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MONTGOMERY COUNTY

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Background

Montgomery County is located adjacent to the nation's capital, Washington D.C., and measures approximately 497 square miles (317,000 acres) of land area. This County is Maryland's most populous and affluent jurisdiction. In 2000, the population of Montgomery County included 873,341 people, 16.5% of the total Maryland population (U.S. Census Bureau, 2002). The population in the County is unevenly distributed, with majority of the population concentrated along the middle portion of the County, along I-270, (Germantown, Gaithersburg, Rockville) and the southern cities of the County (Bethesda, Potomac, Silver Spring, and Wheaton). The population is predicted to be 1.07 million people by 2020, an increase of approximately 18% (MCDPP, 2004).

Montgomery County borders Frederick County to the northwest, the Potomac River to the west and southwest, Howard County to the northeast, and Prince George's County and the District of Columbia to the southeast.

Montgomery County has rolling to moderately steep topography. Elevations range from 52 feet above sea level near the District line to 850 feet in the northern portion of the County near Damascus. The County has 81% of land being flat to moderate slopes (0 to 15 percent), 12% of land being 15-25 percent slopes, and 7% of land being greater than 25 percent slopes (M-NCPPC).

Based on Maryland Department of Planning (MDP) 2002 GIS land use data, Montgomery County has 7,369 acres of open water and 317,253 acres of land. The land acres are divided as follows: urban 145,791 acres (46%), agriculture 77,419 acres (24%), forest 92,401 acres (29%), wetlands 1,438 acres (1%) and barren land 204 acres (<1%). Since estimates of wetland acreage using MDP data are often underestimated, DNR wetland GIS data, as described later, should be used for wetland acreage values.

Soil classified as prime farmland [based on Natural Resources Conservation Service (NRCS) GIS Soil Survey Geographic (SSURGO) Database] is scattered throughout the County. In order to preserve agriculture in the County, wetland restoration/creation should attempt to avoid areas classified as prime farmland.

Quarry products including stone and aggregates, clays and shale are the mainstay of mineral resource extraction in the County. These resources are actively mined at the Rockville Crushed Stone Quarry, Stoneyhurst Quarries, Tri-State Stone &Building Supply, Inc., and B. Giancola, Inc. Stone Quarry. All these quarries are operating at relatively low intensity as they near the end of their reserve, thus presenting possible opportunities for wetland and stream restoration. However, the timeframe for closure of these quarries cannot be estimated (MDP, 1997).

Water supply for the County is mainly from the Potomac River and to a lesser extent the Patuxent River. Washington Suburban Sanitary Commission (WSSC) pumps approximately 85-100 million gallons of drinking water per day for Montgomery County. In addition to the river water supply, there are approximately 50,000 water wells in Montgomery County, utilized by businesses (e.g. golf courses) and rural residential (MC-DEP web).

There are three State-designated 6-digit watersheds and eight 8-digit watersheds in this County. Patuxent River (021311) includes Rocky Gorge Dam (02131107) and Brighton Dam (02131108); Washington Metropolitan (021402) includes Potomac River Montgomery County (02140202), Anacostia River (02140205), Rock Creek (02140206), Cabin John Creek (02140207) and Seneca Creek (02140208); Middle Patuxent River (021403) includes Lower Monocacy River (02140302).

These watersheds are affected by various factors including stormwater runoff. In Montgomery County, programs focus on restoring streams to more natural, healthier conditions. The Department of Environmental Protection has designed or constructed several restoration projects.

Streams

The following information is based on the Maryland Tributary Strategies 2004 document entitled *Maryland Upper Potomac River*. Maryland's Upper Potomac River basin includes all of Allegany and Washington Counties, and part of Frederick, Carroll, Montgomery, and Garrett Counties. It reports that water quality in the Upper Potomac River Basin is variable, with some waterways being healthy trout streams and others being nearly lifeless due to acid mine drainage. The eastern portion of the basin (Piedmont and Great Valley areas east of Allegany County) contribute high amounts of nutrients and sediment from development and agriculture. The middle portion of the basin is fairly forested, so does not contribute excessive pollutants. The western portion of the basin (the Appalachian Plateau) contributes pollution from agriculture and development, but also contributes acid mine drainage. In 2002, the main nitrogen, phosphorus, and sediment sources within the Upper Potomac River basin were agriculture (56%, 59%, and 80% respectively). There are no major wastewater treatment plants in this County within the Upper Potomac River Basin. This document describes the success of BMPs in the Upper Potomac River Watershed like this:

> A series of Best Management Practices (BMPs) have been planned in the basin to help reduce non-point source pollution. As of 1998, the implementation of these practices varies from having exceeded the goal to not having made any progress. Implementation of BMPs for animal waste management, conservation tillage, cover crops, and stream buffers have made good progress towards Tributary Strategy goals. Unfortunately, there has been no progress in forest harvesting BMPs, which consist of regulatory and voluntary measures applied to timber harvests, including erosion and sediment control and streamside management. Others, such as nutrient management and stream protections have exceeded the goals.

The following information is based on the Maryland Tributary Strategies 2004 document entitled *Middle Potomac River Basin Summary*. Maryland's Middle Potomac River basin includes part of Montgomery and Prince George's Counties. This basin has the most percent urban land use of the three Potomac River Basins (55%). Agriculture(16%) and forest (28%) are largely at the northern and southern portions of the River. In 2002, the main nitrogen, phosphorus, and sediment sources within the Middle Potomac River basin were point sources (52%, 17%, and 0% respectively), urban sources (30%, 60%, and 46% respectively), and agriculture (13%, 15%, and 41% respectively). There are three major wastewater treatment plants in this County (Damascus, Poolesville, and Seneca Creek) contributing roughly 1% of the total nitrogen and 20% of the total phosphorus load in the Middle Potomac River basin. Tributary stations sampled in 2000-2002 had total nitrogen status of good to poor, with all sites improving over the period of 1985-2002. Higher nitrogen levels were found in the areas with more agriculture land use (Seneca Creek)

and just below DC. Total phosphorus was ranked good to poor (the poor site was Seneca Creek). Phosphorus levels were either improving during the period 1985-2002 or had no trend. Algae abundance was ranked fair to good, but most sites were degrading since 1985. Total suspended solids was ranked fair to good with the trend being improving or no trend. In 2002, SAV in the downstream sections were all below the SAV goal, except the Mattawoman area. During 1994-2000, benthic monitoring in the tidal freshwater portion found a high abundance, suggesting organic overenrichment.

The Maryland Tributary Strategies document *Patuxent River Basin Summary Final Version for 1985-2002 Data: January 29, 2004* describes the Patuxent River Watershed (an area containing parts of St. Mary's, Anne Arundel, Prince George's, Calvert, Charles, Howard, and Montgomery Counties). As of 1998, some BMP goals for this basin have been met (marine pumpouts, shore erosion, septic connections, and stormwater management retrofits) but some have not been met (controlling erosion and sediment, urban nutrients, septic pumping, enhanced stormwater management, forest practices). The Patuxent River receives water from the Little Patuxent, Middle Patuxent and Patuxent. This watershed has over 100 species of fish. Land use for the entire basin is dominated by forest (44%), followed by urban (30%), and agriculture (26%). About 70% of the houses are on municipal sewage and 81% are on public water. In 2002, the main nitrogen, phosphorus, and sediment sources within the Upper Potomac River basin were point sources (34%, 30%, 0%, respectively), urban (32%, 36%, 28%, respectively), agriculture (21%, 22%, and 55%, respectively). Tributary stations had total nitrogen levels mostly ranked as good and levels were generally improving since 1985. The two sites ranked poor were located at the northern portion (MD Route 97 and MD Route 4). Total phosphorus, total suspended solids, and algae were ranked poor to good, with most stations improving for phosphorus but not as much for the other parameters. Stations ranked poor were located in the middle portion of the river. Of the three sites sampled for SAV abundance, two (the upper and middle portion of the river) exceeded SAV goals during the period between 1984 and 2002.

Montgomery County has approximately 1,500 miles of streams and 1,200 miles of storm drains, which drain over 313,000 acres. Montgomery County watersheds fall into three major River Basins, Potomac Washington Metro, Middle Potomac, and Patuxent. Water qualities in these River basins are summarized as follows. Potomac Washington Metro river basin which includes, Anacostia River (02140205), Rock Creek (02140206), Cabin John Creek (02140207), Seneca Creek (02140208), and Potomac River Montgomery County (02140202) watersheds indicates 20% of stream miles having < 1 mg/l nitrate concentration, 75% of stream have 1-10 mg/l nitrate concentration, and 5% of the streams have >10 mg/l nitrate concentration. This river basin streams have DO of 5 mg/l and above. Middle Potomac River basin which includes Lower Monocacy watershed (02140302) has 20% of stream miles with < 1 mg/l nitrate concentration, and 80% stream miles with 1-10 mg/l nitrate concentration. This river basin streams score DO value of 5 mg/l and above. Patuxent River basin which includes, Brighton Dam (02131108), and Rocky Gorge Dam (02131107) watersheds has 50% of stream miles with < 1 mg/l nitrate concentration and 50% of stream miles with 1-10 mg/l nitrate concentration.

Approximately 2% of the stream miles in Patuxent River basin score a DO value of less than 5 mg/l (Boward et al. 1999).

MBBS reports on these three river basins indicate that Potomac Washington Metro has >98% of stream miles with poor to fair Combined Biotic Index (CBI), and the rest (<2%) with good CBI. Middle Potomac River basin has 5% of stream miles with good CBI, and 95% of stream miles with poor to fair CBI. Patuxent River basin has 12% of stream miles with good CBI, and 88% have poor to fair CBI (Boward et al. 1999).

Biological impairment within this County is largely caused by stream erosion and sedimentation (Montgomery County, 2004). Streams in Montgomery County suffer from being located in a highly urbanized area that has experienced rapid development over the last 60 years. Some of the most common problems facing these streams include: excessive sedimentation, unstable stream banks, severely eroded stream channels, lack of forested stream buffer areas, uncontrolled runoff from high stormwater flows, and spills or illegal discharges of pollutant. The Anacostia River, which many of the County streams drain to before reaching the Potomac River, has consistently been ranked as one of the nation's ten most polluted rivers (M-NCPPC).

Montgomery County, through *Countywide Stream Protection Strategy* (CSPS), has continually made positive strides towards stream monitoring. The goal of CSPS for watershed and stream restoration is to restore streams damaged by inadequate water management practices of the past, by reestablishing the flow regime, chemistry, physical conditions, and biological diversity of natural stream systems. According to 1994-2000 summary findings on County Stream Resource Condition, a total of 1,272 stream miles and 289,614 acres of watershed assessed had their conditions range from excellent to poor. Sixty-two percent of the monitored stream miles in the County are rated as “excellent” or “good”, while thirty-eight percent of the total stream miles are rated as “fair” or “poor” (Table 1).

A detailed summary on the status of individual streams and watersheds will be explored in later sections of this report.

Table 1. Summary of 1994-2000 Findings on County Stream Resource Conditions

Stream Resource condition	Stream Miles	Stream Miles Monitored (%)	Watershed (acres)	County Acreage Monitored (%)
Excellent	84	7	18,091	6
Good	695	55	143,512	50
Fair	362	28	86,431	30
Poor	131	10	41,580	14
Total Monitored Miles	1,272	100	289,614	100
Unmonitored streams*	112			
River/lake/canal systems**	114			
Total County Stream	1,498		291,001	

* Stream or streams too deep to monitor
** Monitored by other agencies

Wetlands

Wetlands are most commonly found in the floodplains of stream valleys, and less frequently in small depressions, at the base of steep slopes, and drainageways. The steep or rolling topography, with relatively few low, flat areas, has resulted in fewer wetlands in comparison with Coastal Plain Counties. Hydrology of the wetland is primarily from groundwater, with some surface water collecting over soils with fragipans (Croton), seepage from adjacent slopes, and overbank flooding. Overbank flooding as a contributor to wetland hydrology likely occurs less frequently in developed watersheds due to increased runoff and subsequent channel erosion and incision. The flood attenuation function thus is less effective than it may have been in a less disturbed watershed.

Montgomery County has an unknown, but possibly extensive, number of small depressions that are considered vernal pools. Vernal pools may be considered as seasonal ponds that dry up every year, or may be dry only in drought years. They may or may not be nontidal wetlands under State law, depending on the presence of vegetation, and extent and duration of ponding. Vernal pools are critical habitat for amphibians and certain invertebrates.

Vegetated wetlands in Montgomery County are freshwater, or palustrine, wetlands. Palustrine wetlands can be classified into four major groups depending on the dominant vegetation type: forested, scrub-shrub, emergent, and aquatic.

<u>Wetland classifications</u>

According to Tiner and Burke (1995), in 1981-1982 there were 9,699 acres of wetlands (1.6% of the State's total). The wetland types were Palustrine (9,566 acres), Riverine (31 acres), and Lacustrine (102 acres). Comparisons of this 1981-1982 wetland acreage with historic wetland acreage (based on hydric soils) represents a 67%, or 19,345 acre, loss (MDE, 2002).

The following wetland plant community descriptions are based on Tiner and Burke (1995).

- Palustrine wetlands can be classified into four major groups depending on the dominant vegetation type: forested, scrub-shrub, emergent, and aquatic. These wetlands were described for the Piedmont Province.
    - Palustrine forested wetlands are often found in stream floodplains. They can be categorized into two main types.
        - Seasonally flooded palustrine forested wetlands: These wetlands are flooded for some period (e.g. greater than two weeks) during the spring. Common tree species include Red maple, Black willow, and Green ash. There is often a dense understory of shrubs (e.g. Spicebush and Southern arrowwood) and herbaceous species (e.g. Skunk cabbage). Tiner and Burke gave an example of a seasonally flooded forested wetland community within Frederick County. The example was a Silver maple-Black willow dominated community. Associate tree species were Red maple, shrub species were Alder and Dogwood, and herbaceous species were Jewelweed, Joe-Pye weed, Blue vervain, Lurid sedge, and Big arrowhead.
        - Temporarily flooded palustrine forested wetlands: These wetlands are flooded for some period (e.g. a week or less) during the spring, less than that in the seasonally flooded forested wetlands. These systems may contain Red maple, Sycamore, Green ash, Silver maple, Pin oak, Tulip poplar, Black walnut, Black locust, or Box elder. The shrub layer may be less dense than in the seasonally flooded system. Temporarily flooded forested wetlands along the Potomac River floodplain are often dominated by Eastern cottonwood and Silver maple, with some Sycamore and Black willow. Tiner and Burke give two examples of wetland communities found within Frederick County. The first system, a Green ash-Sycamore-Box elder dominance, was found along Bennett Branch. Associate tree species were Pawpaw, Ironwood, Beech, Hackberry, and Tulip poplar. Associate shrubs species were spicebush and elderberry, herbaceous species were wood nettle, garlic mustard, wood sorrel, Lady's thumb, False nettle, and clearweed. Other associate vine-like species were Virginia creeper and poison ivy. The second example was a Red Maple dominance. Associates tree species were Sycamore, Box elder, and Silver maple. Shrub species were Multiflora rose, herbaceous species were Jewelweed and Goldenrod, and other species were Japanese honeysuckle and Blackberry.

    - Palustrine shrub wetlands contain shrubs and tree saplings. The wetter systems are often dominated by Bottonbush, while the drier seasonally flooded systems may be dominated by a number of different species. Herbaceous species may form an understory.
    - Palustrine emergent wetlands:
        - Semipermanently flooded marsh
        - Seasonally flooded marsh: These systems may be dominated by cattail, rice cutgrass, arrow arum, and rush.
        - Seasonally flooded meadow: This is the most common wetland type in the region. These systems would naturally be forested wetlands, but were cleared. Many have high plant diversity.
        - Temporarily flooded wet meadow: These systems may be adjacent to the seasonally flooded meadows, but they are flooded less often and for shorter durations.
    - Palustrine aquatic beds are small ponds with partial or total vegetative cover.
- Riverine wetlands are found within the channel and include nonpersistent vegetation.
- Lacustrine wetlands are associated with deepwater habitat (e.g. freshwater lakes, deep ponds, and reservoirs). They can be classified into lacustrine aquatic beds (wetlands are located in the shallow water) and lacustrine emergent wetlands (wetlands are located along the shoreline).

Wetland Functions

Stormwater and Flood Control

Wetlands are often credited with providing natural stormwater and flood control benefits. Inland wetlands adjacent to rivers, streams and creeks hold excess discharge and runoff during periods of increased precipitation such as tropical storms and hurricanes and during periods of rapid snow-melt in mountainous regions.

Several factors influence the effectiveness of a wetland in reducing adverse effects of stormwater and floods. Factors include the characteristics of the wetland, local land conditions, and landscape features in the surrounding larger watershed, as well as the type of storm itself. The physical structure of many wetlands, with dense vegetation, fallen trees, topography (hummocks, depressions), and complexity of stream channel systems serve as resistance features to slow flow of surface water from floods and surface runoff, the height of peak floods, and delay the timing of the flood crest. Wetlands are typically in topographically low position, which provides a natural basin for water storage. The depth of the basin and soil characteristics affect the wetland's storage capacity at surface and subsurface levels. Water is released more slowly from the wetlands, thereby reducing both erosion and damage to property and structures farther downstream. In the surrounding areas, the ability of the land to also reduce runoff may aid the wetland in its flow retention/reduction function. At the landscape level, the position of the wetland in the watershed and the ratio of size of the wetland to the size of

the watershed also affect the function. Wetlands higher in the landscape and of large in size in relation to the watershed are most effective. While wetlands retain surface flows that enter the wetlands at a gradual rate, they are considered to be more effective at reducing damages from short duration storms.

Also, some water will be removed from the wetland through ground water recharge, soil retention and evapotranspiration.

Development and increases in impervious surfaces have resulted in stream channel erosion and downcutting of stream channels. Some streams have been channelized and armored. This has in some instances resulted in less out of bank flooding for low intensity storm events, thus less opportunity for adjacent wetlands to provide the flood attenuation function. Some floodplain wetlands are also found in pasture land with little natural vegetation. Lack of dense vegetation reduces the ability of a wetland to slow velocities of floodwaters, further reducing the flood attenuation function. Floodplains are relatively narrow, which is another limitation to the storage capacity of wetlands in the floodplain. In areas of less development, headwater streams still may provide some flood attenuation functions.

Values

Ground water discharge helps maintain a wetland's water balance and water chemistry. This wetland function is also critical to the formation of hydric soils and the maintenance of ecosystem habitats in different types of wetlands. Soils found in heads of drainages and at the base of slopes often provide groundwater discharge that is important for maintaining stream base flow.

Ground water recharge is the primary mechanism for aquifer replenishment which ensures future sources of groundwater for commercial and residential use.

Modification of Water Quality

Water Quality Improvement

Wetlands are valued for their ability to maintain or improve quality of adjacent surface waters. This ability is primarily accomplished by the following processes:

- Nutrient removal, transformation, and retention
- Retention of toxic materials
- Storage of the sediment transported by runoff or floods.

Hydrophytic vegetation (adapted to live in water) and microbial activity in soils help remove toxic substances and excess nutrients from surface water. Dissolved solids and other constituents may be removed or degraded, such that they become inactive, or incorporated into biomass. This occurs through adsorption and absorption by soil particles, uptake by vegetation and loss to the atmosphere through decomposition and exchange between atmosphere and water.

Nutrient Cycling: Addition, Removal and Transformation

Nutrients are carried into wetlands by hydrologic pathways of precipitation, river flooding, tides, and surface and ground water inflows. Outflows of nutrients are

controlled primarily by outflow pathways of waters. The inflow and outflow of water and nutrients are important processes that effect wetland productivity.

Wetland biological and chemical processes remove suspended and dissolved solids and nutrients from surface and ground water and convert them into other forms, such as plant or animal biomass or gases. Debris and suspended solids (fine sediment or organic matter) may be removed by physical processes, such as filtering and sedimentation.

Soil characteristics, landscape position, and hydrology all contribute to the relative ability of a wetland to perform nutrient removal and transformation. Sufficient organic matter must be present for microorganisms in the soil to consume or transform the nutrients. Wetlands are often depressions in the landscape that hold water, transported sediment, and attached or dissolved nutrients for a longer period of time than a sloping area or areas with relatively higher elevations. A longer retention time allows for chemical interactions and plant uptake to occur.

Nitrogen undergoes some chemical transformations and may be taken up in soluble form, absorbed by plants through their roots, or consumed by anaerobic microorganisms that convert the nitrogen to organic matter (Mitsch and Gosselink, 2000). Anaerobic microbes may also convert the nitrogen from a nitrate form to nitrogen gas. Phosphorus is often bound to clay particles, and these fine sediments are transported into wetlands by riparian flooding and tidal action. Phosphorus may be stored in a wetland attached to the clay particles, however, phosphorus becomes available for plant uptake in its soluble form after flooding, saturation and anaerobic conditions typical of a wetland occur. Nutrient processes vary seasonally. Cooler temperatures slow microbial activity and plant uptake while higher flows of water transport more materials out of non-isolated wetland systems. The transported organic material is critical for downstream food chain support.

Tidal wetlands are highly effective sinks and/or transformers of nutrients, as nutrients are taken up and stored by plants or released as nitrogen gas into the atmosphere. However, the uptake and transformation occurs on a seasonal basis during the growing season. At the end of the growing season, as plants die and decompose, nutrients are released back into the aquatic system.

Wetlands are most effective at nutrient transformation and uptake when there are seasonal fluctuations in water levels (Tiner and Burke, 1995). Wetlands that are temporarily flooded (saturated or inundated for brief periods early in the growing season) and those that are permanently inundated would generally be less effective than seasonally wet areas (saturated or inundated for longer periods during the early-mid growing season but are drier by the end of the growing season).

Toxics Retention

Retention of heavy metals has been reported most often in studies of tidal wetlands, though most wetlands are believed to serve as sinks for heavy metals. Accumulation is primarily in soils, with plants playing a more limited role (Mitsch and Gosselink, 2000). Plants such as cattails, bulrushes, and *Phragmites* are among the more effective and commonly used plants for uptake of toxic materials such as metals. As is the case for

nutrient transformation and sediment retention, soil characteristics, landscape position, vegetation, and hydrology all contribute the relative ability of a wetland to retain toxic materials. The longer the duration that water and transported materials remain in the wetland, the greater the likelihood that the materials will be retained. Many wetlands have been constructed as part of stormwater management facilities to treat surface runoff.

Sediment Reduction

Wetlands along rivers, streams and coastal areas are important for removing sediment from surface and tidal waters. During large flood events, rivers frequently overtop their banks and water flows through adjacent floodplains and wetlands. Flood waters carry large volumes of suspended sediment, mostly fine sand, silt and clay. Because floodplains and wetlands provide resistance to flow - from dense vegetation, microtopography, and woody debris - the flow of water is slowed and sediment is deposited and stored in these areas. Similarly, coastal marshes and estuaries retain sediment brought in by tides and residual suspended sediment from rivers.

Lack of dense vegetation in some floodplains, and narrow width of floodplains, would reduce the ability of wetlands to slow velocities of floodwaters and allow settling of transported sediments.

Wildlife Habitat/Biodiversity

Many of the wetlands in this County provide unique habitats for various flora and fauna. Some contain rare, threatened or endangered species (RT&E). Wetland degradation is mainly as a result of past and present impacts including agricultural activities, logging, mining, non-point source pollution, and development.

Wetlands adjacent to coldwater streams in Montgomery County also aid in providing shade to maintain cool temperatures for aquatic species such as trout.

Nontidal Wetlands of Special State Concern

There are 12 State-designated Nontidal Wetlands of Special State Concern within this County. These wetlands provide a habitat for rare, endangered or threatened species, scenic beauty and opportunities for recreation and education. Individual wetland descriptions and suggested Best Management Practices (BMPs) are explained in later sections under their respective eight digit watersheds.

Wetland Restoration Considerations

Hydric soils suggest where wetlands are currently or were historically. There is a fair amount of “poorly drained” hydric soil that is not mapped wetlands (based on NRCS SSURGO GIS data and NWI/DNR wetlands) mostly occurring along waterways. Hydric soils that are not currently wetlands may be good potential sites for wetland restoration. While not classified as hydric soil, there are additional ”somewhat poorly drained” soils that may be good areas for wetland creation.

Vegetated stream buffers have the potential to intercept and remove nutrients, sediments, and other pollutants. Peterson et al. (2001) found that the smallest headwater streams, which are often found in association with springs and groundwater discharge wetlands, have the most rapid uptake and transformation of inorganic nitrogen (ammonium and nitrate) in comparison with other surface waters. The authors believed that the large surface to volume ratio in small streams resulted in rapid nitrogen uptake and processing. An excess of discharges to overload these systems would result in nitrogen being transported farther down the drainage systems to rivers and estuaries. Forested stream buffers can also improve down steam biodiversity by contributing organic matter to the food web, providing woody debris which increases diversity of physical habitat, and reducing stream temperature. Headwater streams are thought to be the most beneficial at these processes. Therefore, wetlands adjacent to streams should be high priority for restoration/preservation, with emphasis on headwater stream systems. Wetlands adjacent to Scenic Rivers and around all tributaries of waterways used for drinking water (COMAR Use P) should also be ranked higher.

DNR assessed the development risk for all land within Maryland. Wetlands within areas of high development risk should be higher priority for preservation.

In order to maintain water quality of surface water reservoirs, wetlands within the watersheds of surface water reservoirs should be higher priority for preservation.

Wetland restoration may be more desirable in land uses that contribute high pollution, currently provide relatively low amounts of biodiversity, and are easy to convert to wetlands. As a general rule, agriculture fits these criteria more than other land use types. Forested land is generally not as high of a pollutant source and it also provides better habitat for plants and wildlife. For these reasons, converting upland forest to wetland may provide fewer benefits than converting agriculture to wetlands. However, projects that have converted artificially drained forest to wetland have resulted in beautiful wetlands with diverse ecology. Additionally, wetlands may be built in urban land use, but they are generally much smaller and sometimes more costly. Urban areas may provide good potential for wetlands designed for storm water management.

Other Relevant Programs

Green Infrastructure

State-designated Green Infrastructure is located throughout the County. These include Green Infrastructure hubs along the Potomac River, the Patuxent River, and along many of the larger park systems. There are many Green Infrastructure corridors that connect these hubs. Identified “gaps” in the Green infrastructure network may be restored to natural vegetation. Designated Green Infrastructure that is not currently protected should be high priority for protected.

A Countywide Green Infrastructure is being developed for Montgomery County, and should be adopted in 2007.

Ecologically Significant Areas

DNR designates areas that contain habitat for rare, threatened and endangered species and rare natural community types. These areas are buffered to create the "sensitive species project review areas" GIS layer, intented to assist in assessing environmental impacts and reviewing potential development changes. This layer generally includes designated Natural Heritage Areas, Wetlands of Special State Concern, Colonial Waterbird Colonies, and Habitat Protection Areas.

Natural Heritage Areas

There is a State-designated Natural Heritage Areas (NHA) located in the Potomac River watershed. To get this designation, this area 1) Contain species considered to be threatened, endangered, or in need of conservation; 2) Have unique geology, hydrology, climate or biology; and 3) Are among the best Statewide examples.

Land Preservation and Recreation

The following information is summarized from the documents: *General Plan Refinement of Goals and Objectives* (1993), *Plowing of New Ground, Agriculture and Rural Open Space (2001)*, and *Legacy Open Space Program Reports (2004)*.

The Montgomery County Master Plan outlines objectives and guidelines for protecting natural resources to provide a healthy and aesthetically-pleasing environment. This plan aims to minimize the impacts of human activity on natural resources. Objectives include:

- Land acquisition
- Regulations
- Public/private involvement
- Awareness
- Greenways system
- Conservation easements
- Flood control
- Habitat rehabilitation

Environmentally sensitive areas are designated as Special Protection Areas (SPAs). This status requires that these areas be conserved beyond regular measures. At this point, three SPAs have been designated in the County. Preliminary monitoring results indicate that since their designation as SPA's, their environmental quality has greatly improved.

Another strategic program pursued by the County is called the Legacy Open Space program. This program works to conserve and steward land of exceptional value. These include: water supply areas, heritage resources, greenway and trail connections, farmland, rural, and urban open spaces. Resources are purchased and added to the park system, or they are protected through easements or public/private partnerships. Since this program began, 2,800 acres of land have been protected.

In Montgomery County, parkland totals 47,300 acres. This total includes, 32,200 acres of MNCPPC parkland, 12,000 acres of State parkland, and 3,100 acres of national parkland. Of MNCPPC's 32,200 acres, 78% was purchased, 15% was dedicated, and the remaining land was donated. Most of this M-NCPPC land is green space, stream valleys, and conservation parks that comprise 15% of all parkland. Regional parks comprise 20% of total parkland, of which 67% is maintained as natural areas. Over 105 acres of parkland have been reforested by M-NCPPC in the past 10 years.

An agriculture preservation and zoning program has led to the preservation of 91,000 acres of open space, excluding parkland. According to the national publication, Farmland Preservation Report, Montgomery County is ranked first in the nation in preserving agricultural land.
Components of agricultural preservation in this County include:

- 2,831 acres in the Maryland Agricultural Land Preservation Fund
- 2,086 acres in the Maryland Environment Trust
- 6,678 acres in Montgomery Agricultural Easement Program
- 4,3145 acres in Transferable Development Rights (TDR) sold

There is some controversy about conducting wetland restoration within agricultural easements. Most would agree that it is desirable to preserve good farmland. However, properties within these easements may also contain spots of soil with lower productivity due to wetness. These low productivity spots may be a hassle to the farmer and may be good areas for wetland restoration. First, the property owner may be able to benefit from an additional program for that low productivity area, resulting in the owner getting more money for the land and utilizing the land to its full extent. Since these property owners are already involved in a preservation program, they may be more likely to consider additional programs. Second, since some of these agricultural easements are temporary, after the agricultural easement expires, the land owner may decide to get out of agriculture, and a wetland program could help to preserve some of the land from development.

Some open space is owned and maintained by homeowners associations, especially in concentrated residential developments. This common space includes more than 6,800 acres, many of which are wooded and protected by conservation easements.

Another program, Rural Open Space, focuses on areas where subdivisions have eroded large areas of farmland. Rural cluster zones (RC) are used to confine development to a smaller portion of the site, thereby reducing the cost of development and preserving agriculture or open space. The owners determine the need for clustering.

Special Protection Areas (SPAs)

The following information is a summary from MC-DEP 2002 SPA Annual Report.

The Montgomery County Code Chapter 19, Article V (Water Quality Review-Special Protection Areas Section 19-67), establishes Special Protection Area (SPA) Program. This program ensures that stream systems within designated areas are protected as much as possible from the impact of the master planned development. Annual stream monitoring reports are required for these areas.

The County Council has designated three areas as Special Protection Areas: Clarksburg, Paint Branch, and Piney Branch. These areas have high quality stream systems needing additional protection.

Results from 2002 stream monitoring indicated a slight impact on biological communities, with lower overall numbers of individuals than previous years. This was mainly a result of drought conditions in 2002. More details on individual SPAs is given under their respective 8-digit watershed information section.

Watershed Planning

Plans that assess watershed conditions and identify restoration opportunities (focusing on stormwater retrofit and stream restoration) are complete for roughly 40% of the County (Montgomery County, 2004). These Watershed Conservation Planning projects have been completed for the subwatersheds Hawlings River, Upper Rock Creek, Lower Rock Creek, Cabin John Creek, and Northwest Branch. They are ongoing (according to the Montgomery County 2004 NPDES report) for subwatersheds Watts Branch and Paint Branch and are planned for subwatersheds Upper Great Seneca Creek, Middle Great Seneca Creek, Lower Great Seneca Creek, Muddy Branch, Little Falls Branch, and Sligo Creek. From the period between 1996 and 2003, 8.25 miles of stream restoration was completed and 33.8 miles of stream restoration was being implemented (Montgomery County, 2004).

Rural Legacy

Designated Rural Legacy land is located in the west (surrounding Poolesville and encompassing Barnesville) and in the northeast (around Patuxent River State Park). For detailed information about the program, refer to the individual watershed sections.

Priority Funding Areas

Priority Funding Areas are focused in the southeast portion of the County and along the 270-corridor. Other significantly sized areas include Olney, Poolesville, and Damascus.

Stakeholders in wetland management may have conflicting goals for wetlands in Priority Funding Areas. Some may advocate preserving wetlands in these areas as greenways, for aesthetics, or as unique communities in a developing area. Other interests may seek flexibility and expedited review of proposals to impact wetlands due to other goals for growth and economic development in a designated area. There may be benefits to protecting and restoring wetlands for water quality in a growth area, particularly as an

offset against future or existing TMDLs. Preservation of biodiversity may be more of a challenge due to possible increases in nonpoint source pollution and fragmentation. Stormwater management associated with growth may also reduce certain nonpoint source impacts to wetlands in PFAs.

Watershed Information

Information on individual watersheds within Montgomery County will be summarized under 8-digit watersheds designations. For clarity of this document, "subwatershed" refers to Montgomery County designated watersheds within the larger 8-digit watersheds.

Rocky Gorge Dam (02131107)

Background

This watershed is in Patuxent River basin, within Montgomery and Howard Counties. The watershed covers a total of 33,368 land acres in both Counties. However, most of this land area, three-quarters, is in Montgomery County. Based on MDP 2002 GIS land use data, the Rocky Gorge Dam watershed has 339 acres of open water and 25,255 acres of land. The land acres are as follows: urban 8,040 acres (32%), agriculture 7,508 acres (30%), forest 9,706 acres (38%), and barren land 1 acres (<1%). Since estimates of wetland acreage using MDP data are often underestimated, DNR wetland GIS data, as described later, should be used for wetland acreage values.

The following information is based on the document entitled *Damascus and Vicinity Environmental Resources Inventory*. The study area included portions within the 8-digit watersheds Brighton Dam, Seneca Creek, Lower Monocacy River, and a small portion within Rocky Gorge Dam (within Laytonsville in the Hawlings River subwatershed). Montgomery County Department of Environmental Protection, USGS, and MNCPPC are working to identify the vernal pools in the County. Rare, threatened, or endangered (RTE) species are more likely in areas underlain by ultramafic and diabase rock formations and serpentine soils. Ultramafic rock is located within the Hawlings River watershed.

The Montgomery County Patuxent Primary Management Area is a water quality protection and restoration area that consists of a 1,320 foot buffer along the Patuxent and Hawlings Rivers and a 660 foot buffer along the tributaries of these waterways. Properties will be subject to special review only when it is submitted to MNCPPC (MNCPPC and MCDPP, 2003).

Lower Patuxent River and the remaining majority of Hawlings River subwatersheds in Montgomery County fall within this watershed. Information on these subwatersheds is summarized as follows from a document entitled *Olney and Vicinity Environmental Resources Inventory* (M-NCPPC, 2002).

The Hawlings River, located in the northeastern part of the County, is a designated Use IV stream. It includes approximately 129 miles of stream that drain 28 square miles (18,069 acres) of land upstream of its confluence with the Patuxent River, between the Triadelphia and Rocky Gorge Reservoirs. This river is a major tributary to the Patuxent River.

The Hawlings River subwatershed, particularly above the Reddy Branch tributary, is constituted of agricultural land, parkland, and large lot residential areas. The river passes through three distinct land uses. The upper watershed above Sundown Road is in rolling agricultural lands east of Laytonsville. This headwater area has many tributaries. The middle section passes through a narrow, rocky valley area where the velocity of the stream increases. Within Rachel Carson Conservation Park is some of the best stream habitat in the subwatershed. Below Georgia Avenue, the stream passes through a sandy loam floodplain that is characterized by severe bank erosion and scour pools.

A Watershed Restoration Study was completed in 2003 for Hawlings River. Streambank erosion and down-cutting are problems in this stream system. This study identified sites for stream restoration (12 sites) and stormwater retrofits. The stream condition is rated as good for the northern portion of the Hawlings River subwatershed. Subwatersheds with fair stream conditions are Middle Zion tributary, Reddy Branch, and Lower James Creek. Subwatersheds with poor stream conditions are Upper Mt. Zion Tributary, Upper Olney Mill, and Upper James Creek.

Lower Patuxent River subwatershed consists of the Patuxent mainstem and its tributaries below the Hawlings River (CSPS, 1998).

The Patuxent River was designated as a scenic river by the Maryland General Assembly.

The *Draft Environmental Impact Statement/Draft Section 4(f) Evaluation: InterCounty Connector I-270 to US 1. Vol. 1* (2004) reported the results of some wetland assessments for parts of the watershed. Wetlands in the study area occur in narrow stream valleys in the headwaters. The dominant vegetation is most often forest.

Estimates of wetland acreage for the entire Maryland portion of the watershed, based on DNR mapped wetlands, are as follows:

- Palustrine
    - Aquatic bed: <1 acre
    - Emergent: 73 acres
    - Scrub shrub: 30 acres
    - Forested: 502 acres
    - Unconsolidated bottom: 122 acres
    - Unconsolidated shore: 1 acre
    - Farmed: 4 acres
- Riverine unconsolidated shore: <1 acre
- Total: 733 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight gain in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02131107	-3.40	3.78	0	0	0.39

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. For this watershed, they are designated as follows:

- Use I-P: recreation contact, protection of aquatic life, public water supply; Patuxent River and all tributaries except those designated below as Use IV-P Above Rocky Gorge Dam
- Use IV-P: recreational trout waters, public water supply; Patuxent River and tributaries Between Rocky Gorge Reservoir and Triadelphia Reservoir, and including Triadelphia Reservoir

Water Quality

The 1998 Clean Water Action Plan classified this watershed as a "Priority" Category 1, a watershed not meeting clean water or other natural resource goals and being most in need of restoration. Failing indicators included a high population density, high soil erodibility (0.30), and being on the 303d list for water quality impairment. Historic wetland loss is estimated at 1,337 acres. This watershed was placed on the "Priority" list since it contains a drinking water reservoir for the Maryland suburban area of Washington, DC. It was also classified as a "Selected" Category 3, a pristine or sensitive watershed that needs the most protection, for the same reason. Another indicator suggesting need for preservation included a high imperiled aquatic species indicator.

According to the 2002 Maryland Section 305(b) Water Quality Report, the wadeable tributaries of Rocky Gorge Reservoir watershed fully supports all designated uses.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Rocky George Dam Impoundment*; nutrients.
- *Patuxent River* (021311070942 non-tidal); poor biological community.

The stream conditions in the Hawlings River subwatershed range from good to poor. A cool-water fish community is found in this subwatershed, thus placing Hawlings River resource conditions in an overall good range. Below Georgia Avenue, stream habitat conditions degrade with large areas of bank erosion, scour pools, and sediment deposition being more evident (CSPS, 1998).

The upper portion of Lower Patuxent River supports good stream condition while the lower portion has fair stream condition.

Restoration/Preservation

State-designated Green Infrastructure hub is located mainly along the Patuxent River and Hawlings River, with corridors connecting these hubs to other hubs outside of the watershed (DNR, 2000-2003). While much of this hub is protected, there are still some unprotected GI hub areas (headwaters of Hawlings River) and corridors.

There is a designated Rural Legacy Area within Montgomery and Howard County, watersheds Rocky Gorge and Brighton Dam. Only a portion is currently protected, with main areas being Patuxent River State Park, Hawlings Run Park, and Rachel Carson Conservation Park. In addition to the Rural Legacy Program, other programs should consider preservation of these sites.

There are no State-designated Nontidal Wetlands of Special State Concern in this watershed.

Existing Recommendations for Restoration:

- Restore wetlands and streams within the headwaters.
- Stream restoration and stream buffer planting in the Hawlings River watershed, as identified in the Hawlings River Watershed Restoration Study. Top priorities include a project in the Lower Olney Mill and Reddy Branch subwatersheds and in Lower James Creek subwatershed (Johnson and EQR, 2003).
- Restore area with the 1,320 foot buffer along the Patuxent and Hawlings Rivers and a 660 foot buffer along the tributaries of these waterways (MNCPPC and MCDPP, 2003).
- Restore "gaps" in Green Infrastructure to natural vegetation.
- Restore land within the designated Rural Legacy Area.
- Restore vernal pools.
- Reduce sediment and nutrients into Rocky Gorge Reservoir
- Recommendations based on the *Draft Environmental Impact Statement/Draft Section 4(f) Evaluation: InterCounty Connector I-270 to US 1. Vol. 1* (2004):
    - Improve water quality and instream habitat.
    - Increase acreage of wetlands and forest.
    - Decrease stream channel erosion.

Existing Recommendations for Preservation:

- Protect wetlands and streams within the headwaters.
- Protect additional wetland areas within State-designated Ecologically Significant Areas.
- Protect portions of Green Infrastructure that are not currently protected, especially along the headwaters of Hawlings River.

- Parkland, buffers and master planning protects much of the land in Lower Patuxent River subwatershed.
- Protect land within the designated Rural Legacy Area.
- Protect areas within a 1,320 foot buffer along the Patuxent and Hawlings Rivers and a 660 foot buffer along the tributaries of these waterways (MNCPPC and MCDPP, 2003).
- Protect vernal pools.

Brighton Dam (02131108)

Background

This watershed is within the Patuxent River basin. The majority of the watershed drainage area is located in Howard County. For detailed information on portions of this watershed in Howard County, refer to the individual County description.

Based on MDP 2002 GIS land use data the Brighton Dam watershed has 341 acres of open water and 13,687 acres of land. The land acres are divided as follows: urban 1,186 acres (9%), agriculture 6,520 acres (48%), and forest 5,981 acres (44%). Since estimates of wetland acreage using MDP data are often underestimated, DNR wetland GIS data, as described later, should be used for wetland acreage values.

The following information is based on the document entitled *Damascus and Vicinity Environmental Resources Inventory*. The study area included portions within the 8-digit watersheds Brighton Dam, Seneca Creek, Lower Monocacy River, and a small portion within Rocky Gorge Dam. Stream conditions in the headwater streams of the Upper Patuxent River, Little Bennett Creek, and some of Upper Great Seneca Creek are mostly rated excellent or good. These streams are considered to be the least impaired within the County. Bennett Creek watershed is also rated excellent to good and is a "healthy agricultural watershed." Streams rated as fair are located in areas with more development (i.e. Magruder Branch subwatershed of Upper Great Seneca Creek). Forests mainly follow the stream valley, with significant areas along Bennett and Little Bennett Creeks and the Patuxent River. Wetlands are generally located along streams, with the largest amounts in Upper Great Seneca and Little Bennett watersheds. These wetlands provide wildlife habitat, flood storage, water quality improvements, and groundwater recharge. There is a fair amount of protected agricultural land in this study area. While much of the protected land is located along stream valleys, there are many streams, largely in headwaters, that remain unprotected.

The large populations of whitetail deer are negatively impacting the herbaceous layers in many areas. Montgomery County Department of Environmental Protection, USGS, and MNCPPC are working to identify the vernal pools in the County. RTE species are more likely in areas underlain by ultramafic and diabase rock formations and serpentine soils. Ultramafic rock and diabase rock seams are located within this watershed. Most known occurrences of RTE species are within parkland (MNCPPC and MCDPP, 2003).

The Patuxent River supports a naturally reproducing population of brown trout and stocked rainbow trout. Other pollution-intolerant fish have also been found here. The upper Patuxent (above Georgia Avenue) has been designated a special trout management area. The mature forests and floodplains contain some of the best forest interior dwelling bird habitat in the County. Water quality issues within Triadelphia Reservoir include sediment and nutrient enrichment from agriculture and development. The Montgomery County Patuxent Primary Management Area is a water quality protection and restoration area that consists of a 1,320 foot buffer along the Patuxent and Hawlings Rivers (Rocky Gorge Dam watershed) and a 660 foot buffer along the tributaries of these waterways. Properties will be subject to special review only when it is submitted to MNCPPC (MNCPPC and MCDPP, 2003).

Sensitive areas (as defined in the 1992 State Planning Act as streams and their buffers, 100-yr floodplain, steep slopes, and habitats of RTE species) are generally located within the stream valleys, and cover roughly 24% of the study area. A third of these are located within parkland, with most of the remaining within unprotected stream buffers. Most of the study area has slopes ranging from 3-14%. Steep slopes are located along the mainstems and major tributaries of Bennett Creek, Little Bennett Creek, Patuxent River, and Great Seneca Creek. 58% of these steep slopes are within parkland (MNCPPC and MCDPP, 2003).

Upper Patuxent River subwatershed forms the boundary between Montgomery and Howard County and includes all the land draining to the Patuxent River above the Tridelphia Reservoir. The subwatershed is mainly rural with much of its total land cover being agricultural or forest. Farmland and open space throughout the subwatershed are rapidly lost to low to medium density single-family residential development (CSPS, 1998).

The Patuxent River was designated as a scenic river by the Maryland General Assembly.

The *Draft Environmental Impact Statement/Draft Section 4(f) Evaluation: InterCounty Connector I-270 to US 1. Vol. 1* (2004) reported results from an assessment for part of the watershed. A small number of wetlands that developed in abandoned gravel mine in the headwaters were identified.

Estimates of wetland acreage for the entire Maryland portion of the watershed, based on DNR mapped wetlands, are as follows:

- Lacustrine unconsolidated shore: 1 acre
- Palustrine
    - Emergent: 346 acres
    - Scrub shrub: 143 acres
    - Forested: 1,151 acres
    - Unconsolidated bottom: 216 acres
    - Farmed: 48 acres
- Total: 1,906 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight gain in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02131108	-0.40	0.43	0	0	0.03

Code of Maryland Regulations

All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. For this watershed, they are designated as follows:

- Use I-P: recreation contact, protection of aquatic life, public water supply; Patuxent River and all tributaries except those designated below as Use III-P or Use IV-P Above Rocky Gorge Dam
- Use III-P: natural trout waters, public water supply; Patuxent River and tributaries Above Triadelphia Reservoir
- Use IV-P: recreational trout waters and public water supply; Patuxent River and tributaries Between Rocky Gorge Reservoir and Triadelphia Reservoir, and including Triadelphia Reservoir

Water Quality

The 1998 Clean Water Action Plan classified this watershed as a "Priority" Category 1, a watershed not meeting clean water or other natural resource goals and being most in need of restoration. Failing indicators included a high population density and being on the 303d list for water quality impairment. Historic wetland loss is estimated at 3,371 acres. This watershed was placed on the "Priority" list since it contains a drinking water reservoir for the Maryland suburban area of Washington, DC. It was also classified as a "Selected" Category 3, a pristine or sensitive watershed that needs the most protection, for the same reason. Another indicator suggesting need for preservation includes being a fish hatchery water supply and containing 1,048 Wildland acres.

According to the 2002 Maryland Section 305(b) Water Quality Report, the mainstem river above Tridephia Reservoir fully supports all designated uses, while a portion of the nontidal, wadeable tributaries (>48 miles) fail to support all uses due to a poor biological community from habitat alteration.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may require a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Brighton Dam Impoundment*; sediments, nutrients.
- *Tridelphia Reservoir* (021311080967 non-tidal).
- *Tridelphia Reservoir Unnamed Tributary* (021311080967 non-tidal).
- *Cattail Creek Unnamed Tributary* (021311080967 non-tidal).

According to the recent CSPS report (MCDEP, 1998), the streams in Upper Patuxent subwatershed are in excellent condition and have been designated by the State as a Use III streams; natural trout waters, including those potentially or actually suitable for the growth and propagation of trout and capable of supporting natural trout populations and the associated food organisms.

Mean MBSS values for this watershed are FIBI = 3.54, BIBI = 3.69, and CBI = 3.70 (DNR, 2004).

Despite the excellent conditions of this watershed, poor bank stability with high levels of sediment deposition have been reported on some portions of the subwatershed which have less forest cover (CSPS, 1998).

Preservation/Restoration

State-designated Green Infrastructure hub is located along the Patuxent River, with corridors connecting this hub to other hubs outside of the watershed (DNR, 2000-2003). Most of the hub is within Patuxent River State Park and Tridelphia Reservoir.

The Upper Patuxent River falls within the Patuxent Primary Management Area (PMA). The PMA areas are maintained in low-density, low intensity land uses with establishment of a minimum 50-foot forested buffer immediately adjacent to all streams. Areas dominated by agricultural activities are designated as Agricultural Watershed Management Areas, and others as Watershed Preservation Areas.

There is a designated Rural Legacy Area within Montgomery and Howard County, watersheds Rocky Gorge and Brighton Dam. Only a portion is currently protected, with main areas being Patuxent River State Park, Hawlings Run Park, and Rachel Carson Conservation Park. In addition to the Rural Legacy Program, other programs should consider preservation of these sites.

There are no State-designated Nontidal Wetlands of Special State Concern in this watershed.

Existing Recommendations for Restoration:

- Restore “gaps” in Green Infrastructure to natural vegetation.
- Restore wetlands and streams within the headwaters.
- Restore land within the designated Rural Legacy Area.
- Restore vernal pools.
- Restore a 50 foot minimum forested buffer around streams.
- Protect a 1,320 foot buffer along the Patuxent River and a 660 foot buffer along the tributaries (MNCPPC and MCDPP, 2003).
- Recommendations based on the *Draft Environmental Impact Statement/Draft Section 4(f) Evaluation: InterCounty Connector I-270 to US 1. Vol. 1* (2004):
    - Improve water quality and instream habitat.

  - Increase acreage of wetlands and forest.
  - Decrease stream channel erosion.

Existing Recommendations for Preservation:

- Protect wetlands and streams within the headwaters.
- Protect portions of Green Infrastructure that are not currently protected, especially along waterways.
- Protect land within the designated Rural Legacy Area.
- Protect vernal pools.
- Protect a 50 foot minimum forested buffer around streams.
- Protect a 1,320 foot buffer along the Patuxent River and a 660 foot buffer along the tributaries (MNCPPC and MCDPP, 2003).

Potomac River Montgomery County (02140202)

Background

Based on MDP 2002 GIS land use data the Potomac River Montgomery County watershed has 5,686 acres of open water and 81,783 acres of land. The land acres are divided as follows: urban 33,314 acres (41%), agriculture 22,186 acres (27%), forest 24,893 acres (30%), and wetlands 1,390 acres (2%). Since estimates of wetland acreage using MDP data are often underestimated, DNR wetland GIS data, as described later, should be used for wetland acreage values.

This watershed includes subwatersheds: Broad Run, Muddy Branch, Watts Branch, Rock Run, and Little Falls Branch subwatersheds, as described in further detail later in this section.

Estimates of wetland acreage for the entire Maryland portion of the watershed, based on DNR mapped wetlands, are as follows:

- Lacustrine
  - Aquatic bed: 5 acres
  - Unconsolidated shore: 2 acres
- Palustrine
  - Aquatic bed: 28 acres
  - Emergent: 274 acres
  - Scrub shrub: 132 acres
  - Forested: 3,236 acres
  - Unconsolidated bottom: 434 acres
  - Unconsolidated shore: 2 acres
  - Farmed: 108 acres
- Riverine unconsolidated shore: <1 acre
- Total: 4,220 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through

December 31, 2004, for this watershed, there has been a slight gain in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02140202	-4.27	1.38	6.00	1.69	4.80

An assessment was conducted of 40 wetland groups in the Potomac subregion study area, which included this watershed and the watershed of Cabin John Creek (02140207). Subwatersheds included Potomac River, Muddy Branch, lower portions of Seneca Creek, Watts Branch, Rock Run and Cabin John Creek. Results are described in the Environmental Resources Inventory for the Potomac Subregion (M-NCPPC 1998). In the study area, wetlands are found in stream valleys, floodplains, low lying areas beyond floodplains, and seeps at base of slopes. Bottomlands in the upper mainstems and tributaries of Watts Branch, Rock Run, Cabin John Creek are dominated by sycamore green ash box elder or silver maple forest association. The associations also includes flowering dogwood, wild grape, red maple, white oak, spicebush, and tulip poplar.

Predicted functions were groundwater discharge, flood flow alteration, sediment retention/nutrient removal, aquatic habitat, wildlife habitat. General findings of assessment were that instream habitat associated with wetlands is moderately to severely stressed in developed portions of watershed. Stream downcutting, tree loss, heavy deposition and sediment loads, were observed. This in turn has degraded adjacent wetlands and vernal pools by altering hydrology through changes to overbank flooding, groundwater discharge, and maintenance of stream baseflow.

The sycamore-river birch association dominates bottomlands along Potomac River, Muddy Branch, lower portions of Seneca Creek, Watts Branch, Rock Run and Cabin John Creek. The sycamore-river birch association dominates bottomlands along Muddy Branch. Other species include slippery elm, green ash, spicebush, poison ivy, red maple, Virginia creeper, poison ivy Japanese honeysuckle, arrowwood, tulip poplar, and black gum.

Emergent and scrub shrub wetland species include poison ivy, Carex, broom-sedge, reed canary grass, soft rush, goldenrod, rice cutgrass, cattail, and field mint.

Priority wetlands were those receiving a high composite score for aquatic and wildlife habitat.

Cumulative impacts of linear projects such as powerline rights of way, sewer lines, and road crossings were considered more detrimental than low-density residential development. Adverse impacts included loss of mature forest canopy, introduction of invasive species, maintenance activities, and fragmentation of wetland and riparian systems.

Headwaters in study area are mostly developed. Higher order streams that were found lower in watershed usually have less development, steep slopes and a wide floodplain.

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. For this watershed, they are designated as follows:

- Use I-P: recreation contact, protection of aquatic life, public water supply; Potomac River and all tributaries From MD/DC line to Frederick/Montgomery County line

Water Quality

The 1998 Clean Water Action Plan classified this watershed as a Category 1, a watershed not meeting clean water or other natural resource goals. Failing indicators included a low non-tidal benthic index of biotic integrity, a high percent impervious surface (>13%), a high population density, high percent unforested stream buffer (40%), and being on the 303d list for water quality impairment. Historic wetland loss is estimated at 8,768 acres. It was also classified as a Category 3, a watershed that needs protection. Indicators suggesting need for preservation included a migratory fish spawning area, 453 Wildland acres, and the presence of two drinking water intakes.

According to the 2002 Maryland Section 305(b) Water Quality Report, the mainstem Potomac River (Little Falls to the Monocacy River) fully supports all uses. A portion of the wadeable tributary streams fully supports all uses (53 miles), another portion fails to support all uses (86 miles) due to poor biological community, and the remainder (21 miles) had inconclusive results.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may need a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Potomac River* (non-tidal); sediments, nutrients.
- *Potomac River Unnamed Tributary* (021402020852 non-tidal); poor biological community.
- *Potomac River Unnamed Tributary* (021402020850 non-tidal); poor biological community.
- *Little Monocacy River* (021402020853 non-tidal); poor biological community.
- *Little Monocacy River Unnamed Tributary* (021402020853 non-tidal); poor biological community.
- *Horsepen Branch* (021402020850 non-tidal); poor biological community.
- *Horsepen Branch Unnamed Tributary* (021402020850 non-tidal); poor biological community.
- *Rock Run* (021402020845 non-tidal); poor biological community.
- *Willett Branch* (021402020844 non-tidal); poor biological community.
- *Muddy Branch* (021402020848 non-tidal); poor biological community.

The mean water quality for this watershed is ranked poor for FIBI (2.82), fair for BIBI (3.27), and CBI (3.00). 42.86% stream miles have FIBI < 3, 26.67% stream miles have

BIBI <3, and 33.33% of stream miles have CBI < 3 (DNR, 2004). Individual subwatershed water quality, restoration and preservation strategies are summarized below.

Subwatersheds

The following background information about the subwatersheds is excerpted from the 1998 and 2003 CSPS report, and a document titled *Environmental Resources Inventory, Potomac Subregion*, M-NCPPC, 1998.

Muddy Branch subwatershed

Muddy Branch subwatershed covers a land area of 7,732 acres. It is located in an area of mixed land uses. The subwatershed is urbanized in its headwaters especially along MD 28 corridor, as well as north of the Potomac subregion in the City of Gaithersburg. The southern and western portions of the subwatershed are dominated with small farms and large lots, retaining a more rural character. This subwatershed has significant amounts of parkland, which serve as habitat for deer, wild turkey, birds, mammals, reptiles, and amphibians. The subwatershed imperviousness ranges from 5% to 23%.

Water Quality

The CSPS characterizes the biological stream condition of this watershed as fair in the city of Gaithersburg just north of Potomac subregion, with good stream conditions occurring within the Potomac subregion. A 1996 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 score fair, 2 scored good, and 2 scored poor.

The most significant features limiting the quality of these streams are identified as uncontrolled stormwater runoff (from portions of the City of Gaithersburg developed prior to the requirement for stormwater management controls), stream channelization, poor bank stability, sediment deposition, and embeddedness.

Restoration/Preservation

The Potomac Subregion Master Plan study currently underway includes an examination of land use and stream condition relationships. Two different protection levels are currently designed, in order to respond to different levels of stream protection needs. They include:

- Watershed Protection Areas
    - Includes subwatersheds below Rte. 28. Evaluates the extent to which stream channels have been impacted by higher densities of land use.
    - Remedial level protection – Includes areas between Rte. 28 and Turkeyfoot Rd. These areas are currently experiencing high levels of bank erosion occurring due to the conditions upstream. This strategy

concentrates on on-site stormwater management controls and other remedial efforts to correct previously impacted areas.

- Watershed Management Strategy
  - Includes continued application of environmental guidelines and regulations for new developments.
  - Detailed analysis of stream monitoring data gathered in the past.
  - Further evaluation of relationship between land use and stream conditions throughout the Potomac Subregion Master Plan Study.

Three wetlands were identified as priorities due to high scores for aquatic and wildlife habitat in the Environmental Resources Inventory for the Potomac Subregion:

- 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 mainstem of Muddy Branch.

Watts Branch subwatershed

Watts Branch subwatershed covers an area of 10,332 land acres. This subwatershed has been described as a "watershed in transition." While much of the northern and eastern parts of the subwatershed have been developed for a number of years, significant portions of the northern and central areas are currently under development. The 1998 CSPS report estimates that imperviousness in the upper Watts Branch watershed ranges from 22 to 33 percent, indicating a fairly intense level of development (City of Rockville and I-270). The southern and western portions of the watershed remain relatively undisturbed, characterized by a mix of small farms and large-lot development that have persisted for many years. The CSPS estimates the imperviousness in this area to range from 6 to 16 percent.

There are approximately 3,200 acres of forest in the Watts Branch subwatershed. These are predominantly deciduous forest, habitat for forest interior bird dwelling species among other wildlife.

Water Quality

A study of Watts Branch subwatershed in 1997 using the rapid stream assessment technique (RSAT), Biohabitats, Inc. (1997) found the overall RSAT scores to range from fair to good. The sections of the stream with the lowest ratings were in the most heavily developed portions of the subwatershed. Measurements of physical and chemical parameters were generally consistent with the Maryland Use I-P designation.

Historic data on water quality of Watts Branch was characterized as good in 1972 and excellent in 1973 based on MCDEP data on temperature, DO, pH, BOD, nitrate, phosphate, turbidity, and total and fecal coliform. In 1990-1991, Maryland DNR

evaluated two stations in Watts Branch and concluded that the streams display high water quality and diverse benthic and fish assemblages. In 1994, Watts Branch was categorized as having unimpaired stream habitat but severely impacted biological community due to suburban runoff.

1996 MCDEP monitoring reports of Watts Branch stream conditions indicated that fish and benthic communities were in fair condition in Upper Watts Branch and had improved in the downstream areas (Lower Watts Branch). This subwatershed supports a fish community of approximately 25 species. Many of the more tolerant species are well represented, although some sensitive fish species are found in fewer numbers.

Wetlands in the Watts Branch subwatershed are mostly in stream valley parks containing the mainstem of Watts Branch. Forested wetlands and vernal pool were found in the upper portions of the watershed. Utility lines often fragmented other wetlands. Functional scores ranged from low to high. Instream habitat was moderately to severely stressed, with streambank erosion, downcutting, and sedimentation. Flooding problems were noted at the Wootton Parkway and Glen Road crossings of Watts Branch.

Piney Branch SPA

The Piney Branch was designated as a SPA because of the high water quality and the intense planned development. Piney Branch is a subwatershed of Watts Branch, located in south-central portion of the County, west of Rockville. The SPA includes all 2,400 acres of Piney Branch subwatershed.

Land use within Piney Branch has been largely agricultural and residential, with some commercial and office development. In early 1993, residential development began in the headwater area of Piney Branch, posing a threat to the integrity of the watershed. This prompted the County Council to designate Piney Branch as a SPA.

Piney Branch benthic macroinvertebrate community exhibits a high degree of variability from year to year. However, fish community has remained relatively stable over the period of 1995-2002. DEP suspected that this variability of macroinvertebrates was related to water quality problems in Piney Branch, where low DO levels have been observed. Algae growth throughout Piney Branch mainstem is believed to be the cause of low DO. Because excess algae growth can be caused by overabundance of nutrients, DEP conducted nutrient sampling throughout Piney Branch in 2002. The results found relatively low nutrient concentrations throughout the watershed. Since the cause of this increased algal growth remains unknown, a high priority is to conduct an intensive study into the cause of excessive algae growth that causes high variability of benthic macroinvertebrates.

Most of the floodplain is on privately owned land, with few areas of parkland. Road crossings and utility lines often fragmented wetlands. However, some of the utility lines also supported braided streams and vernal pools of high habitat value. One headwater area, PB1, was a priority wetland.

Greenbriar Branch subwatershed
Most wetlands are located on floodplains on private land outside parkland. There are some additional seeps and ponds near the stream valleys. Headwater wetlands have been lost or altered by the Rockville Crushed Stone Quarry. Greenbriar Branch now originates from seeps forming braided channels southwest of a power line crossing. Wetlands GB2 and GB3 were identified as priority wetlands. Some fragmentation has occurred due to road crossings and utility lines.

Restoration/Preservation

The Potomac Subregion Master Plan study currently underway includes an examination of land use and stream condition relationships. Three different protection levels are currently designed, in order to respond to different levels of stream protection needs. They include:

- Special level of protection
  - Include existing regulatory SPA especially for Piney Branch tributary, which is currently experiencing problems of unusual flow conditions due to prior agricultural uses, and current development projects which were approved prior to establishment of Piney Branch SPA.
- Watershed Protection Strategy
  - Advocates for continued implementation of the SPA regulation.
  - Remedial level protection, which addresses special problem areas that are influencing overall watershed conditions. This strategy helps to halt stream degradation and forestall the need for more costly efforts in the future.
- Watershed Management Strategy
  - Targeted public education and outreach, and cooperative efforts with private landowners to improve riparian areas.
  - Further evaluation of relationships between land use and stream conditions through the Potomac Subregion Master Plan Study.
  - Stormwater retrofits to improve performance of old structures as well as to provide new controls feasible to improve conditions and provide opportunities for downstream habitat improvements and stream restoration efforts.

Broad Run subwatershed

The following information is a summary from *Broad Run Watershed Study* in 2002 by MCDEP.

Broad Run subwatershed originates west of Poolesville near Wasche Road and West Hunter Road, and flows south towards the Potomac River. It flows through a part of the County's agricultural preserve, characterized by rolling hills and many forested stream buffer areas.

Water Quality

Stream habitats are reported to be in good condition with stable overhanging banks providing excellent fish cover, frequent riffles, and stream base flow reaching both lower banks with little channel substrate exposed. The stream supports a variety of biological communities. Seventeen species of fish were found in the lower Broad Run including bass and five species of sunfish.

Physical chemistry samples are within MDE's COMAR parameters. Despite the overall good condition of this watershed, attributes such as entrenchment, floodwater, and sedimentation, have been reported to affect the water quality.

Restoration/Preservation

Broad Run is located in the Agricultural Reserve wedge, characterized by dominant agricultural land use. Recommendations include: use of Best Management Practices (BMPs) on agricultural areas, good stewardship, stream valley conservation measures, as well as improving riparian buffers.

Little Falls subwatershed

The following information is excerpted from 1998 and 2003 CSPS watershed reports, and MCDEP web page.

The Little Falls subwatershed is one of the County's most urban stream systems, with part of its drainage from the northwest portion of the District of Columbia. This subwatershed contains some of the oldest developed areas of the County. There are several historic elements in the watershed such as Battery Bailey (a landmark fortification from the Civil War), the route of the old trolley line, the Washington Aqueduct, and the C&O Canal, all of which have played a role in shaping the watershed's landscape.

Most of the development in this subwatershed occurred prior to today's requirements for natural stream buffer, wetland and floodplain protection, and stormwater runoff controls. The original drainage pattern of Little Falls has been extensively altered, with much of the original headwaters and tributaries enclosed in storm drainpipes or channelized.

Water Quality

The overall water/stream conditions range from poor to fair. The waters in this subwatershed support minimal biological community, with only five fish species identified. Impacts may be due to point and non-point source pollution, and high velocity, high temperature runoff from channelized and piped areas. These storm flows impact the natural channels downstream.

Restoration/Preservation

The Little Falls Watershed Restoration Plan recommends pollution prevention and stabilizing/restoring areas of natural stream channel that still have the potential to support an aquatic community. Consequently, measures to control stormwater runoff from these developed watershed are aggressively pursued.

Some areas of the watershed, Willet Branch and Spring Valley Tributary, are categorized as Urban Watershed Management Area. Management strategies for these areas include pipe defectives and stormdrain monitoring, stormwater controls and redevelopments.

Others areas including Upper Mainstem, Middle Mainstem, Dalecarlia subwatershed, Little Falls Mall tributary, and lower Mainstem are categorized as Watershed Restoration Areas. Management strategies for these areas include identification and implementation of stream restoration opportunities, and managing storm drain discharges throughout the watershed.

Rock Run subwatershed

Rock Run subwatershed is characterized with steep forested slopes adjacent to forested floodplains. Approximately 800 acres of forest areas are present in this subwatershed. This subwatershed 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.

Rock Run subwatershed has escaped many of the effects of urbanization common in subwatersheds developed many years earlier. Potomac occupies the headwaters of this subwatershed. Much of the subwatershed is dominated by large lot subdivisions, with a mix of older residential areas interspersed with newer planned communities. Imperviousness in the Rock Run subwatershed is estimated by the CSPS to be in the range of 25 to 30 percent.

The Rock Run subwatershed has comparatively large areas of forest. Floodplain areas occur on both private and public land.

Water Quality

The CSPS (1997) indicates that stream habitat in Rock Run is generally good, due to the forested stream valleys. Despite the generally good habitat, the biological community in this subwatershed is showing signs of impairment (low abundance of macroinvertebrates). Upper Rock Run has poor overall resource condition, partly due to high nutrient loads. Lower Rock Run has a fair overall condition, with a more diverse fish community partly due to influence from the Potomac River.

Restoration/Preservation

Two strategies have been suggested for management of this watershed.

- Watershed Restoration Area

  - The whole Rock Run subwatershed is currently designated as a watershed restoration area because of impaired biological community.
  - A comprehensive plan should examine and address impaired streams conditions throughout the watershed, and mitigating the effects of high-density development in the headwaters.
  - Effects of past gold-mining activities in this subwatershed are examined, and areas needing channel restoration are identified.
- Watershed Management Strategy
  - This strategy aims to develop targeted public education and outreach program to promote watershed friendly yard care and turf management practices.
  - Conduct baseline biological monitoring and update preliminary resource conditions.
  - Evaluate relationship between land use and stream condition through the Potomac Subregion Master Plan Study.

A priority wetland was identified as RR2 in the *Environmental Resources Inventory for the Potomac Subregion* (1998), which included the mainstem and tributaries of Rock Run from its confluence with the Potomac to Oaklyn Drive.

Restoration/Preservation of overall Potomac River Montgomery County (02140202)

State-designated Green Infrastructure hub is mainly located along the Potomac River, with corridors connecting this hub to other hubs within and outside of the watershed (DNR, 2000-2003). Large portions of this hub are protected by C&O National Historical Park, McKee Beshers WMA, Seneca Creek State Park, Izaak Walton League, and Muddy Branch Park.

The following information is based on the document *Rural Legacy FY 2003: Applications and State Agency Review*. The Mid-Maryland Montgomery Rural Legacy Area has approximately 49,907 acres located in the watersheds: Potomac River, Seneca Creek, and Lower Monocacy River. This area is currently largely undeveloped (91%). This area was chosen in order to protect contiguous properties of rural land, including agriculture, forest, and other natural resources, and improve water quality of the Potomac River. The goal is to protect 37,566 acres (75%). Currently, 34,117 acres (68%) of this land is protected through various methods. The sponsor is Montgomery County. The report also includes a list of property owners who are interested in selling an easement and the priority of acquiring these easements. Since the Rural Legacy Program funds are not adequate enough to support all of these requests, other programs should consider preservation of these sites.

The Potomac River (Montgomery and Frederick Counties) was designated as a scenic river by the Maryland General Assembly. Great Falls is a designated Natural Heritage Area within this watershed. To get this designation, an area must contain threatened or endangered species and be the best Statewide examples. It is protected by the C&O National Historical Park.

Near the mouth of Seneca Creek, there are several wetlands scattered along the Potomac River that were designated in a 1981 MDP document as Areas of Critical State Concern. These wetlands are known as Hughes Hollow, Seneca Swamp, and C&O Canal.

There are seven State-designated Nontidal Wetlands of Special State Concern (WSSC) in Potomac River Montgomery County watershed. The following information about these wetlands is summarized from the document titled *Nontidal Wetlands of Special State Concern of Five Central Maryland Counties and Coastal Bay Area of Worcester County, Maryland*, 2003. In this document, the seven State-designated wetland are grouped into two large wetland systems due their close proximity.

- *Canal Bottomland (DNR combined with Sycamore Landing Wetlands)*. This site is partially protected by BcKee-Beshers WMA and C&O National Historical Park.
- *Little Falls (DNR name: Potomac Gorge).* This site is protected by C&O National Historical Park.
- *Great Falls Floodplain and NHA (DNR name: Potomac Gorge).* This site is protected by C&O National Historical Park.
- *McKee-Beshers West Swamp* (DNR combined with Sycamore Landing Wetlands). This site is unprotected.
- *Sycamore Landing Riverside* (DNR name: Sycamore Landing Wetlands). Located in Broad Run subwatershed, this contiguous sequence of alluvial floodplain forest habitats , emergent, forest, seeps, and open water ponds along the Potomac River connects the McKee-Beshers West Swamp, Sycamore Landing Riverside, and Canal Bottomland wetland sites. Numerous rare plant species and insects are found on the site. Threats include spread of invasive, non-native species, deer browse, anthropogenic disturbances, and beaver activity. Recreational use should be managed to protect rare, threatened, and endangered species. In order to protect invertebrates, pesticide use should be avoided in the wetland. Any development within the boundaries of this wetland should mitigate for water quality and hydrological impacts and strictly adhere to BMPs. This site is protected.
- *Potomac Gorge*. Located in Rock Run and Little Falls subwatersheds, this wetland incorporates the Great Falls Floodplain, Great Falls NHA, Little Falls, and Potomac River-Cropley sites. This wetland complex provides a habitat for over 120 RT&E, besides other natural biological communities, thus regarded to be among the most significant natural areas in the eastern United States. The habitats include Piedmont/mountain bottomland forest, vernal pools, seeps, and ponds. The C&O canal, restricting it in size, affects this wetland complex. The wetland is threatened by fragmentation, edge effects, increasing recreational use, invasion by non-native weeds, and increasing deer population. With all these factors influencing the functioning of this wetland, long-term environmentally sensitive management is required. This site is protected by C&O National Historical Park.
- *Violets Lock Floodplain (DNR named: Blockhouse Point Floodplain)*. This site is protected by C&O National Historical Park.

- *Proposed WSSC.* There are two areas of proposed WSSC near Sycamore Landing Wetlands WSSC. These sites are protected by McKee Beshers WMA and Seneca Creek State Park.

Existing Recommendations for Restoration:

- Restore "gaps" in Green Infrastructure to natural vegetation.
- Restore wetlands and streams within the headwaters.
- Restore land within the designated Rural Legacy Area.
- Restore vernal pools.
- Restore impaired stream biological community within Rock Creek subwatershed
    - Mitigate impaired streams for effects of high-density development in the headwaters.
    - Channel restoration for past gold-mining activity.
- Little Falls subwatershed
    - Stabilize/restore areas of natural stream channel that still have the potential to support an aquatic community.
    - Stream restoration in Upper Mainstem, Middle Mainstem, Dalecarlia subwatershed, Little Falls Mall tributary, and lower Mainstem.
- Improving riparian buffers in Broad Run.
- Watts Branch subwatershed
    - Piney Branch tributary.
    - Habitat improvement and stream restoration.

Existing Recommendations for Preservation:

- Protect wetlands and streams within the headwaters.
- Priority wetlands, as identified in the Environmental Resources Inventory for the Potomac subregion are:
    - 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
- Protect additional wetland areas within State-designated Ecologically Significant Areas.
- Protect portions of Green Infrastructure that are not currently protected, especially along the Potomac River.
- Protect land within the designated Rural Legacy Area.
- Protect vernal pools.
- Protect WSSC and buffers.
- A priority wetland was identified as RR2 in the *Environmental Resources Inventory for the Potomac Subregion* (1998), which included the mainstem and tributaries of Rock Run from its confluence with the Potomac to Oaklyn Drive.
- Three wetlands were identified as priorities due to high scores for aquatic and wildlife habitat in the Environmental Resources Inventory for the Muddy Branch subwatershed of the Potomac Subregion:

- 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 mainstem of Muddy Branch.

Anacostia River (02140205)

Background

The Anacostia River is approximately 176 mi^2 and has one of the highest watershed population densities for the Chesapeake Bay. This watershed is within the Piedmont and Coastal Plain physiographic provinces, with the boundary between these two roughly following the County boundary. It has three major subwatersheds: Northwest Branch, Northeast Branch, and the tidal drainage portion. The Northeast and Northwest Branches converge in Bladensburg to form the tidal drainage portion. The Northwest Branch is roughly 32,000 acres and is highly developed land. Most of this subwatershed is within Montgomery County, with about one fifth in Prince George's County. The Northeast Branch is about 48,000 acres, with some urban and some being Agricultural Research areas. The majority of this subwatershed is within Prince George's County, with some of the headwaters in Montgomery County and D.C. This tidal portion, mainly in D.C. is over 8 miles long and feeds into the Potomac River (MDE, 2005a).

The Anacostia River watershed is located in Prince George's County (49%), Montgomery County (34%), and D.C. (17%). Of this entire watershed, about two thirds is in the Coastal Plain and one third is in the Piedmont. The tidal portion of the river is within the Coastal Plain, where they are influenced by a three-foot tidal cycle. The head-of-tide is located just outside of D.C., near Bladensburg (in Prince Georges County) (Shanks, 2005). Anacostia River watershed is located in Potomac Washington Metro River basin. In Montgomery County, the watershed includes Sligo Creek, Northwest Branch, Paint Branch, and Little Paint Branch subwatersheds. The characteristics and conditions of Montgomery County portion of this watershed will be described based on the individual subwatersheds.

Based on MDP 2002 GIS land use data the Anacostia River watershed has 46 acres of open water and 38,863 acres of land. The land acres are divided as follows: urban 30,195 acres (78%), agriculture 1,533 acres (4%), forest 6,990 acres (18%), and barren land 145 acres (<1%). Since estimates of wetland acreage using MDP data are often underestimated, DNR wetland GIS data, as described later, should be used for wetland acreage values.

Hickory shad has been increasing. After DNR stocked smallmouth bass in the Upper Northwest Branch, this species seems to be self-sustaining (Shanks, 2005).

The Anacostia River was designated as a scenic river by the Maryland General Assembly.
Due to the multi-jurisdictional nature of the Anacostia River watershed, a Joint Agency Committee (composed of Washington Suburban Sanitary Commission, and both Montgomery and Prince George's County branches of M-NCPPC) was formed to oversee the Anacostia Scenic River Study and implement the study's recommendations. Major problems affecting the River include:

- Erosion and sedimentation.
- Malfunctioning sanitary sewers.
- Illegal and undesirable discharges.
- Trash and litter.
- Destruction of aquatic and riparian habitats.
- Deforestation along the stream banks due to flood control projects.
- Stormwater runoff.

In response to the above problems, the study recommends the following:

- Managing the Anacostia River as a whole, rather than a series of separate jurisdictional responsibilities.
- Public education and information on attributes and problems of the Anacostia River.
- Stream valley park acquisitions.
- Increase considerations of environmental factors in land use plans.
- Maintain natural conditions along the river and its tributaries.
- Inspection and stricter enforcement of sediment control ordinances.
- Provide a comprehensive stormwater management program for the Anacostia River watershed.

Estimates of wetland acreage for the entire Maryland portion of the watershed, based on DNR mapped wetlands, are as follows:

- Palustrine
    - Aquatic bed: 1 acre
    - Emergent: 209 acres
    - Scrub shrub: 119 acres
    - Forested: 1,682 acres
    - Unconsolidated bottom: 250 acres
    - Unconsolidated shore: 64 acres
- Riverine unconsolidated shore: 16 acres
- Total: 2,341 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight gain in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02140205	-28.23	32.33	0	1.11	5.21

The watershed is contained in both the Piedmont and Coastal Plain physiographic provinces, although the Prince George's portion is entirely within the Coastal Plain. Channel morphology changes near the boundary of the Piedmont/Coastal Plain physiographic regions. Significant sediment deposition normally occurs in the transition area downstream of the boundary, as the material which had been carried by the higher velocity Piedmont flow settles out in the slower Coastal Plain flow.

The Anacostia River watershed once had extensive areas of wetlands, particularly tidal freshwater wetlands. In its 1994 report, the U.S. Army Corps of Engineers, mentioned historical sources describing extensive marshes dominated by wild rice. There was an estimated 2,600 acres of tidal marsh in the Anacostia River extending to Bladensburg. The flood control projects in Prince George's County resulted in the loss of 800 acres of wetlands. This included 713 acres of wetlands along Northeast Branch and Northwest Branch and 134 acres along Indian Creek and Paint Branch. An additional 348 acres of area identified by the Corps of Engineers as bottomland hardwood, (USACE, 1994) which may also have included wetlands, was lost. One Prince George's County flood control project was completed as recently as 1975. At the time of the 1994 report, an estimated 100 acres of vegetated tidal wetlands was all that remained, primarily due to dredging and channelization of the entire tidal portion of the river in the 1920's and 1930's (USACE, 1994). The largest remaining tidal marsh is Kenilworth Marsh in the District of Columbia.

Existing mud flats and debris along the tidal shoreline limit the extent of vegetated wetlands. The elevation of the mud flats and their prolonged inundation during high tides are unfavorable conditions for supporting emergent vegetation. Debris is also believed to abrade the shoreline and smother vegetation that may colonize the shoreline (USACE, 1994). However, mudflats themselves may also be important habitat for wildlife species such as shorebirds.

Remaining tidal wetlands in the Washington Metropolitan basin, which includes the Anacostia watershed, are of three major types: shrub swamp dominated by smooth alder and black willow, tidal swamp forest with red maple and ash, tidal fresh marshes with smartweed and rice cutgrass, and fresh marshes dominated by spatterdock. The estimated total acreage in the basin in Maryland is less than 300 acres (McCormick and Somes, 1982).

Native plants in the floodplains of Coastal Plain watershed include birch, elm, alder, willow, red maple, sycamore, and beech (USACE, 1994). Swamp oak, river birch, white ash, willow, and hornbeam were noted in the Piedmont floodplains of the Anacostia watershed. However, extensive land clearing and landscaping has resulted in the introduction and spread of many non-native woody and herbaceous species.

Nontidal wetlands were likely historically supported by both overbank flooding and high ground water seepage, as suggested in the hydric soils description in the *Soil Survey of Prince George's County*. However, intense urbanization has resulted in incised stream channels, so that overbank flooding rarely occurs. Remaining wetlands may be drier than they were in times of less urbanization, since the remaining hydrology is often from groundwater alone. Lack of overbank flooding would also reduce the importance of the wetland as an area of floodwater attenuation. Remaining wetlands probably still provide water quality benefits by uptake and transformation of nutrients and sediment trapping. The nontidal wetlands most effective at nutrient transformation may be the wetlands on the very poorly drained Johnston soils with their high organic matter. The soil type is not common in the County, but there is an extensive area on the Beltsville Agricultural Research Center property. These wetlands are probably among the least disturbed in the watershed and include the Beltsville Bottomland Forest Nontidal Wetlands of Special State Concern.

Some wetlands in the watershed were assessed and the following results were summarized from the 1996 M-NCPPC *Environmental Resource Technical Report, Eastern Montgomery County Master Plan Areas*. Most of the headwater streams are fed by springs and seeps. They have been particularly important in supporting high quality stream, cold water, unsilted stream bed, needed for brown trout reproduction in Paint Branch.

Wetlands are more common in less developed, wider valleys of the upper reaches of watersheds in study area. Wetland functions included groundwater recharge and discharge, flood attenuation, nutrient and sediment trapping, baseflow maintenance, food chain support, and terrestrial and aquatic habitat. Forested wetlands are the most common type. Few wetlands remain in highly urbanized areas, in which streams are incised as a result of increased storm flows. In comparison with the Potomac subregion, wetlands with high functional scores are less common, but are part of the wildlife corridor in the stream valley parks.

Forested wetland vegetation often includes red maple and tulip poplar as co-dominants.

Some wetlands on abandoned mine sites in the Little Paint Branch subwatershed were found to support vernal pools and amphibian breeding habitat. Some vernal pools also exist as seeps from toes of slopes within the floodplain. A large wetland system of mature forest split by a utility right-of-way contains an area with bog conditions and a rare plant species. The site is known as McKnew Bog and may qualify as a Nontidal Wetlands of Special State Concern, though the site has not being evaluated for formal designation. This site is also supported by seepage from adjacent slopes (Walbeck, 2004 Pers comm.).

In the Indian Creek sub-watershed, there are additional wetlands in sediment and wash ponds associated with a mining operation. The wetlands are largely dominated by *Phragmites*, and show little vegetative diversity. The major function provided by these wetlands is water quality improvement (Walbeck, 2004 Pers comm.). There is evidence that *Phragmites* is one of the more effective plants for uptake of nutrients and some

metals (Kobriger, et al., 1983). Some vernal pools, critical as amphibian breeding habitat, also exist in some of the mined areas. On the west side of I-95, a series of wetlands supported by groundwater seepage along the highway embankment contain a diverse bog plant community (Walbeck, 2004 Pers comm.). The site, Aitcheson's Bog, may also be considered for future listing as a Nontidal Wetlands of Special State Concern.

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. For this watershed, they are designated as follows:

- Use III: natural trout waters; Paint Branch and all tributaries Above Capital Beltway (I-495)
- Use IV: recreational trout waters; Northwest Branch and all tributaries Above East-West Highway (Rt. 410)

Water Quality

The 1998 Clean Water Action Plan classified this watershed as a "Priority" Category 1 watershed, a watershed most in need of restoration. Failing indicators included a poor nontidal benthic index of biotic integrity, high percent impervious surface (33%), high population density, high historic wetland loss (16,720 acres), high soil erodibility (0.31), and being on the 303d List for water quality impairment. It is also a Category 3 watershed, a watershed that needs protection. Indicators suggesting need for preservation included a high imperiled aquatic species indicator and presence of migratory fish spawning and trout spawning areas.

According to the 2002 Maryland Section 305(b) Water Quality Report, the Anacostia River nontidal mainstem (<1 miles) fails to support all uses due to bacteria. The station at East-West Blvd had elevated bacteria levels likely from upstream urban and natural nonpoint runoff (MDE, 2000). The nontidal wadeable tributaries (163 miles) fails to support all uses due to poor biological community from sewerage systems, urban runoff, habitat alteration, hydromodification-channelization. Results for the 22-acre Greenbelt Lake and the 5-acre Pine Belt Lake were inconclusive.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may need a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Anacostia River* (non-tidal); poor biological community, heptachlor epoxide, PCBs in water, sediment, nutrients, biological oxygen demand.
- *Anacostia River* (tidal); sediments, nutrients, biological oxygen demand.
- *Beaverdam Creek* (non-tidal); poor biological community.
- *Lower Beaverdam Creek* (non-tidal); poor biological community.
- *Beaverdam Creek* (021402050816 non-tidal Prince Georges County); poor biological community.

- *Beaverdam Creek* (021402050823 non-tidal Prince Georges County); poor biological community.
- *Indian Creek* (non-tidal); poor biological community.
- *Northwest Branch* (non-tidal); poor biological community.
- *Northwest Branch* (021402050818 non-tidal); poor biological community.
- *Northwest Branch Unnamed Tributary* (021402050818 non-tidal); poor biological community.
- *Cattail Branch* (021402050816 non-tidal in Prince Georges County); poor biological community.
- *Paint Branch* (non-tidal); poor biological community.
- *Little Paint Branch* (non-tidal); poor biological community.
- *Little Paint Branch* (021402050825 non-tidal); poor biological community.
- *Sligo Creek* (non-tidal); poor biological community.
- *Sligo Creek* (021402050821 non-tidal); poor biological community.

TMDLs have not been completed yet for the Maryland portion of the river, but have been completed for biological oxygen demand (BOD) and total suspended solids within the District of Columbia's portion. While the 2001 TMDL for BOD does recommend reductions in nitrogen and phosphorus loads, it does not establish a TMDL for these pollutants. The TMDL concludes that water from both Maryland and DC contributes to the low summer DO. It also concludes that reducing the BOD would improve the DO levels. Sources of BOD in Maryland are nonpoint sources (e.g. stormwater outfalls) while in DC they are nonpoint (e.g. stormwater outfalls) and point sources (combined sewer overflows). This TMDL recommends a 50% BOD reduction and a 30% nutrient reduction for stormwater pollutants in Maryland and DC and a 90% reduction in BOD from combined sewer overflow. The District of Columbia's TMDL for Total Suspended Solids (TSS) recommended a TSS reduction of 86% for Maryland, and 83% for both DC's combined sewer overflow and DC's stormwater. The largest amount of TSS is entering from Maryland (Shanks, 2005).

A Draft TMDL was completed in 2005 for fecal bacteria in the Anacostia River. The main sewage treatment plants are Blue Plains Advanced WWTP and BPA WWTP, both discharging outside of the watershed. There are some septic systems in the northern portion of the watershed, around Sandy Spring, Spencerville, Beltsville, and north of Beltsville. Sources of fecal bacteria were largely domestic animals, human, and wildlife, followed by livestock.

A long-term water quality monitoring station near Alt Rte. 1 Bridge (near Bladensburg) shows that nitrogen decreased between 1986 and 2002, while phosphorus and sediment did not show this trend. The District of Columbia monitoring site, near the Maryland border, found low summer dissolved oxygen. Water sampling upstream conducted by Maryland found higher DO levels, but found elevated nitrogen, phosphorus, and bacteria. Sedimentation is high on the Anacostia, near the Bladensburg Waterfront Park. Point source discharges contribute a relatively small amount of nutrients and bacteria to the waterway. Sources of bacteria are largely from stormwater runoff and leaks in the sanitary sewer system (Shanks, 2005).

Overall watershed water quality problems include combined sewer overflows, urban runoff, construction and surface mining erosion, and localized point sources. Poorest water quality was located in the channelized Northwest Branch, followed by lower Beaverdam Creek and Little Paint Branch. Water quality has improved slightly in Indian Creek and declined slightly in upper Northwest Branch. Major water quality issues within this watershed include high amounts of sediment and bacteria, elevated water temperatures, and localized high nutrient or toxic contaminants (USEPA, 1989).

In 1989, Paint Branch still supported a trout population. However, this population is being stressed by channel scouring during storms, increased sediment, and general degradation of physical habitat within the main trout-stream – Good Hope tributary (a tributary of Paint Branch). It appears that watershed development is one of the greatest impacts. Another Paint Branch tributary – Upper Gum Springs – also supports trout, while mainly young-of-year trout. Several check dams were installed in this tributary to increase the number of pools and therefore the number of adult trout (USEPA, 1989).

Subwatersheds

The following information is about the subwatersheds.

Sligo Creek subwatershed

The following background information is summarized from a document titled *Environmental Resources Technical Report, Eastern Montgomery County Master Plan Areas*, M-NCPPC, 1996.

Sligo Creek is a major tributary of Northwest Branch. It drains an area of 13.3 square miles of dense commercial and residential development including Wheaton Triangle area and part of Wheaton Central Business District, Takoma Park, and downtown Silver Spring. An almost continuous, narrow buffer of publicly owned parkland borders most of the stream, with many different species of trees shading its banks. This subwatershed has a little open space outside this stream valley park, which harbors a variety of urban wildlife including, foxes, squirrels, opossums, groundhog, and various bird species.

The remains of Sligo Creek's natural stream network are mainstems of streams with most feeder tributaries paved over and piped into storm drains. The remaining stream system has been heavily armored in many areas to reduce channel erosion. These alterations have improved bank stability, but provided limited habitat value. Unarmored areas exhibit varying degrees of bank instability and erosion problems due to uncontrolled stormflows.

The stream is designated as a Use I stream, water contact recreation, aquatic life and water supply. This creek is easily accessible, thus its recreational use occurs throughout the year.

Water Quality

Sligo Creek stream and habitat conditions range from fair to good overall. Preliminary results on Wheaton Branch evaluation indicates stream conditions to be fair, with habitat conditions ranked as good. Factors affecting stream conditions include high imperviousness, channel alteration and urban pollutant loads (MC-DEP web).

Upper and Lower Sligo stream conditions are poor, with an overall fair to good habitat. High imperviousness, embeddedness and unstable banks have attributed to these conditions (MC-DEP web).

Several retrofit projects have taken place in the Sligo Creek watershed to improve the water quality in Sligo Creek. Some wetlands and vernal pools have also been created.

Restoration/Preservation

All of the Sligo Creek drainage area is designated as a Watershed Restoration Area. This subwatershed has been targeted as an important part of the overall Anacostia watershed restoration and urban pollutant control effort to restore habitat conditions.

Construction of Wheaton Branch pond, stream channel restoration and transplantation of native fish from other similar watersheds have helped in augmenting the recovery of fish populations in Sligo creek. Recent biological monitoring conducted by the Interstate Commission of the Potomac River Basin (ICPRB) indicates an increase in number of re-established fish species in Upper Sligo Creek mainstem from three in 1988 to eleven currently. However, existing blockages downstream restrict normal fish movement in Sligo Creek, thus limiting natural re-establishment of a more diverse fish community (MC-DEP web).

Northwest Branch subwatershed

The following background information is summarized from a document titled *Environmental Resources Technical Report, Eastern Montgomery County Master Plan Areas*, M-NCPPC, 1996.

The Northwest Branch subwatershed drains a larger area, 53.2 square miles, than any other Anacostia tributary. Ridges and deep narrow stream valleys, channels and floodplains created by moderate to high velocity streams flowing over moderate gradients characterize this watershed. Extensive stretches of undeveloped woodland and agricultural or low-density areas surround the upper portions of the watershed. The upper reaches have stable shaded banks and pool formations in the swift waters. However, the stream slows and widens in the downstream urbanized areas south of east Montgomery County. The Northwest Branch watershed has a Use IV designation: recreation trout waters, including those potentially or actually capable of supporting adult trout for put and take fishing; or managed as a special fishery by periodic restocking.

In the Piedmont portion of Northwest Branch, the floodplain is relatively narrow. The stream is incised in the vicinity of Randolph Road, used as a sample area for the USACE study, and banks are often undercut. Moderate to low stormflows were found to no longer reach the original floodplain, so any wetlands, if present, would perform limited flood attenuation functions.

The *Draft Environmental Impact Statement/Draft Section 4(f) Evaluation: InterCounty Connector I-270 to US 1. Vol. 1* (2004) reported the results of some wetland assessments for parts of the watershed. The southern portion of this sub-watershed contains large, diverse wetlands typically associated with broad floodplains.

Water Quality

Overall, Northwest Branch stream conditions can be described as ranging from fair to good. Most notable threats to stream quality include: poor bank stability, sediment deposition and embeddedness causing habitat impairments. High imperviousness and uncontrolled runoff has severely affected habitat for fish and other macroinvertebrates especially on lower reaches (MC-DEP web).

Restoration/Preservation

Tributaries that have been designated as Watershed Protection Areas include the Lower Left Fork of the Upper Mainstem, Sandy Spring, Old Orchard, Bryants Nursery, Batchellor's Forest, and Rolling Stone.

Three tributaries with excellent stream conditions (Old Orchard tributary, Bryants tributary, and Upper Mainstem) are accorded special level protection.

Remedial protection has been recommended for much of the headwaters of Northwest Branch, including Batchellors Forest, Lower Left Fork, Sandy Spring, Old Orchard, Bryants Nursery, Upper main, and Rolling stone tributaries. The stream channels in these areas have been destabilized by past erosion and accelerated downcutting associated with land clearing activities without adequate BMPs, particularly the use of forested buffers.

The Northwest Branch mainstem and tributaries from the Northwest Branch golf course downstream have been designated as restoration areas. High impervious levels are evident in these areas, resulting in uncontrolled runoff. Although these areas have stormwater management controls, they have been said to be less effective. Opportunities to improve the quantity of stormwater runoff are remote. Voluntary actions to slow runoff from yards and roof-drains, along with controlling non-point source pollutants, such as nutrient from yards and pet waste, have been suggested (MC-DEP web).

Other Management Recommendations:

The *Draft Environmental Impact Statement/Draft Section 4(f) Evaluation: InterCounty Connector I-270 to US 1. Vol. 1* (2004) identified some options for environmental

stewardship: 1) Improve water quality and instream habitat; 2) Increase acreage of wetlands and forest; and 3) Decrease stream channel erosion.

Paint Branch subwatershed

The following background information is summarized from a document titled *Environmental Resources Technical Report, Eastern Montgomery County Master Plan Areas*, M-NCPPC, 1996.

Paint Branch is one of the three major County watersheds draining to the Anacostia River. This watershed originates in the area south of Spencerville Road and is 17 miles in length, draining a 31.5 square mile area. The mainstem of Paint Branch is moderately sized, fourth order stream which terminates at its confluence with Northeast Branch in the middle of Prince George's County.

Paint Branch supports a unique County and regional resource including an urban water fishery and wild brown trout population. The upper portion of this watershed flows through predominantly low density residential areas interspersed with large tracts of undeveloped land. This upper reach provides spawning/nursery areas for young trout, an indicator of very high water quality due to this species' requirement for cold clean water and unsilted streambed conditions. A variety of wildlife thrives in the watershed including several fish species.

Tributaries in the Lower Paint Branch subwatershed have suffered impairments over the years from older developments and land uses that do not have adequate stormwater controls. Forest cover in this area is largely confined to the stream valleys, but does not help to prevent the stream temperatures from heating beyond the upper temperature limits of the adult brown trout found here. Resource conditions in Lower Paint Branch range from good to poor.

The *Draft Environmental Impact Statement/Draft Section 4(f) Evaluation: InterCounty Connector I-270 to US 1. Vol. 1* (2004) reported the results of some wetland assessments for parts of the watershed. The southern portion of this sub-watershed contains large, diverse wetlands typically associated with broad floodplains.

Water Quality

Overall the water quality in this subwatershed has been described to range from good to excellent. The streams exhibit a generally low stream temperature and a steady base flow, providing a good habitat for young trout. Some factors that have been noted to affect the stream condition include uncontrolled storm runoff, sedimentation, and channel widening (MC-DEP web).

Restoration/Preservation

- Paint Branch wetlands (M-NCPPC 1996)

- Wetlands and streams in upper Paint Branch watershed, north of Fairland Road (M-NCPPC 1996)
- Because of the unique cold-water community in this subwatershed, the Paint Branch has received much attention over the years and has been a focus of many innovative efforts to address the effects of land use on the stream resource. Large areas of Upper Paint Branch have been acquired for parkland to limit overall watershed imperviousness. The upper watershed (above Fairland Rd.) was designated a SPA in 1995 and development done after the implementation of this legislation is limited to a 10% impervious area cap. BMPs are aggressively pursued through the County, working cooperatively with other agencies including DNR, to improve stormwater retrofit and stream restoration projects (MC-DEP web).

Paint Branch SPA

The following information is a summary from MC-DEP *SPA Annual Report* 2002.

The Paint Branch SPA is recognized as a unique County resource and is designated as Use III, naturally reproducing trout stream. Previous monitoring reports indicated that certain portions of this watershed did experience considerable stress from prior land development, although water quality during recent years has remained unchanged.

DEP is pursuing projects intended to supplement improvements in watershed management achieved through the SPA permit process. DEP, M-NCPPC, and other agencies, are working closely to inventory 75 potential stream habitat restoration, wetland creation, and storm water retrofit projects. Some of these projects are capital projects while others involve small habitat restoration of wetlands and tree plantings that are partially implemented by volunteers.

For management purposes, this SPA is divided into five subwatersheds; Left Fork, Right Fork, Gum Spring, Good Hope, and Paint Branch subwatersheds. As of August 2003, nine restoration projects had been completed for this SPA. Eight of these projects are in the Good Hope subwatershed and one is in the Gum springs subwatershed. Seven other projects are in design phase, one in Good Hope subwatershed, three in the Gum Spring subwatershed, two in the Right Fork subwatershed and one in the Left fork subwatershed.

DEP has completed 2.25 miles of stream restoration on the Paint Branch mainstream between Fairland Road and Route 29. This restoration included: bank stabilization, tree planting, grade control, woody debris placement for fish habitat, and channel relocation to protect historic site.

The *Draft Environmental Impact Statement/Draft Section 4(f) Evaluation: InterCounty Connector I-270 to US 1. Vol. 1* (2004) identified some options for environmental stewardship: 1) Improve water quality and instream habitat; 2) Increase acreage of wetlands and forest; and 3) Decrease stream channel erosion.

Little Paint Branch subwatershed

The following background information is summarized from a document titled *Environmental Resources Technical Report, Eastern Montgomery County Master Plan Areas*, M-NCPPC, 1996.

Little Paint Branch subwatershed is located in the eastern most area of the County. The mainstem of the stream is in Prince George's County where it flows into the Paint Branch near College Park. This subwatershed covers an area of 10.8 square miles, mostly suburban development with open spaces provided by Fairland Recreational Park, which straddles the Montgomery/Prince George's County line and Beltsville Agricultural Research Center in Prince George's County.

This subwatershed has the unique characteristic of being in a transition area between the Piedmont ecoregion and the Coastal Plain ecoregion. Streams in the Piedmont generally are fast flowing on steeper gradients with a rockier substrate. Coastal Plain streams generally are slower, more meandering, with a sandier substrate.

The *Draft Environmental Impact Statement/Draft Section 4(f) Evaluation: InterCounty Connector I-270 to US 1. Vol. 1* (2004) reported the results of some wetland assessments for parts of the watershed. Wetlands in the southern part of the watershed are primarily forested and supported by overbank flooding and groundwater seepage. Some wetlands have developed on abandoned gravel mines and provide breeding habitat for amphibians such as wood frogs and spotted salamander. The largest wetland is on the mainstem of Little Paint Branch and seeps from adjacent slopes. In the northern watershed there is a large forested wetland fragmented by a utility right of way. Within the corridor of the right of way, the wetland is emergent and contains a State listed plant species, bog-like conditions, and an unusual plant community. The area has been named McKnew Bog and may qualify as a nontidal wetland of special State concern. Seepage from adjacent uplands provides the hydrological support of this wetland.

Water Quality

Stream resource conditions range from poor in the lower tributaries of Little Paint Branch, fair in the middle reaches below Greencastle Rd., to good above Greencastle Rd. The primary cause of degraded stream conditions has been attributed to high-density development, impervious influence conditions, unstable stream banks, and sediment deposition. There is lack of stormwater controls, especially in old developed areas (MC-DEP web).

Restoration/Preservation

- Silverwood tributary to Little Paint Branch (M-NCPPC 1996)
- Stormwater Retrofit projects, as described in the *Environmental Resources Technical Report, Eastern Montgomery County Master Plan Areas*, M-NCPPC, 1996.

- Most of the areas in Little Paint Branch subwatersheds are transferable development right (TDR) receiving areas. High density uses in these areas allow the County to transfer development rights from land in the Agricultural Reserve and locate housing and jobs in parts of the County that have or are planned for more intensive infrastructure improvements (MC-DEP web).

Restoration/Preservation of Anacostia Watershed

There are some linear State-designated Green Infrastructure hubs, largely along the already protected areas of Northwest Branch Park, Wheaton Regional Park, and Paint Branch Park (DNR, 2000-2003). There are some unprotected hub just north of Northwest Branch Park, that should be high priority for protection. There are also some connecting corridors that are unprotected.

Nine subwatersheds were selected as priority: Sligo Creek, Hickey Run, Indian Creek, Northwest Branch, Upper Paint Branch, Beaver Dam Creek, Northeast Branch, Watts Branch, and Tidal estuary. Sligo Creek is one of the most urbanized tributaries to the Anacostia. Flooding and severe streambank erosion are the main problems. Little aquatic life is present. Hickey Run, within the District of Columbia, is highly impacted by upstream commercial and industrial pollution, including oil spills, stormwater runoff of oil and grease, bacteria, BOD, trace metals, pH, DO, and phosphates. Indian Creek meanders through several active and abandoned sand and gravel mining areas, contributing large amounts of sediment to the waterway. The lower portion of Indian Creek is surrounded by urban, commercial, and residential areas, and turns into a concrete channel near its confluence with Paint Branch (USEPA, 1989).

Examples of basinwide pollution controls that have been implemented include (USEPA, 1989):

- Improving combined sewage systems
- Stormwater retrofits (e.g. Wheaton Branch stormwater retrofit)
- Point source controls (e.g. at Mineral Pigments Plant on Indian Creek and at Hickey Run METRO site)
- Controls on new development (including urban BMPs to control stormwater runoff and construction sediment)
- Surface mine reclamation (e.g. Magruder/Rawklins)

The Migratory Fish Barrier Working Group identified sites where there were barriers to Herring migration (USEPA, 1989). Since the publication of this report, these sites have likely already been restored:

- Northwest Branch weir behind PG-MNCPPC offices (restoration was scheduled to begin in 1990)
- Northwest Branch 38th Street dam in Hyattsville
- Northwest Branch sewer encasements (200 yards upstream from 38th Street dam).

In the northern part of the Indian Creek sub-watershed, some wetlands have developed or been expanded as a result of mining activities. There are also some disturbed areas that

may be suitable for creation, restoration, or enhancement. There are other areas along Indian Creek that were investigated for mitigation purposes, though these were primarily for stream restoration. There were opportunities for riparian buffer enhancement and removal of fish blockages, but opportunities to re-establish floodplain connections were fair to poor. Small areas of filled wetlands were also noted (Walbeck, 2004 Pers comm.).

Despite the extensive development, a number of partially forested stream valley parks and several Nontidal Wetlands of Special State Concern (within PG County) remain. Enhancement opportunities may exist in the stream valley park, though wetlands may be limited. Parks to be investigated under the Corps study include Northwest Branch, Paint Branch and Beltsville Community Park. Some opportunity may exist also on Beltsville Agricultural Research Center (BARC) property. Several sites on BARC property have been used for wetland mitigation, and other opportunities may exist. Opportunities for expanding, enhancing, or increasing protection of the Nontidal Wetlands of Special State Concern are encouraged.

In 1993, approximately 32 acres of freshwater tidal wetlands were restored using dredged material at Kenilworth Marsh in the District of Columbia. In 2000, approximately 32 acres of freshwater tidal wetlands were restored in the old Kingman Lake (also in DC), although some of this has since reverted back to mudflat (Neff, 2006, Pers. Comm.). In order to measure success, one of the reference sites for comparison was at Dueling Creek in Prince George's County. This site is one of the few remaining marshes in the Anacostia system. Prior to channelization (in the 1930's) however, the marsh may have been part of the Anacostia River bottom. The site has also been used or recommended as a reference site for other tidal restoration projects. In restoring tidal freshwater wetlands to this region, critical factors for success include establishing correct elevations, excluding goose predation by mechanical means or selection of plant species not preferred by geese, and consideration of natural revegetation potential and whether or not planting is appropriate (Neff, 2002). Additional freshwater tidal wetland restoration projects have been conducted along the Anacostia River itself (Neff, 2006, Pers. Comm.). These sites are quickly colonized with volunteer wetland plants and animals. Osprey, bald eagles, heron, and egrets are some of the common visitors.

The goal for restoration in Prince George's County in the Corps project was to restore fish and wildlife habitat. Potential sites were investigated in Prince George's County in Bladensburg, but were rejected as it was considered infeasible to restore wetlands maintaining the integrity of the flood control project (USACE, 1994). In the 1994 Corps of Engineers feasibility report, 34 sites in the entire watershed were evaluated as possible wetland creation sites. Additional sites were evaluated for wetland creation as part of retrofit stormwater projects. Some of these projects have since been constructed. Several wetland/stormwater retrofit were constructed in Montgomery County in the Paint Branch watershed in 2000, and three similar projects were completed in the Prince George's County portion of the watershed in 2001-2002: Indian Creek Stormwater Management Facilities Nos. 10 and 5, and the Greenleaf Road Stormwater Management Facility. The three projects created 1.1 acres of wetlands. Approximately 3.5 acres of wetlands were created in the floodplain of Northwest Branch near Fordham Street.

While there are no designated Nontidal Wetlands of Special State Concern within the Montgomery County portion of this watershed, there are several within the Prince George's portion. Additionally, there are four proposed Nontidal Wetlands of Special State Concern within the Montgomery County portion. These are located: in Northwest Branch Park (just north of Bel Pre Manor and south of Colesville), near Paint Branch (unprotected), and on the northern border of Montgomery and Prince Georges Counties (north of Fairland Regional Park - unprotected).

Anacostia River watershed restoration approaches including stream restoration to address erosion and stream bank instability have been recommended, and are underway in several areas.

Existing Recommendations for Restoration:

- Restore wetlands and streams within the headwaters.
- Restore "gaps" in Green Infrastructure to natural vegetation.
- Restore vernal pools.
- Restore the scenic Anacostia River.
- Restore wetlands designed to remove biological oxygen demand (BOD) and total suspended solids from the waterways.
- Nine subwatersheds were selected as priority: Sligo Creek, Hickey Run, Indian Creek, Northwest Branch, Upper Paint Branch, Beaver Dam Creek, Northeast Branch, Watts Branch, and Tidal estuary.
- Remove fish blockages downstream of Sligo Creek (MC-DEP web).
- The Northwest Branch mainstem and tributaries from the Northwest Branch golf course downstream – to control runoff (MC-DEP web).
- DEP is identifying potential stream habitat restoration, wetland creation, and storm water retrofit projects within Paint Branch subwatershed.
- Recommendations based on the *Draft Environmental Impact Statement/Draft Section 4(f) Evaluation: InterCounty Connector I-270 to US 1. Vol. 1* (2004):
    - Improve water quality and instream habitat
    - Increase acreage of wetlands and forest
    - Decrease stream channel erosion.
- Sites within Little Paint Branch subwatershed:
    - Silverwood tributary to Little Paint Branch (M-NCPPC 1996)
    - Stormwater Retrofit projects, as described in the *Environmental Resources Technical Report, Eastern Montgomery County Master Plan Areas*, M-NCPPC, 1996.

Existing Recommendations for Preservation:

- Protect wetlands and streams within the headwaters.
- Protect additional wetland areas within State-designated Ecologically Significant Areas.
- Protect portions of Green Infrastructure that are not currently protected, especially the hub north of Northwest Branch Park.
- Protect vernal pools.

- Protect the scenic Anacostia River.
- Protect wetlands that function to remove biological oxygen demand (BOD) and total suspended solids from the waterways.
- Northwest Branch subwatershed.
    - Watershed Protection Areas include the Lower Left Fork of the Upper Mainstem, Sandy Spring, Old Orchard, Bryants Nursery, Batchellor's Forest, and Rolling Stone.
    - Old Orchard tributary, Bryants tributary, and Upper Mainstem are accorded special level protection.
    - Remedial protection has been recommended for much of the headwaters of Northwest Branch, including Batchellors Forest, Lower Left Fork, Sandy Spring, Old Orchard, Bryants Nursery, Upper main, and Rolling stone tributaries.
- Upper Paint Branch subwatershed (MC-DEP web).
- Protect potential WSSC called McKnew Bog.
- Sites within Paint Branch subwatershed:
    - Paint Branch wetlands (M-NCPPC 1996)
    - Wetlands and streams in upper Paint Branch watershed, north of Fairland Road (M-NCPPC 1996)

Rock Creek (02140206)

Background

Roughly 80% of this watershed is within Montgomery County and the remainder is within Washington, DC. This creek begins at Laytonsville and flows through the County, into D.C., and finally into the Potomac River. Needwood Lake and Lake Bernard Frank are two impoundments within this watershed. The three major basins within Rock Creek are the mainstem, the North Branch, and the tidal portion. The nontidal portions are mainly within Montgomery County, in the Piedmont physiographic province, covering about 60 mi^2. The tidal portion is mainly within Washington, D.C., in the Coastal Plain physiographic province (MDE, 2005c Draft).

This watershed is located in Potomac Washington Metro River basin and encompasses lower and upper Rock Creek subwatersheds. Based on MDP 2002 GIS land use data, the Rock Creek watershed has 159 acres of open water and 39,099 acres of land. The land acres are divided as follows: urban 29,376 acres (75%), agriculture 2,778 acres (7%), forest 6,918 acres (18%), and barren land 27 acres (<1%). Since estimates of wetland acreage using MDP data are often underestimated, DNR wetland GIS data, as described later, should be used for wetland acreage values.

The following summary provides an overview of upper Rock Creek subwatershed from a document titled *Environmental Resource Inventory*, *Upper Rock Creek,* M-NCPPC, 2000.

The upper Rock Creek subwatershed includes approximately 95 miles of streams that drain 18,860 acres of land. The public parks occupy one fourth of this watershed area (4,320 acres) while the remaining three-fourths (14,540 acres) is non-parkland area.

Based on the M-NCPPC 1993-94 plainimetric data, agricultural land uses are concentrated in the northern headwaters of the watershed. The upper reach of the mainstem is the most rural of the streams in this watershed area.

The lower Rock Creek subwatershed is heavily urbanized and densely populated.

The *Draft Environmental Impact Statement/Draft Section 4(f) Evaluation: InterCounty Connector I-270 to US 1. Vol. 1* (2004) reported the results of some wetland assessments for parts of the Upper Rock Creek and North Branch subwatersheds. The highest quality wetlands were identified in a section of the Rock Creek floodplain as a large forested wetland system that also contained vernal pools. Hydrology was from flooding by Rock Creek and seepage from adjacent slopes. Functions were assessed to include wildlife habitat, floodflow alteration, sediment/toxicant removal, uniqueness/heritage, and recreation. Wetlands and their functions in the North Branch subwatershed were similar to those in Upper Rock Creek.

Estimates of wetland acreage for the entire Maryland portion of the watershed, based on DNR mapped wetlands, are as follows:

- Lacustrine unconsolidated shore: 4 acres
- Palustrine
    - Emergent: 90 acres
    - Scrub shrub: 33 acres
    - Forested: 795 acres
    - Unconsolidated bottom: 63 acres
    - Unconsolidated shore: 4 acres
    - Farmed: 13 acres
- Riverine unconsolidated shore: <1 acre
- Total: 1,001 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight gain in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02140206	-2.47	2.96	0	0	0.48

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. For this watershed, they are designated as follows:

- Use III: natural trout waters;
    - Rock Creek and all tributaries Above Muncaster Mill Road
    - North Branch Rock Creek and all tributaries Above Muncaster Mill Road
- Use IV: recreational trout waters; Rock Creek and all tributaries From 766.7/ 459.3 to From Rte. 28 to Muncaster Mill Road

Water Quality

The 1998 Clean Water Action Plan classified this watershed as a "Priority" Category 1, a watershed not meeting clean water or other natural resource goals and being most in need of restoration. Failing indicators included a high modeled nitrogen loading rate, a low nontidal benthic index of biotic integrity, and high percent impervious surface (34%), a high population density, a high percent unforested stream buffer (38%), high soil erodibility (0.31), and being on the 303d list for water quality impairment. Historic wetland loss is 1,804 acres. It was also classified as a Category 3, a watershed that needs protection. Indicator suggesting need for preservation included a high imperiled aquatic species indicator and presence of migratory fish spawning area.

According to the 2002 Maryland Section 305(b) Water Quality Report, Rock Creek mainstem fails to support all designated uses due to bacteria from natural and unknown sources. A portion of the wadeable streams (stream order ≤ 4) fails to fully support all designated uses (19 miles) due to a poor biological community due from urban runoff, another portion fully supports all uses (23 miles), and the remainder had inconclusive results (12 miles). Lake Bernard Frank fully supports all uses while Lake Needwood does not, due to nutrients from upstream and natural sources.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may need a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Rock Creek* (non-tidal); sediments, nutrients, poor biological community.
- *Rock Creek* (021402060840 non-tidal); poor biological community.
- *Rock Creek* (021402060837 non-tidal); poor biological community.
- *Rock Creek* [DC line to East-West Highway (MD410)]; fecal coliform.
- *Unnamed Tributary to Rock Creek* (021402060840 non-tidal); poor biological community.
- *Unnamed Tributary to Rock Creek* (021402060837 non-tidal); poor biological community.
- *Upper Rock Creek* (Mill Creek upper, Southlawn Branch, Lower Croydon non-tidal); poor biological community.
- *Lower Rock Creek* (Lower Mainstem Vier Mills, Sycamore Creek, Turk non-tidal); poor biological community.

In a 1977 water management quality study, the upper Rock Creek mainstem generally failed the criteria related to pH, channel widening, nutrients, and BOD. Likewise, upper Rock Creek mainstem occasionally failed to meet the following Maryland water quality criteria: temperature, DO, fecal coliform, and turbidity. These conditions occurred 25

percent of the time, and were therefore assigned a 'medium' problem severity value. Along with the mainstem, major tributaries of upper Rock Creek subwatershed failed to meet water quality criteria. Upper Rock Creek sources of pollution were identified to include nutrients and suspended sediments originating from non-point and natural sources.

Lake Needwood and Lake Bernard Frank, located within this watershed, were on Maryland's 303(d) list of water quality limited segments as impaired by nutrients, thus requiring TMDL. However, recent reports indicated that the impairments no longer exist, and water quality standards are being met, so these lakes were removed from the 303(d) list.

Currently, a CSPS 2003 update characterizes the stream condition in the upper Rock Creek subwatershed as ranging from good to poor. Southlawn Branch exhibits poor stream biological conditions primarily due to existing industrial area in the headwaters. Poor stream biological conditions were also reported in Manor Run and the upper portion of Mill Creek where higher density developments were built with little or no stormwater management controls.

The lower Rock Creek subwatershed stream quality is ranked fair overall. The cause of these conditions is attributed to development and urban runoff in these areas.

A Draft TMDL was completed in 2005 for fecal bacteria in Rock Creek basin. Most of the sewers flow into the Blue Plains Advanced WWTP, which discharges outside of this watershed. There are some septic systems in the northern portion of the watershed, around Rockville and north of Rockville. Fecal bacteria was estimated to be from the following sources, ordered from highest to lowest amounts: wildlife, livestock, domestic animals, and human.

Restoration/Preservation

State-designated Green Infrastructure hub is mainly located along the Rock Creek Park (DNR, 2000-2003). While most of this hub is protected, there are small portions that are unprotected. There are additional connecting corridors, some of which are unprotected.

Some of the restoration measures in place for this watershed *Restoration/Preservation* as per MCDEP reports include stormwater retrofit, stream restoration, and habitat improvements.

There are two State-designated Nontidal Wetlands of Special State Concern in this watershed. The following information about these wetlands is summarized from the document titled *Nontidal Wetlands of Special State Concern of Five Central Maryland Counties and Coastal Bay Area of Worcester County, Maryland* (2003).

- *Puller Marsh*. Located within a portion of young maturing floodplain forest along lower Rock Creek subwatershed, this semi-open wetland provides a habitat for a range of native forest and wetland plants as well as basking

snapping turtles. A unique copepod has been documented at this site, though its current status is unknown. Notable threats to this site include non-native invasive species, which are dominant within the wetland and surrounding areas. Development within the wetland buffer is discouraged, however, active management is required to reduce and control the non-native invasives.

- *Unit 1 Spring*. Located within the Albert Powell Fish Hatchery in Lower Rock Creek subwatershed, this wetland provides a habitat to three faunal species ranked in Maryland as State rare and watch list, or uncommon. The Appalachian spring snail (*Fontigens bottimeri*), a globally rare species, and Checkered sculpin (*Cottus* sp), a highly rare species, are found in this site. Due to susceptibility of these two species to changes in the natural hydrology regime, efforts to avoid activities that cause such disturbance are highly recommended. A flowing spring supports a braided seep system. Invasive species and deer browse are the major threats, no additional removal of native vegetation is recommended. No new roads are recommended through this area and pesticides should be avoided to protect the invertebrates.

Existing Recommendations for Restoration:

- Restore "gaps" in Green Infrastructure to natural vegetation.
- Restore wetlands and streams within the headwaters.
- Restore vernal pools.
- Recommendations based on the *Draft Environmental Impact Statement/Draft Section 4(f) Evaluation: InterCounty Connector I-270 to US 1. Vol. 1* (2004):
    - Improve water quality and instream habitat
    - Increase acreage of wetlands and forest
    - Decrease stream channel erosion.

Existing Recommendations for Preservation:

- Protect wetlands and streams within the headwaters.
- Protect additional wetland areas within State-designated Ecologically Significant Areas.
- Protect portions of Green Infrastructure that are not currently protected.
- Protect vernal pools.
- Protect WSSC and buffers.

<u>Cabin John Creek (02140207)</u>

Background

The headwaters of this watershed originate in the City of Rockville. The Creek flows about 10 miles south to the confluence with the Potomac River. It is within the Piedmont physiographic province. Soils are mostly the Baile soil series, consisting of very deep poorly drained soil (MDE, 2005 Draft).

The following background information is summarized from a document titled *Environmental Resources Inventory, Potomac Subregion* (M-NCPPC, 1998).

Cabin John Creek watershed is located in Potomac Washington Metro River basin, and entirely within the Montgomery County jurisdiction. Based on MDP 2002 GIS land use data, the Cabin John Creek watershed has 30 acres of open water and 16,394 acres of land. The land acres are divided as follows: urban 14,153 acres (86%), agriculture 100 acres (1%), forest 2,129 acres (13%), and barren land 12 acres (<1%). Since estimates of wetland acreage using MDP data are often underestimated, DNR wetland GIS data, as described later, should be used for wetland acreage values.

Since Cabin John Creek watershed is mostly developed, approximately two-thirds of the watershed is more than 20 percent impervious and about one half of the watershed is more than 25 percent impervious. Rockville Pike and the City of Rockville occupy the headwaters of this watershed.

Stream conditions in Cabin John watershed are typical of an urbanized area, including reduced baseflow, increased channel flow velocities during stormwater runoff periods, degraded water quality and instream habitat. Forests in this watershed include a combination of deciduous and coniferous/evergreen species.

Estimates of wetland acreage for the entire watershed, based on DNR mapped wetlands, are as follows:

- Palustrine
    - Emergent: 5 acres
    - Scrub shrub: 2 acres
    - Forested: 27 acres
    - Unconsolidated bottom: 42 acres
- Total: 76 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight loss in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02140207	-1.57	0.74	0	0	-0.82

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. For this watershed, they are designated as follows:

- Use I-P: recreation contact, protection of aquatic life, public water supply; Potomac River and tributaries from DC line to Montgomery/Frederick line.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as a "Priority" Category 1, a watershed not meeting clean water or other natural resource goals and being most in need of restoration. Failing indicators included a high modeled phosphorus loading rate, a low nontidal fish index of biotic integrity, and high percent impervious surface (37%), a high population density, high soil erodibility (0.31), and being on the 303d list for water quality impairment. Historic wetland loss is estimated to be 992 acres.

According to the 2002 Maryland Section 305(b) Water Quality Report, Cabin John Creek mainstem fully supports all designated uses. The wadeable streams (stream order $\leq$ 4) fail to support all designated uses (29 miles) due to a poor biological community resulting from habitat alteration, channelization, and urban runoff.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may need a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Cabin John Creek* (non-tidal); fecal coliform, sediments, nutrients, poor biological community.
- *Cabin John Creek* (021402070841 non-tidal); poor biological community.
- *Cabin John Creek Unnamed Tributary* (021402070841 non-tidal); poor biological community.
- *Cabin John Creek Tributaries* (Bogley Branch, Middle Mainstem non-tidal); poor biological community.

A Draft TMDL was completed for fecal bacteria in Cabin John Creek watershed. 98% of the watershed has sewer service. There are no WWTPs discharging fecal bacteria directly into this waterway or its tributaries. Source contributions were in the following order of importance: human, domestic animals, livestock, wildlife, and unknown sources.

Cabin John watershed stream conditions score an overall fair (FIBI = 3.67) to poor quality (FIBI = 1.89) (DNR, 2001). According to CSPS 1997, the Upper Cabin John Creek is described as being in fair stream condition, while Buck Branch, Ken Branch, and Congressional Branch are in good condition and support a diverse community of insectivorous fish species. Deborah Drive tributary, lower Old Farm tributary and Capital Beltway (I-495) Branch were found to be in poor condition, while the middle mainstream and lower mainstream are in fair condition.

CSPS categorizes Cabin John watershed as having degraded habitat areas as a result of uncontrolled stormwater from North Bethesda and Rockville. Impacts due to stormwater runoff include accelerated stream channel downcutting and widening of channels that undermine and topple trees. Exposed sanitary sewer lines, in many cases originally buried 10-20 feet below the bottom of stream channels, are a common occurrence in this watershed. Raw sewage from these exposed sanitary sewers may leak into the streams (MC-DEP web).

The Cabin John Creek watershed is the most developed in the Potomac subregion. The stream resource has been characterized overall as "poor," due to areas of unmanaged

stormwater runoff in the Rockville and Bethesda areas. Most remaining forested areas and wetlands are in stream valley parks. Vernal pools were also found in the parks. Roads and utility lines often fragmented remaining wetlands (M-NCPPC 1998).

Restoration/Preservation

A State-designated Green Infrastructure hub is located around Cabin John Regional Park and Bucks Branch Park, with corridors connecting this hub to other hubs outside of the watershed (DNR, 2000-2003). Some of the Green Infrastructure, especially the corridors, are unprotected.

To address the problems associated with urban stream degradation in Cabin John watershed, a watershed restoration action plan was started in 1999 to help identify biological integrity, habitat conditions, and management categories.

- Watershed Protection Areas
    - Three tributaries in this management category, Buck Branch, Ken Branch, and Congressional Tributary are being observed for uncontrolled stormflows and sediment deposition.
    - Remedial level protection in this watershed addresses accelerated stream bank erosion and preservation of refugia as part of a comprehensive effort to restore the watershed and avoid overall deterioration of stream conditions.
- Watershed Management Strategy
    - This strategy aims at conducting biological monitoring to update preliminary assessments.
    - Study and implement remedial protection measures.
    - Evaluate relationship between land use and stream conditions through the Potomac Subregion Master Plan Study.
    - Study and implement stormwater retrofit and stream restoration measures.
    - Ongoing application and enforcement of existing environmental regulations and guidelines.
- Urban Stream Management Areas
    - Two tributaries in this watershed are recommended for this management category – Beltway Branch and Upper Booze Creek. These streams have been highly altered by land use.
    - This strategy is aimed at improving water quality and preventing pollution to ensure that impacts to downstream reaches are minimized.

There are no State-designated Nontidal Wetlands of Special State Concern in this watershed.

Existing Recommendations for Restoration:

- Restore wetlands and streams within the headwaters.
- Restore “gaps” in Green Infrastructure to natural vegetation.
- Restore vernal pools.

Existing Recommendations for Preservation:

- Protect wetlands and streams within the headwaters.
- Protect additional wetland areas within State-designated Ecologically Significant Areas.
- Protect portions of Green Infrastructure that are not currently protected.
- Protect vernal pools.
- Priority wetlands were identified in the 1998 Environmental Resources Inventory as:
    - CJ2 – mainstem and tributaries of Cabin John Creek from right of way to Democracy Blvd.
    - 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.

Seneca Creek (02140208)

Background

Seneca Creek watershed, located in Potomac Washington Metro River basin, lies entirely within Montgomery County. Based on MDP 2002 GIS land use data, the Seneca Creek watershed has 738 acres of open water and 82,000 acres of land. The land acres are divided as follows: urban 27,389 acres (33%), agriculture 27,533 acres (34%), forest 27,010 acres (33%), wetlands 49 acres (<1%) and barren land 19 acres (<1%). Since estimates of wetland acreage using MDP data are often underestimated, DNR wetland GIS data, as described later, should be used for wetland acreage values.

The following information is based on the document entitled *Damascus and Vicinity Environmental Resources Inventory*. The study area included portions within the 8-digit watersheds Brighton Dam, Seneca Creek, Lower Monocacy River, and a small portion within Rocky Gorge Dam. Stream conditions in the headwater streams of the Upper Patuxent River, Little Bennett Creek, and some of Upper Great Seneca Creek are mostly rated excellent or good. These streams are considered to be the least impaired within the County. Bennett Creek watershed is also rated excellent to good and is a "healthy agricultural watershed." Streams rated as fair are located in areas with more development (i.e. Magruder Branch subwatershed of Upper Great Seneca Creek). Forests mainly follow the stream valley, with significant areas along Bennett and Little Bennett Creeks and the Patuxent River. Wetlands are generally located along streams, with the largest amounts in Upper Great Seneca and Little Bennett watersheds. These wetlands provide wildlife habitat, flood storage, water quality improvements, and groundwater recharge. There is a fair amount of protected agricultural land in this study area. While much of the protected land is located along stream valleys, there are many streams, largely in headwaters, that remain unprotected.

Areas designated as Diversity Areas are located within Lower Magruder Branch Park, Great Seneca Park, and Goshen Regional Park. DNR Natural Heritage Program inventoried some significant wetlands within this watershed. In the Magruder Branch stream valley within Damascus Regional Park, there are high-quality forested skunk cabbage wetlands connected by braided streams and seeps. Another forest/emergent wetland complex in this area supports RTE plant species. Forested wetlands along an unnamed tributary of Great Seneca Creek in Goshen Recreation Park contain high quality seeps. Montgomery County Department of Environmental Protection, USGS, and MNCPPC are working to identify the vernal pools in the County. Preliminary results found vernal pool along Great Seneca Stream Valley (below Hawkins Creamery Road, Woodfield Road, and Clematis Drive), Magruder Branch Stream Valley Park (below Sweepstakes Road), Goshen Branch Park (below Huntmaster Road), and north of Germantown Greenway (above Blunt Road). RTE species are more likely in areas underlain by ultramafic and diabase rock formations and serpentine soils. Ultramafic rock is located in the Upper Great Seneca Creek subwatershed. Diabase rock seams run through Middle and Upper Great Seneca Creek watersheds. Most known occurrences of RTE species are within parkland. Sensitive areas (as defined in the 1992 State Planning Act as streams and their buffers, 100-yr floodplain, steep slopes, and habitats of RTE species) are generally located within the stream valleys, and cover roughly 24% of the study area. A third of these are located within parkland, with most of the remaining within unprotected stream buffers. Most of the study area has slopes ranging from 3-14%. Steep slopes are located along the mainstems and major tributaries of Great Seneca Creek (MNCPPC and MCDPP, 2003).

The large populations of whitetail deer are negatively impacting the herbaceous layers in many areas.

Wildcat Branch (a tributary of Great Seneca Creek) supported a naturally reproducing population of brown trout in the past. It also contains rainbow trout, stocked downstream, and 30 additional fish species. However, some tributaries of Wildcat Branch have severe bank erosion and sediment deposition. Inadequate riparian buffers and sediment deposition below Hawkins Creamery Road (in the Upper Great Seneca Creek subwatershed) has negatively affected stream conditions there. Goshen Branch has areas with bad downcutting and sedimentation. East of Rte. 124, streams flowing through agricultural fields have no stream buffer. Upper Great Seneca, Wildcat Branch, Goshen Branch, Middle Great Seneca subwatersheds are designated as Watershed Protection Areas. Magruder Branch is a Watershed Restoration Area. Upper Great Seneca Creek should also receive protection (MNCPPC and MCDPP, 2003).

This watershed encompasses, Great Seneca, Dry Seneca, and Little Seneca subwatershed and Clarksburg SPA.

A wetland assessment was conducted in the 1990's for the Clarksburg planning area (Chris Athanas, Ph.D. & Associates, and Dewberry and Davis 1997). Wetlands in the Ten Mile Creek, Cabin Branch, and Little Seneca Creek subwatersheds. All wetlands were part of stream corridor systems. Wetlands that scored high in the assessment in the Ten

Mile Creek subwatershed were identified as TMC1, TMC3, and TMC5. TMC1 and TMC3 were located in existing or proposed parkland, while TMC5 received high scores for water quality function. Cabin Branch subwatershed contained one highly ranked wetland, CB1, that was found in parkland. Little Seneca Creek subwatershed contained numerous wetlands (SC2, SC3, SC10, SC12, and SC14) that scored particularly high for wildlife and aquatic habitat. At the time of the survey, the high wildlife functional scores of some sites were closely related to adjacent upland forest, which served as a buffer. Most of these sites are also found on parkland.

Estimates of wetland acreage for the entire watershed, based on DNR mapped wetlands, are as follows:

- Palustrine
    - Aquatic bed: 1 acre
    - Emergent: 440 acres
    - Scrub shrub: 75 acres
    - Forested: 1,454 acres
    - Unconsolidated bottom: 255 acres
    - Unconsolidated shore: 1 acre
    - Farmed: 42 acres
- Total: 2,268 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a slight gain in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02140208	-8.47	14.37	0	0.83	6.73

Code of Maryland Regulations

All Maryland stream segments are categorized by Sub-Basin and are given a "designated use" in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. For this watershed, they are designated as follows:

- Use I-P: recreation contact, protection of aquatic life, public water supply; Potomac River and tributaries from DC line to Montgomery/Frederick line.
- Use III-P: natural trout waters and public water supply;
    - Little Seneca Creek and all tributaries From the stream's confluence with Bucklodge Branch to the Baltimore and Ohio railroad bridge
    - Wildcat Branch and all tributaries
- Use IV-P: recreational trout waters and public water supply; Little Seneca Creek and all tributaries

Water Quality

The 1998 Clean Water Action Plan classified this watershed as a "Priority" Category 1, a watershed not meeting clean water or other natural resource goals and being most in need of restoration. Failing indicators included high nutrient concentrations, a high modeled phosphorus loading rate, a low nontidal benthic index of biotic integrity, and high percent impervious surface (12%), a high population density, a high percent unforested stream buffer (38%), and being on the 303d list for water quality impairment. Historic wetland loss is 7,547 acres. It was also classified as a "Selected" Category 3, a pristine or sensitive watershed that needs the most protection. Indicators suggesting need for preservation included a high nontidal instream habitat index, a high nontidal fish index of biotic integrity, and a high imperiled aquatic species indicator.

According to the 2002 Maryland Section 305(b) Water Quality Report, Seneca Creek mainstem (lower segment) fully supports all designated uses. The majority of the wadeable tributaries (stream order ≤ 4) fully supports all designated uses (143 miles). The remaining portion of the wadeable tributaries (36 miles) fails to support all designated uses due to a poor biological community from municipal discharge, agricultural runoff, changes in hydrology, and habitat alteration. Results for the 505-acre Little Seneca Lake were inconclusive. The 90-acre Clopper Lake fails to support all uses due to nutrients and low dissolved oxygen from nonpoint upstream and natural sources.

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may need a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Seneca Creek* (non-tidal); sediments, nutrients.
- *Seneca Creek* (021402080859 non-tidal); poor biological community.
- *Seneca Creek Unnamed Tributary* (021402080859 non-tidal); poor biological community.
- *Little Seneca Creek* (021402080859 non-tidal); poor biological community.
- *Little Seneca Creek Unnamed Tributary* (021402080859 non-tidal); poor biological community.
- *Little Seneca Lake* (non-tidal); nutrients.
- *Clopper Lake*; a TMDL has been completed for sediments and nutrients within this waterway.
- *Dry Seneca Creek* (021402080855 non-tidal); poor biological community.
- *Russel Branch* (021402080855 non-tidal); poor biological community.
- *Great Seneca Creek* (021402080866 non-tidal); poor biological community.
- *Great Seneca Creek* (021402080860 non-tidal); poor biological community.
- *Gunners Branch* (021402080860 non-tidal); poor biological community.
- *Gunners Branch Unnamed Tributary* (021402080860 non-tidal); poor biological community.
- *Magruder Branch* (021402080866 non-tidal); poor biological community.
- *Goshen Branch Unnamed Tributary* (021402080864 non-tidal); poor biological community.
- *Whetstone Run* (021402080862 non-tidal); poor biological community.

The overall water quality of Seneca Creek watershed is ranked fair for FIBI (3.33), poor for BIBI (2.82), and fair for CBI (2.98). A quarter of the watershed stream miles have FIBI < 3, half of the stream miles have BIBI < 3, and the remaining quarter of the stream miles have CBI < 3 (DNR, 2004).

Lake Clopper is listed as impaired by high sediment load. Phosphorus has been identified as the limiting nutrient for production of algae in this lake. An average annual TMDL for phosphorus of about 555lb/yr has been suggested (MDE, 2001).

Individual subwatershed water quality, restoration and preservation strategies are summarized below.

The following background information of the subwatersheds is excerpted from the 1998 and 2003 CSPS reports.

Great Seneca Creek subwatershed

Great Seneca Creek is the largest subwatershed of the Seneca Creek watershed. In addition, two large tributary systems flow into Great Seneca. These are Little Seneca Creek, and Dry Seneca. Almost every species of fish found in Montgomery County can be found in this subwatershed. Smallmouth bass have been found in the lower sections. Redbreast sunfish and central stonerollers are found throughout the middle section, and portions of the upper reaches support a cold-water fish community. The Great Seneca headwaters begin near Hawkins Creamery Road southeast of Damascus and flow through low density residential and agricultural areas. Magruder Branch, a large tributary that begins in south Damascus, flows through County parkland and joins Great Seneca downriver of Woodfield Road. It then passes through commercial areas in Damascus and continues through low to medium density residential areas. Magruder Branch contains a system of vernal pools, built as mitigation for an adjoining hiker-biker trail system that supports a diverse amphibian community. The Damascus Wastewater Treatment Plant (WWTP) is located in the Magruder Branch subwatershed.

Great Seneca Creek flows southwest through the Montgomery Village area, where land use densities increase considerably. Many of these areas were built before modern stormwater runoff controls were required by the State and, consequently, the quality of the stream channel has declined.

The Great Seneca watershed is divided into Upper Great Seneca, Middle Great Seneca, and Lower Great Seneca subwatersheds.

Water Quality

Upper Great Seneca subwatershed stream conditions ranges from fair to excellent. Magruder Branch exhibits fair conditions (FIBI, 3.86), Goshen Branch and Upper Seneca Creek exhibit good condition, and Wildcat Branch exhibits excellent conditions (FIBI,

4.71, BIBI, 3.4). Threats to stream condition in this watershed include bank erosion, sediment deposition, and sparse riparian buffers.

Middle Great Seneca watershed stream conditions range from poor to good. I-270 tributary, and upper Whetstone Run exhibit poor conditions, Cabin Branch, Whetstone Run and Gunners Branch exhibit fair conditions, and Middle Great Seneca exhibits good conditions. Factors causing these poor conditions include high imperviousness and uncontrolled runoff, especially from Gaithersburg Old Town and Lake Forest Mall.

Lower Great Seneca subwatershed stream conditions ranges from fair to good. Dawsonville tributary and upper Long Draught exhibit fair conditions, while South Germantown, Lower Long Draught Quince Orchard, and Lower Great Seneca exhibit good conditions. Threats to stream conditions include sparse riparian buffer, sediment deposition in pools and runs, and eroded stream banks.

Restoration/Preservation

Streams in excellent conditions are accorded Watershed Restoration Areas status, meaning they are given special level protection if they support excellent biological conditions, or remedial level protection if they have undergone a great deal of development activity and therefore need restoration measures (MC-DEP web).

Dry Seneca Creek subwatershed

Dry Seneca Creek, originating south of Barnesville, is a large tributary to the Great Seneca Creek. This subwatershed is situated in primarily agricultural land and large lot residential areas. The upper reaches of Dry Seneca contain forested tributaries, while the relatively open southern part of the subwatershed has the streambed cut down, revealing blocks of red sandstone bedrock. The fish community in this area includes large populations of central stonerollers, which feed on the algae coating these sandstone blocks.

Water Quality

Stream conditions in Dry Seneca are generally good, although habitat conditions tend to be influenced by excessive levels of sediment deposition and occasional overflow of a newly designed wastewater treatment plant (WWTP). Lower Dry Seneca streams are in excellent conditions, however, it has low abundance of macroinvertebrate community, likely as a result of the upstream WWTP.

Restoration/Preservation

Land uses in this watershed are largely agricultural, with few residential developments. All of the subwatersheds in Dry Seneca are characterized as Agricultural Watershed Management Areas, therefore BMPs are mainly used to maintain the integrity of the watershed (MC-DEP web).

Little Seneca subwatershed

The Little Seneca Creek watershed is a large sub-basin of the Great Seneca watershed and drains a significant portion of the western part of the County. The stream system originates slightly south of Damascus and drains areas of Clarksburg, Germantown, and Boyds before flowing into Great Seneca Creek just above Route 28 at Dawsonville. Little Seneca Lake, located near Boyds, is a large regional impoundment that serves as an emergency water supply source. This lake is the focal point of the Black Hill Regional Park and is known regionally as a prime location to view wintering waterfowl. The lake has been stocked with tiger muskie, largemouth bass, bluegill and channel catfish. Little Seneca Creek upstream of the lake is a designated recreational trout waters by the State (Use IV-P) due to temperature and dissolved oxygen standards that make it suitable for an adult trout "put-and-take" population. Downstream of the Little Seneca Lake dam, cold water discharges from the deeper part of the lake water column, thus sustaining brown trout population as well as a diverse cold-water community. Beaver have impounded large areas of Little Seneca below the lake and massive beaver dams can be found 5 to 6 feet high (MC-DEP web).

The Little Seneca subwatershed has a very mixed character of land uses, including rural areas around Boyds and the west side of Clarksburg, and higher density land uses in Germantown. Located along I-270, both Clarksburg and Germantown are "corridor communities" containing existing and planned development in support of the County's housing and job needs. Southwest of Germantown, land uses in the watershed are typical of the agricultural reserve, with a mixture of farms and large-lot residential areas, interspersed with commercial uses at several crossroads.

Water Quality

The stream conditions in this watershed range from poor, in Brodsky and West Lake direct tributaries, to excellent in upper Ten Mile Creek, town Center tributary, Upper Little Seneca SPAs, and Milestone tributary. Threats to stream conditions include entrenchment, channel erosion, sedimentation, and poor bank stability (MC-DEP web).

Restoration/Preservation

Extensive planning efforts have occurred as part of the Germantown Master Plan and Clarksburg Master Plan to protect stream quality in Little Seneca Creek. These efforts include density limitations, stream valley park acquisition and dedication, reforestation, and designation of a part of Clarksburg as a Special Protection Area (SPA). SPA regulatory requirements include enhanced plan review, stream monitoring, and BMP performance monitoring for new development.

The Wetlands study in Clarksburg (Chris Athanas, Ph.D. & Associates, and Dewberry and Davis 1997) identified four potential mitigation sites in the Ten Mile Creek

subwatershed, and eight sites in the Little Seneca Creek subwatershed. Most of the sites were in what was agricultural land.

Clarksburg SPA

The following information is a summary from *MC-DEP SPA Annual Report 2002*.

Land development activities during 2002 were confined primarily to the new Clarksburg town center and Clarksburg Detention Center. Monitoring results downstream of these developments indicate that the condition of the biological community is unchanged, however, fine sediments are present in the stream. Increased sediment input to the stream is very much a concern, especially given the amount of land disturbance that will occur in near future. Monitoring results from the rest of Clarksburg SPA indicate that stream condition is generally unchanged from previous years.

Restoration/Preservation for Seneca Creek Watershed

A State-designated Green Infrastructure hub is located around Black Hill Regional Park, Little Seneca Regional Park, Seneca Creek State Park, Great Seneca Park, and Lower Magruder Branch Park. There are some additional unprotected GI hubs, including between Little Seneca Regional Park and Seneca Creek State Park, and along Ten Mile Creek (just below Little Bennett Regional Park). There are several corridors connecting these hub to other hubs outside of the watershed, with some also being unprotected (DNR, 2000-2003).

The following information is based on the document *Rural Legacy FY 2003: Applications and State Agency Review*. The Mid-Maryland Montgomery Rural Legacy Area has approximately 49,907 acres. This area is currently largely undeveloped (91%). This area was chosen in order to protect contiguous properties of rural land, including agriculture, forest, and other natural resources, and improve water quality of the Potomac River. The goal is to protect 37,566 acres (75%). Currently, 34,117 acres (68%) of this land is protected through various methods. The sponsor is Montgomery County. The report also includes a list of property owners who are interested in selling an easement and the priority of acquiring these easements. Since the Rural Legacy Program funds are not adequate enough to support all of these requests, other programs should consider preservation of these sites.

There are two State-designated Nontidal Wetlands of Special State Concern in Seneca Creek watershed. The following information about these wetlands is summarized from the document titled *Nontidal Wetlands of Special State Concern of Five Central Maryland Counties and Coastal Bay Area of Worcester County, Maryland* (2003).

- *Germantown Bog*. Located in Little Seneca subwatershed, this wetland is a circumneutral spring-fed seepage wetland, actually a fen, with several threatened plant species. A forested wetland with a diverse understory is also present. Three State Threatened species, Buxbaum's sedge, Canada burnet, and swamp oats are found here. This wetland has hydrology independent from adjacent streams and

storm water systems, and thus maintains a high level of water quality despite being surrounded by roads and suburban development. Non-native invasive weeds, possible expansion of red maple, and excessive deer browsing are the main threats to this site and to the RT&E species. Development, agriculture or logging within the wetland buffer is discouraged, while extension of the buffer is recommended. The stormwater management system in the adjacent development should be continued to be managed to bypass the wetland.

- *Blockhouse Point Floodplain (Violets Lock Floodplain)*. Located in the lower Great Seneca subwatershed, this wetland, like other floodplains along nearby portions of the Potomac River, supports a number of RT&E species. Four State Endangered plants have been found here, in addition to one State Threatened species, two State Rare species, and a host of uncommon "watch list" species. The site also contains high quality scour bar habitat, some seeps adjacent to the slopes, and Piedmont bottomland forest. Anthropogenic disturbances, excessive deer activity, and invasion by non-native species are noted threats to this wetland. Management should focus on managing deer and preventing further spread of invasive plant species.

Existing Recommendations for Restoration:

- Restore wetlands and streams within the headwaters.
- Restore "gaps" in Green Infrastructure to natural vegetation.
- Restore vernal pools.
- Restore land within designated Rural Legacy Area.
- Restore wetlands designed to remove sediment and phosphorus from the waterways before entering Lake Clopper.
- Dry Seneca subwatershed - BMPs should be implemented (MC-DEP web).
- Little Seneca Creek - stream valley park acquisition, reforestation.
- Great Seneca Creek subwatershed - restore

Existing Recommendations for Preservation:

- Protect wetlands and streams within the headwaters.
- Protect additional wetland areas within State-designated Ecologically Significant Areas.
- Protect portions of Green Infrastructure that are not currently protected.
- Protect vernal pools.
- Protect WSSC and buffers.
- Protect land within designated Rural Legacy Area.
- Protect wetlands that remove sediment and phosphorus from the waterways before entering Lake Clopper.
- Upper Great Seneca subwatershed.

<u>Lower Monocacy River (02140302)</u>

Background

Most of this watershed drainage is in Frederick County. Only a small portion, Bennett Creek subwatershed, is in Montgomery County. Based on MDP 2002 GIS land use data, the Lower Monocacy River watershed has 18 acres of open water and 20,102 acres of land. The land acres are divided as follows: urban 2,090 acres (10%), agriculture 9,245 acres (46%), and forest 8,767 acres (44%). Since estimates of wetland acreage using MDP data are often underestimated, DNR wetland GIS data, as described later, should be used for wetland acreage values.

The Monocacy River was designated a State Scenic River in order to restore the water quality. The following information was summarized from the *Monocacy River Study and Management Plan* (1990). Since much of the land adjacent to the Monocacy and its tributaries had fairly low topographic gradients, development and agricultural were possible next to the water. As discussed later, this proximity increases pollutant entry into the waterways.

There are many springs and seeps, often being wetlands. The majority of these areas produce little water, with the exception of Fountain Rock Spring. Since these springs and seeps may provide important conditions required for certain species (e.g. brook trout and pearl dace), these sites may provide good opportunities for protection. The wetlands located in the mountain region, often getting water from seeps, contain rare plant species.

The following information is based on the document entitled *Damascus and Vicinity Environmental Resources Inventory*. The study area included portions within the 8-digit watersheds Brighton Dam, Seneca Creek, Lower Monocacy River, and a small portion within Rocky Gorge Dam. Stream conditions in the headwater streams of the Upper Patuxent River, Little Bennett Creek, and some of Upper Great Seneca Creek are mostly rated excellent or good. These streams are considered to be the least impaired within the County. Bennett Creek watershed is also rated excellent to good and is a "healthy agricultural watershed." Streams rated as fair are located in areas with more development (i.e. Magruder Branch subwatershed of Upper Great Seneca Creek). Forests mainly follow the stream valley, with significant areas along Bennett and Little Bennett Creeks and the Patuxent River. Wetlands are generally located along streams, with the largest amounts in Upper Great Seneca and Little Bennett watersheds. These wetlands provide wildlife habitat, flood storage, water quality improvements, and groundwater recharge. There is a fair amount of protected agricultural land in this study area. While much of the protected land is located along stream valleys, there are many streams, largely in headwaters, that remain unprotected. Areas designated as Diversity Areas are located within Little Bennett Regional Park.

DNR Natural Heritage Program inventoried some significant wetlands within this watershed: There is a network of seeps within Little Bennett Regional Park, including a 10-20 acre wetland. Wetlands along mainstem Little Bennett Creek are State-designated WSSC. There is a WSSC within Little Bennett Creek Regional Park. It also contains salamanders, frogs, shrews, and forest-interior dwelling birds. Montgomery County Department of Environmental Protection, USGS, and MNCPPC are working to identify the vernal pools in the County. Most known occurrences of RTE species are within

parkland (MNCPPC and MCDPP, 2003). . The large populations of whitetail deer are negatively impacting the herbaceous layers in many areas.

Little Bennett Creek has been stocked with brown trout that have successfully spawned in some cases. Sensitive areas (defined in the 1992 State Planning Act as streams and their buffers, 100-yr floodplain, steep slopes, and habitats of RTE species) are generally located within the stream valleys, and cover roughly 24% of the study area. A third of these are located within parkland, with most of the remaining within unprotected stream buffers. Most of the study area has slopes ranging from 3-14%. Steep slopes are located along the mainstems and major tributaries of Bennett Creek and Little Bennett Creek. Little Bennett Creek supports a cold-water trout stream above Rte. 355. There is some bank instability and sedimentation from past agriculture. Stream conditions are best in areas where forested stream buffers were maintained. There is some channelization along I-270. This stream is prone to flash-flooding. Most of Little Bennett Creek subwatershed is designated as Watershed Preservation Areas, while the I-270 tributary is listed as Watershed Restoration Area and Little Bennett South is listed as Agricultural Watershed Management Area. Bennett Creek has less forest cover and has more agricultural land than Little Bennett Creek, but still supports cold-water fish. Bennett Creek also has more impervious cover, as Damascus is located in the headwaters. Headwaters have deeply entrenched channels. These subwatersheds are designated as Agricultural Watershed Management Areas (MNCPPC and MCDPP, 2003).

Trout streams include the following: Furnace Branch, Glade Branch, Bear Branch, Friends, Ballenger, Owens, Hunting Tuscarora, and Fishing Creek. Trout populations are higher in the northern waterways, suggesting that water quality in general is better in the north. Waterfowl densities are highest on the Monocacy near Michael's Dam, through the Monocacy Natural Resource Management Area to the Potomac. There are some wetlands in this area that could be protected to maintain wildlife habitat.

During the period of this study, the most dominant land use along the river was agriculture and old fields, with some residential development and light industry. The forest buffer width along the Monocacy River was generally poor, with only about half of the streambanks having adequate buffers (with good buffers being found within park property).

Water impacts include: three major developed areas withdrawing water from the Monocacy River (Frederick, Westminster, and Gettysburg), sewage disposal, and agricultural and residential land use. An important issue in this waterway is suspended sediment, which inhibits aquatic species. This watershed discharges over two times the amount of sediment per acre than any other Potomac River watershed upstream of Point of Rocks. Other pollutants of concern in the Monocacy are nutrients and pathogens. Conversion of the natural buffers and creation of structures within the floodplain increases pollution entering the waterways and increases flash flooding.

This plan proposed developing a Monocacy River overlay extending at least 500 feet on both sides of the River, with wider buffers where the existing conservation boundary is

wider or in areas where there are sensitive resources outside the existing conservation buffer. The following streams should be protected: Furnace Branch, Rocky Fountain Run, Tuscarora Creek, Ballenger Creek, Bennett Creek, Glade Creek, Bush Creek, Toms Creek, Carroll Creek, Owens Creek, Fishing Creek, Friends Creek, and Hunting Creek. Streams that should be developed into stream valley parks include: Glade Creek, Ballenger Creek, Linganore Creek, and Tuscarora Creek. The City of Frederick has already established parts of Carroll Creek as a stream valley park and intends to develop a Monocacy River linear park.

Bennett Creek subwatershed located in western Montgomery County, is comprised of Bennett Creek and Little Bennett Creek draining into the Monocacy River. The watershed is predominately agricultural land uses with large areas remaining in forest cover. Little Bennett Creek is protected by parkland, and supports cold-water wild trout streams. Bennett Creek is less forested and largely actively farmed, but supports a cool-water fish community that includes Potomac sculpin, central stoneroller, common shiners, and Rock bass (MCDEP).

Estimates of wetland acreage for the entire watershed, based on DNR mapped wetlands, are as follows:

- Lacustrine unconsolidated shore: 1 acre
- Palustrine
    - Aquatic bed: 1 acres
    - Emergent: 1,009 acres
    - Scrub shrub: 639 acres
    - Forested: 2,483 acres
    - Unconsolidated bottom: 757 acres
    - Unconsolidated shore: 2 acres
    - Farmed: 219 acres
- Riverine unconsolidated shore: 2 acres
- Total: 5,114 acres

MDE tracks all regulated nontidal wetland activity in Maryland, including regulated wetland impacts and gains. Based on data for the time period of January 1, 1991 through December 31, 2004, for this watershed, there has been a gain in wetlands (Walbeck, 2005).

Basin code	Permanent Impacts	Permittee Mitigation	Programmatic Gains	Other Gains	Net Change
02140302	-6.06	5.91	37.50	0.11	37.46

Code of Maryland Regulations
All Maryland stream segments are categorized by Sub-Basin and are given a “designated use” in the Code of Maryland Regulations 26.08.02.08. Stream segments not specifically listed in COMAR are designated Use I, recreation contact and protection of aquatic life. For this watershed, they are designated as follows:

- Use III-P: natural trout waters and public water supply; Little Bennett Creek and tributaries above MD Rte. 355.

- Use IV-P: recreational trout waters and public water supply; Monocacy River and tributaries except those listed above.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as "Priority" Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. Since it is a "Priority" Category 1 watershed, this watershed was selected as being one of the most in need of restoration within the next two years since it failed to meet at least half of the goals. It is also classified as a "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failing indicators include high levels of the nutrients phosphorus and nitrogen, poor benthic index of biotic integrity (BIBI), high percent unforested stream buffer (63%), and high soil erodibility (0.28). Wetland loss was estimated to be 11,799 acres. This watershed was ranked among the worst 25% of the State watersheds for having high levels of total nitrogen and total phosphorus. Indicators for Category 3 include high fish index of biotic integrity (FIBI), high imperiled aquatic species indicator, and the presence of five drinking water intakes.

According to the *2002 Maryland Section 305(b) Water Quality Report*, some portions of the Lower Monocacy River and larger tributaries do not support all designated uses. There are elevated levels of bacteria in the Monocacy River just above the Potomac River and in the Monocacy River near Reich's Ford Road (DNR, 2000). The Monocacy River between the Potomac River and MD Route 26 partially supports all designated uses, with pollutant sources including agriculture, development, and natural sources (DNR, 2000). However, this pollutant is not severe enough to put this basin on the 303(d) List for impaired waters due to bacterial impairment. The majority of streams (stream order ≤ 4) fail to fully support all designated uses (DNR, 2002). Wadeable streams in the sub-watersheds Carroll Creek and Cabbage Run do not support all designated aquatic life uses due to poor fish and benthic communities (DNR, 2000). This may be due to channelization and poor habitat from bank instability and high rates of sedimentation. Lake Linganore fails to support all designated uses due to siltation and nutrients from sources including upstream, natural, and unknown (DNR, 2002).

The 2004 303(d) List contains basins and subbasins that have measured water quality impairment and may need a TMDL. The basin/subbasin name, subbasin number (if applicable), and type of impairment are as follows:

- *Lower Monocacy River*; fecal coliform. While this watershed is also impaired by nutrients and sediments, a TMDL has been completed for these contaminant.
- *Lake Linganore*; While this waterway is impaired by nutrients and suspended sediments, a TMDL has been completed for these pollutants.
- *Bear Creek* (021403020224 in Frederick); poor biological community.
- *Bennett Creek* (021403020224 in Frederick); poor biological community.
- *Horsehead Run* (021403020227 in Frederick); poor biological community.
- *Carroll Creek* (021403020233 in Frederick); poor biological community.
- *Ballenger Creek* (021403020230 in Frederick); poor biological community.

- *Unnamed tributary to Ballenger Creek* (021403020230 in Frederick); poor biological community.
- *Unnamed tributary to Carroll Creek* (021403020233 in Frederick); poor biological community.
- *Addison Run* (021403020233 in Frederick); sedimentation.
- *Rock Creek* (021403020233 in Frederick); poor biological community.
- *Laurel Run* (021403020237 in Frederick); poor biological community.
- *Laurel Run Unnamed Tributary* (021403020237 in Frederick); poor biological community.
- *Dollyhide Creek Unnamed Tributary* (021403020236 in Frederick); poor biological community.
- *Unnamed tributary to the Monocacy River* (021403020233 in Frederick); sedimentation.
- *Cabbage Run* (021403020237 in Frederick); poor biological community.
- *Unnamed tributary to Israel Creek* (021403020237 in Frederick); poor biological community.

Many of the best streams remaining in the County are found within this watershed and include some of the reference stream reaches used to determine the stream condition of other streams (CSPS, 2003).

Stream conditions range from fair to excellent, FIBI = 4.43, BIBI = 3.2 (DNR, 2001). The Little Bennett headwaters and upper Little Bennett Creek are in good condition. However, they have been impacted by past agricultural land uses including bank instability and sedimentation. The middle Little Bennett stream is in excellent condition, containing high quality cold water providing a habitat for cool-water fish species (CSPS, 2003).

Some of the identified threats to the current water and stream quality include imperviousness and related runoff from towns located in the headwaters, and more large residential development expected in Clarksburg and surrounding areas (MC-DEP web).

Restoration/Preservation

A State-designated Green Infrastructure hub is located within Little Bennett Regional Park, with unprotected corridors connecting this hub to other hubs outside of the watershed (DNR, 2000-2003).

Little Bennett Creek subwatershed is within Little Bennett Regional Park, managed by the M-NCPPC. High quality streams are protected under the Watershed Preservation Areas (WPA) category. Streams within extensive agricultural and large residential areas are managed under Agricultural Watershed Management Areas category, which requires use of BMPs on these actively farmed areas. Watershed areas showing fair resource condition and impacts to the natural channel condition are managed as Watershed Restoration Areas (MC-DEPweb).

There is one State-designated Wetland of Special State Concern in this watershed. The following information about this wetland is summarized from the document titled *Nontidal Wetlands of Special State Concern of Five Central Maryland Counties and Coastal Bay Area of Worcester County, Maryland* (2003). Little Bennett Regional Park is located in Bennett Creek subwatershed. This wetland is composed of mixed habitat of spring seeps, floodplains, small ponds, wet meadows, and swamp complex, and is habitat for multiple State rare, threatened, and watch list species, including two State threatened vulnerable species, and three rare species. Although this wetland is protected by WSSC designation, primary threats to this site have been noted to be non-native invasive weeds, succession of RT&E habitat, and disturbance from high deer populations and increasing recreation. Some of sensitive species are intolerant of shade, and maintenance of early successional habitat is recommended.

The following information is based on the document *Rural Legacy FY 2003: Applications and State Agency Review*. The Mid-Maryland Montgomery Rural Legacy Area has approximately 49,907 acres. This area is currently largely undeveloped (91%). This area was chosen in order to protect contiguous properties of rural land, including agriculture, forest, and other natural resources, and improve water quality of the Potomac River. The goal is to protect 37,566 acres (75%). Currently, 34,117 acres (68%) of this land is protected through various methods. The sponsor is Montgomery County. The report also includes a list of property owners who are interested in selling an easement and the priority of acquiring these easements. Since the Rural Legacy Program funds are not adequate enough to support all of these requests, other programs should consider preservation of these sites.
There are no State-designated Nontidal Wetlands of Special State Concern in this watershed.

Existing Recommendations for Restoration:

- Restore wetlands and streams within the headwaters.
- Restore “gaps” in Green Infrastructure to natural vegetation.
- Restore vernal pools.
- Restore land within the designated Rural Legacy Area.
- Restore designated Watershed Restoration Area along I-270 tributary (MNCPPC and MCDPP, 2003).

Existing Recommendations for Preservation:

- Protect wetlands and streams within the headwaters.
- Protect additional wetland areas within State-designated Ecologically Significant Areas.
- Protect portions of Green Infrastructure that are not currently protected.
- Protect vernal pools.
- Protect land within the designated Rural Legacy Area.
- Protect WSSC and buffers.
- Protect middle Little Bennett Creek.
- Protect Watershed Preservation Areas within Little Bennett Creek subwatershed (MNCPPC and MCDPP, 2003).