characterization[3]	Rock Run Mainstem
Habitat Conditions Qualitative	1991-1992	Dewberry and Davis	grab samples, 4 stations	comparison to upstream and downstream reference stations	narrative	good condition
	MCDEP	Mont. Co. protocols	as in protocols	met Use I criteria		
	1995	Audubon Naturalist Society	visual	Mont. Co. protocols	optimal to poor	good to excellent
	1997	MCDEP	rapid habitat assessment	Mont. Co. protocols	optimal to poor	generally good

Notes:

1. Method or equipment used to collect the referenced sample information in the field.
2. Approach to analyze collected information following a standard or identified methodology.
3. Stream condition characterization attempts to provide the range of possible characterizations included in the methodology used. In some instances, no standard terminology is used.
4. Montgomery County Water Quality Monitoring Program Stream Monitoring Protocols. 1997.
5. Species diversity evaluates the relationship between the number of species present and the number of individuals present. Abundance refers strictly to the number of organisms sampled or the number extrapolated to an area (e.g., number per square meter)
6. Seine and electro-fishing are two common methods used for fish sampling.
7. Comparison of measured water quality parameter values to published standards for Maryland Use I designated waters.

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