CHARLES COUNTY 2

CHARLES COUNTY

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Background

Based on MDP 2002 GIS land use data, Charles County has 119,407 acres of open water and 294,411 acres of land. The land acres are divided as follows: urban 50,660 acres (17%), agriculture 57,515 acres (20%), forest 178,476 acres (61%), wetlands 6,900 acres (2%) and barren land 860 acres (<1%). Since MDP estimates of wetland acreage are often underestimated, DNR wetland data estimates, as discussed later in the watershed sections of this document, are preferred.

This County is within the Coastal Plain physiographic province. The main mineral resources are sand and gravel, which are located throughout the County. Roughly 11% of the County has slopes greater than 15%. The majority (80%) of the County has severe limitation for septic systems due to poor drainage, slow permeability, or a seasonally high water table. Salt water intrusion is the main concern for the drinking water in the coastal areas. There are roughly 183 tidal shoreline miles in the County, with over 90% being forest, wetland, or agriculture. Less than 11 percent of the total shoreline has erosion greater than two feet per year. There are several sites along the mainstem Potomac River where there are high bluffs (40 or 50 feet high). When these bluffs are unprotected, severe erosion can occur at the base of the bank, resulting in the bank collapse. Subsurface seepage can also weaken the bluff face (Charles County, 2005).

Based on the 2000 U.S. Census, there are over 120,000 people in this County. The population is expected to be roughly 194,000 by the year 2025. According to the Comprehensive Plan, some of the issues facing this County are that many of the natural assets are being threatened by development. During recent times, development has extended to all areas of the County. Development between 1990 to 2004 has occurred mainly along the MD 228 and MD 229 corridors, in the St. Charles area, in the Hughsville area, and in the town of La Plata. Development to 2020 should be focused in the northern portion of the County: around Mattawoman sewer service area, Indian Head and La Plata. Waldorf is currently the most developed area in the County. The Land Use Plan divides the land into 12 areas. The area designated as the Rural Conservation District is designed to protect rural land and open space, encourage agriculture, and protect natural resources. This area surrounds the large northern development district. The Agricultural Conservation District, in addition to the prevalent farming, includes additional areas of woodlands, stream valleys, and marshes. This area is in the southwest and eastern portion of the County (Charles County, 2005).

A small percentage of the soil is classified as prime farmland (based on NRCS SSURGO GIS data). In order to preserve agriculture in the County, wetland restoration/creation should attempt to avoid areas classified as prime farmland. Additional areas along some of the waterways are classified as “prime farmland when drained.” While it may not be desirable to exclude all soils classified as “prime farmland when drained” from consideration, these additional areas should be lower priority for wetland restoration/creation than soils not classified as prime farmland.

There are three State-designated 6-digit watersheds and ten 8-digit watersheds in this County. Patuxent River (021311) includes Patuxent River Lower (02131101); Lower Potomac River (021401) includes Potomac River Lower Tidal (02140101), Potomac River Middle Tidal (02140102), Wicomico River (02140106), Gilbert Swamp (02140107), Zenith Swamp (02140108), Port Tobacco River (02140109), Nanjemoy Creek (02140110), and Mattawoman Creek (02140111);Washington Metropolitan (021402) includes Potomac River Upper Tidal (02140201).

Streams

The Maryland Tributary Strategies document *Lower Potomac River Basin Summary Final Version for 1985-2002* describes the basin (an area containing parts of Charles, St. Mary's and Prince George's Counties) as follows. For the entire basin, land use is dominated by forest (60%), followed by agriculture (24%) and urban (16%). In 2002, the main nitrogen, phosphorus, and sediment sources within the Lower Potomac River basin were agriculture (38%, 41%, and 68% respectively) and urban (22%, 34%, and 11% respectively). Point sources also contributed nitrogen and phosphorus (22% and 8% respectively). There are four major wastewater treatment plants in this County (Indian Head NOS, Indian Head, La Plata, and Mattawoman). Water quality parameters at the tributary stations did not show a clear pattern based on location. Sites had poor to good total nitrogen levels, with all sites having decreased nitrogen since 1985. Sites ranked poor for total nitrogen were at Indian Head and Morgantown Bridge – Route 301. Total phosphorus was poor to good, with some sites improving since 1985. The only site ranked poor was Morgantown Bridge – Route 301. Phosphorus was generally good at the northern Potomac section. Algae levels were ranked poor to good, with some stations showing a degrading trend since 1985. Total suspended solids were fair to good. During the period 1984 to 2002, of the five sites monitored for SAV abundance, four met SAV goals at least once during that period. In 2002, only Mattawoman Tidal Fresh site exceeded the goal. Benthic community sampling suggested an organic over enrichment in the oligohaline and tidal freshwater Potomac River and pollution (low dissolved oxygen) in the mesohaline Potomac River.

The Maryland Tributary Strategies document *Patuxent River Basin Summary Final Version for 1985-2002* 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 Rivers. 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), and 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.

Wetlands

Wetlands in Charles County exist as estuarine and freshwater tidal communities, along floodplains, in isolated depressions, in abandoned mine sites, and as boglike communities. Wetland hydrology is from overbank flooding, tidal inundation, groundwater, and perched surface water sources. Along the shoreline of the Potomac River, tidal wetlands are not extensive, though there are large areas of tidal wetlands along the Potomac River tributaries. Some wetlands that developed in disturbed areas such as unreclaimed surface mines and under powerlines now support rare plants. Charles County also contains large wetland complexes long recognized for wildlife habitat and biodiversity.

Wetland classifications

According to Tiner and Burke (1995), in 1981-1982 there were 26,686 acres of wetlands (4.5% of the State's total). The wetland types were Estuarine (4,909 acres), Palustrine (21,755 acres), and Riverine (22 acres). Comparisons of this 1981-1982 wetland acreage with historic wetland acreage (based on hydric soils) represents a 60%, or 39,632 acre, loss (MDE, 2002). A study by the U.S. Fish and Wildlife Service of wetland losses in the County from 1981 to 1988-89 found that approximately 122 acres of vegetated wetlands were converted to uplands, primarily due to housing construction. Most of the wetlands lost were temporarily flooded, forested nontidal wetlands, though many losses were from unknown causes. Commercial development and road construction also caused a large percentage of the losses. There are 140 acres of vegetated wetlands that were converted to another vegetated wetland type, and approximately 40 acres of wetlands that were converted to unvegetated wetlands. Beaver activity was credited with creating an additional 39 acres of vegetated wetlands in uplands, while 105 acres of new ponds were created by human activity in uplands.

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

- Estuarine wetlands can be salt or brackish tidal wetlands. Vegetation is largely dependent upon salinity and hydrology, with plant diversity increasing with decreased salinity and decreased flooding. They can be classified into five groups:
    - Estuarine intertidal flats are mud or sand shores that are exposed twice a day (at low tide) or less. These areas have sparse macrophytic vegetation.
    - Estuarine emergent wetlands have vegetation composition that is strongly influenced by salinity level and duration/frequency of inundation.
        - Brackish marshes are the most common type of Maryland Estuarine wetland, found along the Chesapeake Bay and tidal rivers. Low brackish marsh is often dominated by smooth cordgrass-tall form and water hemp while the high brackish marsh is often dominated by salt hay grass, salt grass, black needlerush, smooth cordgrass-short form, Olney three-square, switchgrass, common three-square, big cordgrass, common reed, salt marsh bulrush, seaside goldenrod, rose mallow, and narrow-leaved cattail.
        - Oligohaline marshes are only slightly saline and are located in the upper tidal rivers. Low oligohaline marshes are often dominated by

arrow arum, pickerelweed, spatterdock, wild rice, soft-stemmed bulrush, narrow-leaved cattail, water hemp, and common three-square while high oligohaline marshes are often dominated by big cordgrass, common reed, narrow-leaved cattail, wild rice, broad-leaved cattail, and sweet flag.

- Estuarine scrub-shrub swamps are often dominated by high-tide bush and groundsel bush.
- Estuarine forested swamps are often dominated by loblolly pine. Due to sea level rise bringing in more salinity, some of these systems are being converted into salt marshes.
- Estuarine Aquatic beds generally contain submerged aquatic vegetation, including eelgrass and widgeongrass in high salinity areas and widgeongrass and other species in lower salinity areas.

- 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 Maryland Coastal Plain Province.
  - Palustrine forested wetlands are the dominant palustrine wetland type on the Coastal Plain and are located in floodplains, depressions, and drainage divides. They can be classified into four main groups:
    - Tidally flooded wetlands are freshwater wetlands that are tidally influenced. Common tree species may include red maple, green ash, black willow and black gum.
    - Semipermanently flooded wetlands are nontidal wetlands that are flooded for much of the growing season. These are uncommon in Maryland. Some examples, dominated by bald cypress, are along Battle Creek and the Pocomoke River. Higher elevations may be dominated by red maple, black gum, sweet bay, swamp black gum, fringe tree, ironwood, and swamp cottonwood.
    - Seasonally flooded wetlands are nontidal wetlands that are flooded for generally longer than two weeks during the growing season. Some of the more common tree dominants include red maple, sweet gum, pin oak, willow oak, loblolly pine, or swamp chestnut oak. There is often a thick shrub understory.
    - Temporarily flooded wetlands are nontidal wetlands that are flooded the least of the four types, about a week. Seasonally saturated wetlands, wetlands having a high water table during the cooler months, are also included in this category. Some of these areas are managed for loblolly pine harvesting. Other tree dominants include red maple, sweet gum, black gum, willow oak, water oak, basket oak, swamp white oak, southern red oak, sycamore, black willow, American holly, sweet bay.
  - Scrub-Shrub wetlands are less common than forested wetlands on the Coastal Plain. They are often dominated by buttonbush (in the wetter systems), silky dogwood, arrowwood, alder and tree saplings.

    - Emergent wetlands are very diverse in the Coastal Plain region due to the occurrence of both tidal and nontidal wetlands. They can be categorized into several different types:
        - Tidal fresh marshes occur along the large coastal waterways, between the brackish marshes and tidal freshwater swamps. It is speculated that in addition to tidal flooding, temporary periods of salt water in these areas may discourage woody succession. These freshwater wetlands are often more diverse than wetlands with higher salinity levels. Vegetative dominance changes seasonally. There is often a distinct vegetative zonation pattern based on elevation. Some common dominance types according to McCormick and Somes (1982) are arrowheads, big cordgrass, bulrushes, bur-marigold, cattails, common reed, giant ragweed, golden club, pickerelweed/arrow arum, purple loosestrife, reed canary grass, rose mallow, and smartweed/rice cutgrass
        - Interdunal wet swales have a very high water table, allowing hydrophytic plants to grow adjacent to dunes having xeric plant species. These sites are often dominated by common three-square, salt hay grass, and rabbit-foot grass.
        - Semipermanently flooded marshes are often dominated by cattail, spatterdock, arrow arum, water willow, and bur-reeds.
        - Seasonally flooded marshes include isolated depressional wetlands called “potholes” or “Delmarva Bays” (mostly in Caroline, Kent, and Queen Anne’s)
        - Temporarily flooded wet meadows include areas recently timber harvested that will soon revert back to woody vegetation.
    - Aquatic beds include small ponds with vegetation on the bottom and/or surface. These are the wettest of the Palustrine types.
- 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).

This same document (*Wetlands of Maryland*) provides numerous examples of various wetland communities found within each County and complete plant lists for certain wetland types.

Tidal wetland acreage was also estimated in *The Coastal Wetlands of Maryland* (Table 1). Charles County had 5,370 acres of vegetated tidally-influenced wetlands (excluding SAV). A large amount of vegetated wetland is brackish high and low marsh. There is also a fair amount of fresh marsh and smaller amounts of shrub and wooded swamp. Due to the higher stress associated with higher salinity levels, brackish marsh often has lower species richness and species diversity than fresh tidal marsh. Brackish marsh may also have quite distinct plant zonation patterns.

Table 1. Tidal wetland acreage within Charles County based on vegetation type (McCormick and Somes, 1982).

Major Vegetation Type	Vegetation Type	Acreage
Shrub Swamp *(Fresh)*	Swamp rose	7
	Smooth alder/Black willow	1
	Red maple/Ash	165
Swamp forest *(fresh except pine, which is often brackish)*	Bald cypress	0
	Red maple/Ash	11
	Loblolly pine	3
Fresh marsh	Smartweed/Rice cutgrass	248
	Spatterdock	26
	Pickerelweed/Arrow arum	155
	Sweetflag	0
	Cattail	186
	Rosemallow	18
	Wildrice	0
	Bulrush	104
	Big cordgrass	310
	Common reed	0
Brackish High Marsh	Meadow cordgrass/Spikegrass	349
	Marshelder/Groundselbush	276
	Needlerush	7
	Cattail	237
	Rosemallow	43
	Switchgrass	0
	Threesquare	669
	Big cordgrass	970
	Common reed	3
Brackish Low Marsh	Smooth cordgrass	320
Saline High Marsh	Meadow cordgrass/Spikegrass	0
	Marshelder/Groundselbush	0
	Needlerush	0
Saline Low Marsh	Smooth cordgrass, tall growth form	0
	Smooth cordgrass, short growth form	0
Submerged Aquatic Vegetation	Submerged aquatic plants	383
Untyped wetlands	Untyped wetlands	1,262

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. Coastal wetlands also hold excess discharge from inland drainage networks as well as tidal waters during storms.

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.

The associated value of this function can be summarized as follows:

a. A decrease in the volume and velocity of flowing water.
   Value: Helps prevent stream channel and shoreline erosion, and habitat destruction.
b. Deposition and retention of fine sediment.
   Value: Helps maintain water quality and aquatic ecosystems.
c. Water storage by extending the period of time during which flood waters are released back into the drainage system.
   Value: Helps prevent the flooding of homes, property, agricultural lands, and structures such as dams, bridges, and roads.

The topography in most of the Lower Potomac River sub-basin rises sharply adjacent to streams, resulting in a relatively narrow floodplain. The width of the floodplain greatly influences the amount of water that can be temporarily stored or slowed, so the flood attenuation function has probably moderate to low benefits. Most structures are located beyond the edge of the ravines bordering the wetlands.

Extensive wetland alteration and channelization along Gilbert Run has reduced the natural flood attenuation functions along the stream reach.

Groundwater Recharge and Discharge

Functions

Wetlands facilitate the flow of water between the ground water system and surface water system. Wetlands periodically perform different functions, depending on the gradient of the groundwater table and the topography of the land surface. The relationship of the groundwater table and the land surface dictates which function - groundwater recharge or discharge - a wetland performs.

Nearly all of Maryland's wetlands are ground water discharge areas, at least for some portion of the year (Fugro East, Inc., 1995). Variations in the depth of the ground water table, resulting from seasonal changes in climate, dictate which of these functions - discharge or recharge - a wetland will perform at a given time.

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.
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

Wetlands provide important habitat for fish, wildlife, and plant species, including rare species. Large contiguous areas of wetland, forest or other relatively undisturbed land are most likely to support sensitive species and diverse, microhabitats. Habitat and biodiversity are threatened not only by direct impacts such as filling, drainage, sediment, and land clearing, but by introduction of exotic and invasive species. Wetlands that are important for habitat and biodiversity often require a relatively undisturbed adjacent buffer to protect the species and habitat from direct and indirect disturbance.

The Zekiah Swamp is a Natural Heritage Area, an Area of Critical State Concern, a Nontidal Wetland of Special State Concern, part of a State Scenic River, and as one of the most significant natural areas on the East Coast. Zekiah Swamp contains a wide range of plant community types, including estuarine emergent wetlands at the mouth to forested wetlands in the headwaters. Mattawoman Creek supports an important recreational fishery.

Nontidal Wetlands of Special State Concern

There are a few State-designated Nontidal Wetlands of Special State Concern (WSSC) and potential WSSC scattered through the County. These are described in the section for the individual 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 and headwaters. There are some large sections near the Potomac River, at the mouths of the Nanjamoy Creek and Wicomico River. Hydric soils that are not currently wetlands may be good potential sites for wetland restoration.

Wetland restoration and preservation may be another useful tool for achieving TMDL requirements. Wetland restoration designed to achieve maximum water quality benefits

towards the TMDL should be focused at the head of tide and upstream. The headwater zone of tidal waterbodies tends to be the location of maximum algal concentrations for several reasons. The tidal headwaters are more stagnant because they tend to be shielded from the wind-generated mixing. This zone is also the depositional area of nutrients from the tidal river's primary nontidal stream system. Finally, this area tends to be shallow. As a consequence, the water tends to be slightly warmer, which increases the rate of algae growth. Additionally, less water volume is available to dilute nutrient fluxes from the bottom sediments (George, 2006, pers. comm.).

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.

MDE has designated some areas as Wellhead Protection Areas (WPAs). In some WPAs, the water table is near the surface, with only a few feet of soil to filter any water entering the ground. Excavation of a few feet would significantly reduce the filtering capacity of the soil, allowing the wetland to act as a direct pathway for nutrients and other pollutants

to enter the groundwater. Therefore, wetland creation designs within WPAs should consider the impact to groundwater quality.

Sensitive Resources

A sourcewater assessment was completed for several community water supplies located throughout the County. These wells, withdrawing from confined aquifers, were not susceptible to land use, but were susceptible to natural contaminants of arsenic, radiological contaminants, and radon (depending on the approved maximum contaminant levels).

The 1992 Resources Protection and Planning Act established environmentally sensitive areas that should be protected. These included streams and their buffers, 100-year floodplains, habitats of threatened and endangered species (19 animals and 86 plants are listed in the County), and steep slopes. The Charles County Comprehensive Plan (2005 Draft) made additional recommendations:

- Protect areas within the Resource Protection Zone, outside of the Critical Area, including Mattawoman and tributaries, Zekiah Swamp, Gilbert Run Swamp, Nanjemoy, Port Tobacco River, Swanson, and Indian Creek's watersheds.
- Acquire land of sensitive areas, including those identified along Zekiah Swamp Run, Allen's Fresh Run, Gilbert Swamp Run, Nanjemoy Creek, Mattawoman Creek, Swanson's Creek, Pomonkey Creek, Indian Creek, Port Tobacco, and their tributaries (Charles County, 1997).
- Also protect Pomonkey Creek, Allen's Fresh Run, and Port Tobacco (Charles County, 1997).
- Protect habitats of local significance within the Critical Area: Audubon Woods, Friendship Landing, Thoroughfare Island, Bullitt Neck Point, Porter Woods, West Stump Shoreline, Cornwallis Neck Marshes, and Purse Uplands and Ravines.
- Protect forested land, including large contiguous tracts and forest interior dwelling species habitat.
- Conserve and encourage riparian buffers.
- Protect wetlands.
- Protect ground water.
- Support Tributary Strategies and Critical Area Program.
- Protect tidal wetlands, shellfish harvesting areas, colonial waterbird nesting areas, and waterfowl staging and concentration areas.
- Increase streambank stabilization.
- Implement the open space network identified in the Waldorf Sub-Area Plan (primarily along the major stream corridors, with some portions opened to the public).
- Improve stormwater management.
- Purchase private sensitive wetlands for long-term preservation (Charles County, 1997).
- Protect habitat of anadromous fish spawning area.

- Develop park, recreation, and open space plans to compliment stream valley protection.
- Limit public access in sensitive environments (Charles County, 1997).
- Promote wildlife education.
- Preserve waterfront area.
- Provide public access to waterfront through natural parks.
- Manage shoreline erosion.
- Protect aquifer recharge areas for Patapsco and Patuxent (Charles County, 1997).
- Maintain buffer between aquatic and upland habitat, including providing wildlife corridors (Charles County, 1997).
- The County has a strong desire to preserve the rural character and agriculture
- The 1992 Resource Protection Zone requires a 50-100 foot buffer around all stream outside of the critical area. This buffer is expanded to include floodplains, nontidal wetlands, and steep slopes.

The Potomac and Patuxent Rivers provide spawning area for anadromous fish and are important for other types of fish. Colonial waterbird nesting sites are present throughout the County. Great blue heron rookeries are located on Mattawoman Creek, Nanjemoy Creek, Zekiah Swamp Run, and Swanson Creek (Charles County, 2005).

Other Relevant Programs

Scenic Rivers
The Wicomico River and its watershed, including Zekiah Swamp, and the Patuxent River are State-designated Scenic Rivers.

Green Infrastructure
Green Infrastructure hubs cover much of the County. A large hub is in the western portion of the County, south of Mattawoman Creek. Areas within the Green Infrastructure network that are currently unprotected should be protected. There are also small sections of Green Infrastructure considered to be "gaps," currently in development, agriculture, or barren land. It is desirable to restore these areas back to natural vegetation, as they can provide a wildlife corridor, a protective buffer, and may be especially important along the waterways. For more detailed information, refer to section on the individual watershed.

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 are four State-designated Natural Heritage Areas (NHA) located in the watersheds Lower tidal Potomac River, Middle Tidal Potomac River, Nanjemoy River, Zekiah Swamp, and Wicomico River. These areas 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.

Rural Legacy

Designated Rural Legacy land is located along the Zekiah Swamp Run. Wetland protection may be especially desirable in these areas. For detailed information about the program, refer to the Zekiah Swamp watershed section.

Priority Funding Areas

Priority funding areas are mostly in the northern portion of the County (e.g. around Waldorf, St. Charles, La Plata, Indian Head, North Indian Head Estates), but there are also a few small ones in the south (e.g. Clifton on the Potomac, Swan Point, Cobb Island). Wetland restoration/creation may not be desirable in these areas.

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.

Agricultural Easements

Some properties are within agricultural easements. Some are permanent and some are shorter-term. 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.

Watershed Restoration Prioritization

Charles County prioritized watersheds for restoration. After considering only watersheds totaling greater than 10% of the County's untreated impervious surface, the County

prioritized projects for watershed restoration. Seven study areas were identified to be the focus of future restoration: Action/Hamilton, Briarwood, Bryans Road, Carrington, Marbella Delight, Pinefield, and Pinefield South. Within Marbella Delight study area, stream erosion was found above Wendy Lane, suggesting the need for stream restoration (Charles County, 2003-2004).

KCI Technologies, Inc. prioritized Charles County watersheds based on need for stormwater retrofits, as described in the NPDES Annual Report for Charles County. This weighted GIS model ranked the County based on eleven variables. These included:

- DNR wetlands
- Nontidal Wetlands of Special State Concern
- Census Blocks
- Forest Cover
- Modeled TN loads
- Modeled TP loads
- Modeled Zn loads
- Modeled TSS loads
- Impervious surfaces
- Riparian Zones
- Critical Areas

The resulting maps suggest where the County should focus their initial stormwater retrofit watershed restoration efforts. The worst ranked 12-digit watersheds are located around Waldorf (subwatersheds 021401110785, 021401110787, 021401110788, 021401080766).

Watershed Information

Information on the individual 8-digit watersheds is as follows:

Patuxent River Lower (02131101)

Background

Based on MDP 2002 GIS land use data, the Charles County portion of the Patuxent River lower watershed has 1,212 acres of open water and 17,939 acres of land. The land acres are divided as follows: urban 4,772 acres (27%), agriculture 3,186 acres (18%), forest 9,676 acres (54%), wetlands 298 acres (2%) and barren land 7 acres (<1%). Since MDP estimates of wetland acreage are often underestimated, DNR wetland data estimates, as discussed later in this document, are preferred.

The Potomac and Patuxent Rivers provide spawning area for anadromous fish. Great blue heron rookeries are located on Swanson Creek (Charles County, 2005).

Fresh tidal marsh are located along meandering portions along the Patuxent River. It likely took hundreds or thousands of years to create these wetlands. The tidal portion extends from Queen Anne's Bridge in Anne Arundel County to the discharge into the

Chesapeake Bay, roughly forty-five miles. The freshwater tidal marsh section runs from Ferry Landing (in Calvert) to Waysons Corner (in Anne Arundel). Between Ferry Point and Cocktown Creek, there is a transition zone with fresh and brackish. South of Cocktown Creek is brackish marsh. It is believed that the Patuxent River was historically wider and deeper, but due to agricultural sedimentation in the 18th and 19th centuries, this open water converted into low marsh and eventually high marsh. It is also believed that common reed has been spreading along the Patuxent River, near Mataponi Creek, due to the heavy sedimentation occurring there. The common reed in the freshwater tidal marshes has replaced the once prevalent stands of wildrice. As of the early 1980s, wildrice was still abundant around Ferry Point and between a mile below MD Rte. 4 and the southern end of Jug Bay (Sipple, 1999).

The Patuxent River was designated as a scenic river by the Maryland General Assembly. The following is a summary from a document entitled *Patuxent River Policy plan: An update for 1984 to 1997* (DNR, 1997). The Patuxent River Commission supports, coordinates, and implements programs, policies, and projects of the Patuxent River. Among the managements plans proposed for the Patuxent River include:

- Establish "a primary management area" delineating the area along the river and its tributaries to identify and manage land from which pollution is most likely to be transported into the river.
    - Prince George's County has established the Patuxent River Management Area, with criteria for stream and wetland buffers within Patuxent watershed.
    - Montgomery County has adopted a master plan for Patuxent River, with guidelines for the protection of steep slopes, wetlands, reservoirs, and other sensitive areas in the Patuxent River watershed.
- Implement a comprehensive watershed management approach to control all sources of pollution and resource degradation.
- Continue restoration, improvement, and protection of the habitat functions of aquatic and terrestrial living resources. These include:
    - Riparian forest: to stabilize stream banks.
    - Stream quality: to improve spawning ranges.
    - Wetlands: protection and restoration.
    - Forest land: to enhance contiguous tracts of forest.
    - Submerged aquatic vegetation and tidal marsh.
    - Concentrate new development in and around existing developed areas and population centers while protecting the rural and agricultural landscape.
    - Enhance the environmental quality and community design in new and existing communities.
    - Develop a sense of stewardship for the Patuxent River and its watershed through increased public education and participation programs.
    - Fund and meet the above plans.

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

- Estuarine
  - Emergent: 4,372 acres
  - Scrub shrub: 89 acres
  - Forested: 10 acres
  - Unconsolidated shore: 125 acres
- Palustrine
  - Aquatic bed: 73 acres
  - Emergent: 605 acres
  - Scrub shrub: 1,040 acres
  - Forested: 7,619 acres
  - Unconsolidated bottom: 687 acres
  - Unconsolidated shore: 7 acres
  - Farmed: 79 acres
- Total: 14,707 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 (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02131101	-11.56	9.98	0	0.15	-1.43

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 II - all estuarine portions of tributaries except Patuxent River and tributaries above Ferry Landing.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. It is also classified as a "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failing indicators include low SAV abundance and habitat index, poor tidal and non-tidal benthic index of biological integrity (BIBI), poor non-tidal instream habitat index, and high amount historic wetland loss (42,599 acres). Indicators for Category 3 include high imperiled aquatic species indicator, migratory fish spawning area, high number of wetland-dependent species, high amount of headwater streams in Interior Forest, and high percent of the watershed being forested.

According to the 2002 305(b) report, a portion of the nontidal mainstem and tributaries fail to support all designated uses due to pesticides, nutrients, low oxygen, and bacteria from nonpoint sources, failing septics, natural sources (poor tidal flushing), eutrophication, and other sources. The nontidal, wadeable tributaries do support all designated uses. Lake Lariat does not support all designated uses due to Hg in fish from atmospheric deposition and other sources.

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:

- *Patuxent River lower* (tidal); fecal coliform, poor biological community, sediments, nutrients, chlorpyrifos (in water).
- *Mill Creek* (tidal); fecal coliform.
- *Mill Creek* (021311010884 tidal in Calvert County); fecal coliform.
- *Solomons Island Harbor* (021311010873 tidal in Calvert County); fecal coliform.
- *Harper and Parson Creeks* (021311010871 tidal in St. Mary's County); fecal coliform.
- *Goose Creek* (021311010871 tidal); fecal coliform.
- *Indian Creek* (021311010887 tidal in St. Mary's/Charles County); fecal coliform.
- *Town Creek* (021311010872 tidal in St. Mary's County); fecal coliform.
- *St. Thomas Creek* (021311010877 tidal in St. Mary's County); fecal coliform.
- *Island Creek* (021311010878 tidal in Calvert County); fecal coliform.
- *Washington Creek* (021311010884 tidal in St. Mary's County); fecal coliform.
- *Persimmons Creek* (021311010884 tidal in St. Mary's County); fecal coliform.
- *Battle Creek* (021311010879 tidal in Calvert County); fecal coliform.
- *Buzzard Island Creek* (021311010882 tidal); fecal coliform.
- *Buzzard Island Creek* (021311010882 non-tidal in Calvert County); poor biological community.
- *Summerville Creek Unnamed Tributary* (021311010894 non-tidal in Prince Georges County); poor biological community.
- *Fowler's Mill Branch* (021311010902 non-tidal in Calvert County); poor biological community.
- *Cuckold Creek* (021311010874 non-tidal in St. Mary's County); fecal coliform, poor biological community.
- *Swanson Creek* (021311010890 non-tidal in Prince Georges County); poor biological community.
- *Patuxent River Unnamed Tributary* (021311010895 non-tidal in Calvert County); poor biological community.
- *Cocktown Creek Unnamed Tributary* (021311010896 non-tidal in Calvert County); poor biological community.
- *Chew Creek* (021311010899 non-tidal in Calvert County); poor biological community.
- *Hall Creek* (021311010902 non-tidal in Anne Arundel County); poor biological community.

Multiple subbasins within this watershed are impaired by a April 7, 2000 PEPCO oil spill. Impaired areas include Swanson, Washington, Trent Hall, Persimmon, Indian, and Cremona Creeks, and Golden Beach. A TMDL is not required for these contaminants since other controls will results in water quality designation attainment.

A TMDL has been completed for Island Creek, Town Creek, Trent Hall Creek, St. Thomas Creek, Harper, Pearson Creeks, Goose Creek and Indian Creek and a Water Quality Analysis for Battle Creek of fecal coliform in Calvert, Charles and St. Mary's Counties, Maryland. There are no direct point sources of fecal coliform. Battle Creek was not impaired by fecal coliform. Sources of fecal coliform are below:

Waterway	Livestock %	Pets %	Humans %	Wildlife %
Island Creek	39	19	1	40
Town Creek	0	62	4	34
Trent Hall Creek	62	13	1	25
St. Thomas Creek	24	26	2	49
Harper and Pearson Creeks	0	2	<1	98
Goose Creek	0	2	<1	98
Indian Creek	65	13	1	22

Restoration/Preservation

Green Infrastructure hubs and corridors run throughout the Charles County portion of this watershed (DNR, 2000-2003). Only a small amount of the Green Infrastructure network is protected by Indian Creek NRMA and Patuxent River NRMA, According to the 2000 Maryland Greenways Commission document, there are two existing or proposed greenways including:

- *Patuxent Regional Greenway.*
- *Patuxent River Water Trail.*

There are no State-designated WSSC within the Charles County portion of this watershed.

The Oyster Recovery Partnership planted large amounts of oyster spat in the Potomac and Patuxent Rivers (many planted on Elbow and Teague Bar Sanctuaries, and Holland Bar) between 2000 and 2003 (Charles County, 2005).

Specific recommendations for restoration:

- Restore "gaps" in the Green Infrastructure network to natural vegetation, especially along waterways.
- Acquire land of sensitive areas, including those identified along Swanson's Creek, Indian Creek and tributaries (Charles County, 1997).
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect areas within the Resource Protection Zone, outside of the Critical Area, including Swanson and Indian Creek watersheds (Charles County, 1997).
- Protect portions of Green Infrastructure that are not currently protected, especially along waterways.
- Protect wetlands and streams within the headwaters.

Potomac River Lower Tidal (02140101)

Background

Based on MDP 2002 GIS land use data, the Charles County portion of the Potomac River lower tidal watershed has 75,255 acres of open water and 28,550 acres of land. The land acres are divided as follows: urban 2,870 acres (10%), agriculture 6,851 acres (24%), forest 17,568 acres (62%), wetlands 1,255 acres (4%) and barren land 6 acres (<1%). Since MDP estimates of wetland acreage are often underestimated, DNR wetland data estimates, as discussed later in this document, are preferred.

The Potomac and Patuxent Rivers provide spawning area for anadromous fish. This river is also important nursery for spot, croaker, gray trout, and white perch (Charles County, 2005).

Popes Creek is a designated Natural Heritage Area within this watershed. To get this designation, an area must contain threatened or endangered species and be one of the best Statewide examples.

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

- Estuarine
    - Emergent: 1,455 acres
    - Scrub shrub: 66 acres
    - Forested: 9 acres
    - Unconsolidated shore: 102 acres
- Lacustrine aquatic bed: 42 acres
- Palustrine
    - Aquatic bed: 20 acres
    - Emergent: 339 acre
    - Scrub shrub: 331 acres
    - Forested: 4,624 acres
    - Unconsolidated bottom: 227 acres
    - Unconsolidated shore: 5 acres
    - Farmed: 85 acres
- Total: 7,306 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 (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02140101	-0.52	0	0	0	-0.52

A cooperative project between the Maryland Departments of the Environment and Natural Resources, Charles Soil Conservation District, and Ducks Unlimited is under construction to restore hydrology to drained forested wetlands in Myrtle Grove Wildlife Management Area. The site drains to Mattawoman Creek.

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 II: shellfish harvesting; all estuarine portions of tributaries except Potomac River and tributaries above line from Smith Point to Simms Point.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. It is also classified as a Category 3, a pristine or sensitive watershed in need of protection. Failing indicators include poor SAV abundance and habitat index, poor tidal benthic index of biotic integrity (BIBI), high historic wetland loss 42,383 acres. Indicators for Category 3 include migratory fish spawning areas, high percent headwater streams in Interior Forest (28%), and high percent of watershed being forested (59%).

According to the 2002 305(b) report, of the tidal mainstem and Maryland tributaries, a portion fails to support all designated uses (63 miles) due to PCBs, low oxygen, and bacteria from nonpoint sources, poor tidal flushing, and eutrophication. The remaining portion fully supports all uses (243 miles). Data for the nontidal, wadeable tributaries is inconclusive.

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:

- *Potomac River lower tidal* (non-tidal); nutrients, sediments, PCBs (in fish tissue), poor biological community.
- *Tall Timbers Cover* (021401010697 tidal in St. Mary's County); fecal coliform.
- *Whites Neck Creek* (021401010702 tidal in St. Mary's County); fecal coliform.
- *Poplar Hill Creek* (021401010698 non-tidal in St. Mary's County); poor biological community.

- *Tarleton Branch* (021401010698 non-tidal in St. Mary's County); poor biological community.
- *Belvedere Creek* (021401010698 non-tidal in St. Mary's County); poor biological community.
- *Ditchley Prong* (021401010704 non-tidal in Charles County); poor biological community.

Restoration/Preservation

Green Infrastructure is spread throughout the watershed, with a large Green Infrastructure hub at the northern portion of the watershed (along the Potomac River bend) (DNR, 2000-2003). The Green Infrastructure hubs are largely unprotected, except Blossom Point Proving Grounds, a few Maryland Environmental Trust easments, and County-owned land. According to the 2000 Maryland Greenways Commission document, there are three existing or proposed greenways including:

- *Popes Creek Railroad*
- *Potomac River Greenway*
- *Potomac River Water Trail*

There are two State-designated Nontidal Wetlands of Special State Concern in this watershed.

- *Maryland Point Swamp*. Located near Maryland Point close to the Potomac River, this diverse beaver-influenced wetland complex contains six rare plant species. The main threat is alteration of hydrology. Additional threats include logging/forest clearing, road construction, and woody plant succession. A highway borders the southern part of the wetland, and agricultural fields and several residences border the eastern and western sides (McCarthy et al., 1988). The site is not protected.
- *Popes Creek NHA*. This site follows Popes Creek to the Potomac River, but is not protected. In order for an area to be designated a Natural Heritage Area, it must contain plants and animals that are among the best Statewide examples. This NHA is an extremely productive and diverse tidal/nontidal wetland containing seven wetland communities. This site also provides habitat for forest interior dwelling birds (DNR, 1991). Popes Creek Natural Heritage Area should be high priority for protection.

The Oyster Recovery Partnership planted large amounts of oyster spat in the Potomac and Patuxent Rivers between 2000 and 2003 (Charles County, 2005).

According to the Charles County comprehensive plan (1997), the following areas along the Potomac River have shoreline erosion rates greater than two feet per year:

- between Sandy Point and lower Thomas Point
- between Blossom Point and Windmill Point
- the eastern shore of Port Tobacco River to Pope's Creek
- the southwest shore of Cobb Island.

Specific recommendations for restoration:

- Restore "gaps" in the Green Infrastructure network to natural vegetation, especially along waterways.
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect WSSC and buffers.
- Protect portions of Green Infrastructure that are not currently protected, especially along waterways.
- Protect additional DNR-designated Ecologically Significant Areas containing wetlands that are not already protected.
- Protect wetlands and streams within the headwaters.

Potomac River Middle Tidal (02140102)

Background

Based on MDP 2002 GIS land use data, the Charles County portion of the Potomac River middle tidal watershed has 26,854 acres of open water and 19,276 acres of land. The land acres are divided as follows: urban 2,318 acres (12%), agriculture 1,388 acres (7%), forest 14,932 acres (77%), wetlands 618 acres (3%) and barren land 20 acres (<1%). Since MDP estimates of wetland acreage are often underestimated, DNR wetland data estimates, as discussed later in this document, are preferred.

The Potomac and Patuxent Rivers provide spawning area for anadromous fish. Striped bass spawn in the Potomac, between Indian Head and Riverside. This river is also important nursery for spot, croaker, gray trout, and white perch (Charles County, 2005).

Chicamuxen Creek is a designated Natural Heritage Area within this watershed. To get this designation, an area must contain threatened or endangered species and be one of the best Statewide examples.

The Chapman State Park and Governor Parris N. Glendening Natural Environment Area is a State-owned 2,180 acre area located along the Potomac River and Rte. 210. This site has nationally recognized significance due to its historical, archeological, and ecological values. The site is broken into two tracts. The 800-acre North Tract (Chapman State Park), has over two miles of Potomac River shoreline, open fields, forests, streams, and wetlands. This area ranks in the top 10% for Statewide habitat value and diversity. There are some thirty foot high bluffs along the Potomac that are subject to rapid erosion. The 1,300 acre South Tract (Governor Parris N. Glendening Natural Environment Area) is south of Rte. 210 and contains forest and two major stream valleys. This area ranks in the top 20% for State Coastal Plain forest. There are several wetland types within these areas. Sandy seeps form perennial streams and fern belts that contain wetland vegetation, such as Ground pine and Skunk cabbage, and are important habitat for amphibians and box turtles. There are also forested wetlands and wet meadows (with the largest wet meadow

being a designated WSSC. Potomac Swamp is a one-mile long non-tidal marsh along the Potomac shoreline, northwest of Mt. Aventine (DNR, 2003a).

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

- Estuarine emergent: 227 acres
- Lacustrine unconsolidated bottom: 26 acres
- Palustrine
    - Aquatic bed: 23 acres
    - Emergent: 213 acre
    - Scrub shrub: 121 acres
    - Forested: 741 acres
    - Unconsolidated bottom: 83 acres
    - Unconsolidated shore: 19 acres
    - Farmed: 2 acres
- Total: 1,455 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 (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02140102	-0.27	0	0	0	-0.27

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 II: shellfish harvesting; all estuarine portions of tributaries except Potomac River and tributaries above line from Smith Point to Simms Point.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. It is also classified as a "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failing indicators include high nitrogen loadings, poor SAV abundance and habitat index, and high historic wetland loss (16,201) acres. Indicators for Category 3 include migratory fish spawning areas, high amount of wetland-dependent species, high percent headwater stream in Interior Forest (42%), and high percent watershed being forested.

According to the 2002 305(b) report, tidal mainstem and Maryland tributaries not identified below fail to support all designated uses due to PCBs. Of the nontidal, wadeable tributaries, a portion fails to support all uses (7 miles) due to poor biological community from habitat alteration and channelization and the remaining portion fully supports all uses (23 miles).

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:

- *Potomac River Middle Tidal*; poor biological community, cadmium, chromium, copper, lead, nutrients, sediments, PCBs (in fish tissue).
- *Reeder Run* (021401020789 non-tidal in Charles County); poor biological community.
- *Reeder Run Unnamed Tributary* (021401020789 non-tidal in Charles County); poor biological community.

Restoration/Preservation

Most of this watershed is designated Green Infrastructure hub (DNR, 2000-2003). Some of this is protected, including Chicamiuxen WMA, Mattawoman NEA, Purse State Park, and Indian Head Naval Surface Warfare Center, but there is still a lot of unprotected Green Infrastructure hub. According to the 2000 Maryland Greenways Commission document, there are two existing or proposed greenways including:

- *Potomac River Greenway*
- *Potomac River Water Trail*

There is one State-designated Nontidal Wetland of Special State Concern in this watershed and three potential WSSCs.

- *Chicamuxen Creek NHA*. This site is mostly protected by Chicamuxen WMA and Indian Head Naval Surface Warfare Center. The only area not protected is just south of Chicamuxen WMA, at Point Landing.
- *Potential WSSC*. One site is located east of Chicamuxen Creek NHA (within Indian Head Naval Surface Warfare Center), one is located near Chapman Point (protected by Mattawoman NEA), and one is located near Douglass Point (unprotected).

The Oyster Recovery Partnership planted large amounts of oyster spat in the Potomac and Patuxent Rivers between 2000 and 2003 (Charles County, 2005).

The area along the Potomac River, between Sandy Point and lower Thomas Point, have shoreline erosion rates greater than two feet per year (Charles County, 1997).

Specific recommendations for restoration:

- Restore “gaps” in the Green Infrastructure network to natural vegetation, especially along waterways.

- Acquire land of sensitive areas, including those identified along Pomonkey Creek and tributaries (Charles County, 1997).
- Control invasive species within Chapman State Park and Governor Parris N. Glendening Natural Environment Area that are threatening the sensitive species (DNR, 2003a).
- Enhance wildlife habitat within Chapman State Park and Governor Parris N. Glendening Natural Environment Area, including connecting existing Greenways that are wildlife corridors (DNR, 2003a).
- Improve the water quality of tributaries originating or running through the Chapman State Park and Governor Parris N. Glendening Natural Environment Area. There are two major stream valleys within the South Tract. The one near Rte. 210 and north of the Southern Maryland Electric Cooperative power line right of way has the poorer water quality of the two, due to development in the headwaters and stormwater runoff. This tributary also has some severely eroded banks from flooding (DNR, 2003a).
- Restore wetlands associated with streams within the Chapman State Park and Governor Parris N. Glendening Natural Environment Area (DNR, 2003a).
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect WSSC and buffers.
- Protect portions of Green Infrastructure that are not currently protected, especially along waterways.
- Protect additional DNR-designated Ecologically Significant Areas containing wetlands that are not already protected.
- Protect Pomonkey Creek (Charles County, 1997).
- Protect wetlands and streams within the headwaters.

<u>Wicomico River (02140106)</u>

Background

Based on MDP 2002 GIS land use data, the Charles County portion of the Wicomico River watershed has 5,653 acres of open water and 17,316 acres of land. The land acres are divided as follows: urban 455 acres (3%), agriculture 6,513 acres (38%), forest 8,522 acres (49%), and wetlands 1,826 acres (11%). Since MDP estimates of wetland acreage are often underestimated, DNR wetland data estimates, as discussed later in this document, are preferred.

There are extensive freshwater tidal marshes located along meandering portions or on alluvial deposits along the Wicomico River (Sipple, 1999).

The Wicomico River and Zekiah Swamp were designated as a scenic river by the Maryland General Assembly. In 1994, Charles and St. Mary's Counties established the Wicomico Scenic River Commission (WSRC), with the goal of encouraging conservation and maintenance of the watershed and surrounding resources. The following information

is from the WSRC website. The Wicomico River is 16 miles long, traveling through rolling plateau. It runs from Zekiah Swamp to Cobb Island, joining with the Potomac River. The entire watershed is designated for special environmental and cultural concern in the 1987 Maryland Scenic Rivers Act. The Wicomico River and tributaries provide important habitat for finfish and wildlife. The River is considered to be one of Maryland's most productive oyster grounds. There are over 150 bird species frequently reported and this is within the neo-tropical migrating bird route. Hurricane Agnes in 1972 dropped the salinity levels in the River, resulting in a massive decline in the oyster fishery. Once the salinity returned to normal, the State worked on restoring this oyster population, with good success. Many crustaceans are found along the River, including blue crabs. There are eleven plant species tracked within the DNR Natural Heritage Program RTE database. These species are being threatened by habitat destruction and timber harvesting.

Most of the Wicomico River is mesohaline (5.0-18.0 ppt salinity). Tidal marsh vegetation in the upper Wicomico River estuary is classified as coastal shallow fresh marsh (e.g. Allens Fresh), while the tidal wetland community in the middle and lower estuary are classified as coastal salt marsh. These areas have thick stands of grass which provide habitat and food for fish, birds, and other wildlife, control shoreline erosion, and filter out sediment (DNR, 1994).

Some relevant recommendations resulting from *The Wicomico Scenic River Study and Management Plan* are as follows:

- Acquire land along Allens Fresh and the Zekiah Swamp, with land adjacent to the Zekiah Swamp Natural Environment Area as highest priority.
- Focus conservation for both Charles and St. Mary's Counties in the Wicomico River/Zekiah Swamp watersheds.
- Restrict livestock from the streams and shorelines.
- Restore Gilbert Run spawning areas for anadromous fish.
- Protect floodplain swamp areas to maintain anadromous fish productivity.
- Preserve remaining Forest Interior Dwelling Bird Habitat.

Gilbert Run was altered in the 1960's to reduce flooding. This included constructing three dams and nine miles of stream channelization. There is concern that this stream alteration negatively impacts the Wicomico River by increasing sediment and pesticides, changing salinity, and reducing finfish habitat (DNR, 1994).

Allen's Fresh is a designated Natural Heritage Area within this watershed. To get this designation, an area must contain threatened or endangered species and be one of the best Statewide examples. Allens Fresh has some of the least salty marshes in the river system. These marshes are extensive. Chaptico Bay is a large coastal salt marsh containing dense reeds and grasses. This dense vegetation helps protect the shoreline from erosion by the tides or storms and provides food and habitat for many types of wildlife (WSRC, 2005).

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

- Estuarine
  - Emergent: 1,861 acres
  - Scrub shrub: 116 acres
  - Forested: 2 acres
  - Unconsolidated shore: 7 acres
- Palustrine
  - Aquatic bed: 2 acres
  - Emergent: 120 acre
  - Scrub shrub: 171 acres
  - Forested: 3,416 acres
  - Unconsolidated bottom: 171 acres
  - Unconsolidated shore: 4 acres
  - Farmed: 41 acres
- Total: 5,910 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 (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02140106	-0.69	0	0	0	-0.69

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 II: shellfish harvesting; all estuarine portions of tributaries.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. It is also classified as a Category 3, a pristine or sensitive watershed in need of protection. Failing indicators include high SAV abundance and habitat index, high historic wetland loss (23,879 acres), and high soil erodibility (0.29). Indicators for Category 3 include migratory fish spawning areas, high amount of wetland-dependent species, and high percent of headwater streams in Interior Forest (24%).

According to the 2002 305(b) report, a portion of the tidal mainstem and tributaries (<1 mile) fail to support all designated uses due to bacteria from nonpoint and natural sources. The remaining portion (18 miles) fully supports all uses. Of the nontidal, wadeable tributaries, one portion (6 miles) fails to support all uses due to poor biological

community, one portion (8 miles) fully supports all uses, and the remaining portion (45 miles) had inconclusive data.

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:

- *Wicomico River* (tidal); nutrients, sediments.
- *Charleston Creek* (021401060733 tidal in Charles County); fecal coliform.
- *Budds Creek* (021401060739 non-tidal in St. Mary's County); poor biological community.

A TMDL was completed for Charleston Creek (in Charles County) and Chaptico Bay (in St. Mary's County). Fecal coliform sources in Charleston Creek are from livestock (63%), pets (3%), humans (<1%), and wildlife (34%). Sources to Chaptico Bay were similar: livestock (66%), pets (8%), humans (<1%), and wildlife (26%).

Restoration/Preservation

Green Infrastructure hub and corridors are scattered throughout this watershed, including along the head of Wicomico River (DNR, 2000-2003). Some of this is protected by Zekiah NEA and METs. Since some of the Green Infrastructure corridors are currently in agriculture, it may be desirable to restore these sites to natural vegetation. According to the 2000 Maryland Greenways Commission document, there are two existing or proposed greenways including:

- *Gilbert Swamp Run.*
- *Zekiah Swamp.*

There is one State-designated Nontidal Wetland of Special State Concern (WSSC) and one potential WSSC in this watershed.

- *Zekiah Swamp/Allens Fresh NHA.* This is a large wetland system following Allens Fresh Run and Zekiah Swamp Run. This wetland complex contains hardwood swamp, shrub swamp, emergent marsh, mudflats, vernal pools, and beaver ponds. This swamp is roughly 15,000 acres, being the largest hardwood swamp in the Western shore. It contains several rare species, including three State-Endangered plant species, a State-Endangered and Federally Endangered bird, and a globally rare stonefly. The Smithsonian Institute designated this swamp as a "Primary Natural Area Recommended for Protection" in 1974. This wetland also provides habitat for forest interior dwelling birds. Since this wetland is immediately upstream of Allen's Fresh NHA, it provides the functions of water quality improvement, flood abatement, and habitat for the NHA (DNR, 1991). The portion within this watershed is largely unprotected, with the exception of a small portion within Zekiah NEA.
- *Potential WSSC.* This site is near Tompkinsville and is unprotected.

Specific recommendations for restoration:

- Restore "gaps" in the Green Infrastructure network to natural vegetation, especially along waterways.
- Acquire land of sensitive areas, including those identified along Allen's Fresh Run and tributaries (Charles County, 1997).
- Restore the scenic Wicomico River.
- Restrict livestock from the streams and shorelines (DNR, 1994).
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect WSSC and buffers.
- Protect portions of Green Infrastructure that are not currently protected, especially along waterways.
- Protect additional DNR-designated Ecologically Significant Areas containing wetlands that are not already protected.
- Protect tidal wetlands used as reference sites in the DNR tidal wetland vegetative community studies, since they are high-quality systems (Harrison, 2001; Harrison and Stango, 2003).
- Protect Allen's Fresh Run (Charles County, 1997).
- Preserve the scenic Wicomico River (WSRC, 2005).
- Acquire land along Allens Fresh and the Zekiah Swamp, with land adjacent to the Zekiah Swamp Natural Environment Area as highest priority (DNR, 1994).
- Focus conservation for both Charles and St. Mary's Counties in the Wicomico River/Zekiah Swamp watersheds (DNR, 1994).
- Protect floodplain swamp areas to maintain anadromous fish productivity (DNR, 1994).
- Preserve remaining Forest Interior Dwelling Bird Habitat (DNR, 1994).
- Protect wetlands and streams within the headwaters.

Gilbert Swamp (02140107)

Background

Based on MDP 2002 GIS land use data, the Charles County portion of the Gilbert Swamp watershed has 205 acres of open water and 24,721 acres of land. The land acres are divided as follows: urban 3,274 acres (13%), agriculture 7,544 acres (31%), forest 13,803 acres (56%), wetlands 30 acres (<1%) and barren land 71 acres (<1%). Since MDP estimates of wetland acreage are often underestimated, DNR wetland data estimates, as discussed later in this document, are preferred.

Wetlands historically existed along Gilbert Run, above the MD Rte. 234 bridge, but have been lost due to channelization (MDP, 1981). Apparently, this had been a very controversial project since Gilbert Run had been a beautiful system (Sipple, 1999). Gilbert Run was altered in the 1960's to reduce flooding. This included constructing three dams and nine miles of stream channelization. There is concern that this stream alteration

negatively impacts the Wicomico River by increasing sediment and pesticides, changing salinity, and reducing finfish habitat (DNR, 1994).

Some relevant recommendations resulting from *The Wicomico Scenic River Study and Management Plan* are as follows:

- Acquire land along Allens Fresh and the Zekiah Swamp, with land adjacent to the Zekiah Swamp Natural Environment Area as highest priority.
- Focus conservation for both Charles and St. Mary's Counties in the Wicomico River/Zekiah Swamp watersheds.
- Restrict livestock from the streams and shorelines.
- Restore Gilbert Run spawning areas for anadromous fish.
- Protect floodplain swamp areas to maintain anadromous fish productivity.
- Preserve remaining Forest Interior Dwelling Bird Habitat.

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

- Estuarine emergent: 17 acres
- Palustrine
    - Aquatic bed: 1 acre
    - Emergent: 58 acre
    - Scrub shrub: 57 acres
    - Forested: 1,752 acres
    - Unconsolidated bottom: 87 acres
    - Unconsolidated shore: 1 acre
    - Farmed: 16 acres
- Riverine unconsolidated shore: <1 acre
- Total: 1,989 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 (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02140107	-0.68	0.92	3.60	0.21	4.05

Two programmatic mitigation sites on private farmland (cropland) were constructed in 2004. The sites will be forested wetlands.

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 II: shellfish harvesting; all estuarine portions of tributaries.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. It is also classified as a "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failing indicators include poor non-tidal benthic index of biotic integrity (BIBI), poor non-tidal instream habitat index, and high soil erodibility (0.37). Wetland loss was estimated to be 14,582 acres. Indicators for Category 3 include high imperiled aquatic species indicator, high amount of wetland-dependent species, high percent headwater stream in Interior Forest (29%), and high percent watershed being forested.

According to the 2002 305(b) report, a portion of the mainstem creek and tributaries (3 miles) fail to support all designated uses due to poor biological community and siltation from habitat alteration and channelization. A portion (15 miles) fully supports all uses and another portion (34 miles) had inconclusive results. Data for Wheatley Lake is inconclusive.

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:

- *Gilbert Swamp* (tidal); nutrients, sediments,
- *Wheatley Run* (021401070750 non-tidal in Charles County); poor biological community.
- *Church Run* (021401070746 non-tidal); poor biological community.

Restoration/Preservation

Green Infrastructure hubs and corridors are spread through the watershed, including along Gilbert Creek (DNR, 2000-2003). Few areas are protected, with the exception of METs and County-owned land. Since some of the Green Infrastructure corridors are currently in agriculture, it may be desirable to restore these sites to natural vegetation. According to the 2000 Maryland Greenways Commission document, there are two existing or proposed greenways including:

- *Elk Creek Greenway.*
- *Patuxent Regional Greenway.*

There is one State-designated Nontidal Wetland of Special State Concern in this watershed following Gilbert Creek and Gilbert Swamp Run. This site, called Zekiah Swamp, is recognized by MDE as a WSSC, but not by DNR. Most of this site is unprotected.

Specific recommendations for restoration:

- Restore "gaps" in the Green Infrastructure network to natural vegetation, especially along waterways.

- Acquire and restore land of sensitive areas, including those identified along Gilbert Swamp Run and tributaries (Charles County, 1997).
- Restrict livestock from the streams and shorelines (DNR, 1994).
- Restore Gilbert Run spawning areas for anadromous fish (DNR, 1994).
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect WSSC and buffers.
- Protect portions of Green Infrastructure that are not currently protected, especially along waterways.
- Protect areas within the Resource Protection Zone, outside of the Critical Area, including Gilbert Run Swamp watershed (Charles County, 1997).
- Protect floodplain swamp areas to maintain anadromous fish productivity (DNR, 1994).
- Preserve remaining Forest Interior Dwelling Bird Habitat (DNR, 1994).
- Protect wetlands and streams within the headwaters.

Zekiah Swamp (02140108)

Background

Based on MDP 2002 GIS land use data, the Charles County portion of the Zekiah Swamp watershed has 62 acres of open water and 65,180 acres of land. The land acres are divided as follows: urban 12,578 acres (19%), agriculture 14,490 acres (22%), forest 37,295 acres (57%), wetlands 157 acres (<1%) and barren land 660 acres (1%). Since MDP estimates of wetland acreage are often underestimated, DNR wetland data estimates, as discussed later in this document, are preferred.

Most of the Wicomico River is mesohaline (5.0-18.0 ppt salinity). Tidal marsh vegetation in the upper Wicomico River estuary is classified as coastal shallow fresh marsh (e.g. Allens Fresh), while the tidal wetland community in the middle and lower estuary are classified as coastal salt marsh. These areas have thick stands of grass which provide habitat and food for fish, birds, and other wildlife, control shoreline erosion, and filter out sediment (DNR, 1994).

The Wicomico River and Zekiah Swamp were designated as scenic rivers by the Maryland General Assembly. In 1994, Charles and St. Mary's Counties established the Wicomico Scenic River Commission (WSRC), with the goal of encouraging conservation and maintenance of the watershed and surrounding resources. The following information is from the WSRC website. The Wicomico River is 16 miles long, traveling through rolling plateau. It runs from Zekiah Swamp to Cobb Island, joining with the Potomac River. The entire watershed is designated for special environmental and cultural concern in the 1987 Maryland Scenic Rivers Act. The Wicomico River and tributaries provide important habitat for finfish and wildlife. The River is considered to be one of Maryland's most productive oyster grounds. There are over 150 bird species frequently reported and this is within the neo-tropical migrating bird route. Hurricane Agnes in 1972

dropped the salinity levels in the River, resulting in a massive decline in the oyster fishery. Once the salinity returned to normal, the State worked on restoring this oyster population, with good success. Many crustaceans are found along the River, including blue crabs. There are eleven plant species tracked within the DNR Natural Heritage Program RTE database. These species are being threatened by habitat destruction and timber harvesting.

In 1974, the Smithsonian Institution described the Zekiah Swamp as "one of the most important remaining ecological areas on the East Coast." It was also identified as a priority wetland under the 1986 Emergency Wetlands Resources Act (DNR, 1994).

Some relevant recommendations resulting from *The Wicomico Scenic River Study and Management Plan* are as follows:

- Acquire land along Allens Fresh and the Zekiah Swamp, with land adjacent to the Zekiah Swamp Natural Environment Area as highest priority.
- Focus conservation for both Charles and St. Mary's Counties in the Wicomico River/Zekiah Swamp watersheds.
- Restrict livestock from the streams and shorelines.
- Restore Gilbert Run spawning areas for anadromous fish.
- Protect floodplain swamp areas to maintain anadromous fish productivity.
- Preserve remaining Forest Interior Dwelling Bird Habitat.

Allen's Fresh is a designated Natural Heritage Area within this watershed. To get this designation, an area must contain threatened or endangered species and be one of the best Statewide examples. Allens Fresh has some of the least salty marshes in the river system. These marshes are extensive (WSRC, 2005).

The 17,800-acre Zekiah Swamp is the best example of a non-tidal wetland in the County. While the Zekiah Swamp is located in Charles County, it originates in Prince George's County. It is 20 miles long and ¾ miles wide, dominated by hardwoods. This area was a designated Area of Critical State Concern. This is the largest hardwood swamp in Maryland and is rated highest for natural areas within the Chesapeake Bay region by Smithsonian Institute (Charles County, 1997). It provides diverse habitat for wildlife species such as beaver, osprey, herons, wood duck, mink, Wilson's snipe, bald eagle, woodpeckers, Zekiah stonefly, and Diamondback Terrapin (MDP, 1981). The drier bottomland woods of the Zekiah Swamp are dominated by the plant species sweet gum, red maple, river birch, swamp white oaks, jewelweed, arrowwood, grape, swamp rose, arrowhead, smart weeds, and ferns such as New York, Cinnamon, and Christmas ferns (WSRC, 2005).

Great blue heron rookeries are located on Zekiah Swamp Run (Charles County, 2005).

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

- Estuarine emergent: 72 acres
- Palustrine

  - Aquatic bed: 15 acres
  - Emergent: 207 acre
  - Scrub shrub: 321 acres
  - Forested: 7,532 acres
  - Unconsolidated bottom: 386 acres
  - Unconsolidated shore: 38 acres
  - Farmed: 85 acres
- Total: 8,656 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 (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02140108	-4.04	7.63	0	0.28	3.86

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; Tilghman Lake Reservoir.
- Use II: shellfish harvesting; all estuarine portions of tributaries.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. It is also classified as a "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failing indicators include high historic wetland loss (36,637 acres) and high soil erodibility (0.29). Indicators for Category 3 include high imperiled aquatic species indicator, high percent headwater streams in Interior Forest, and high percent watershed being forested.

According to the 2002 305(b) report, of the mainstem creek and tributaries, a portion (16 miles) fail to support all designated uses due to poor biological community from urban runoff, while the remaining portion (105 miles) fully supports all 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:

- *Zekiah Swamp* (tidal); sediments, lead, zinc, selenium, copper.
- *Zekiah Swamp* (non-tidal); nutrients.

- *Zekiah Swamp Run* (021401080766 non-tidal in Charles County); poor biological community.
- *Zekiah Swamp Run Unnamed Tributary 4* (021401080754 non-tidal in Charles County); poor biological community.
- *Bowling Creek* (021401080755 non-tidal in Charles County); poor biological community.
- *Piney Branch Unnamed Tributary* (021401080764 non-tidal in Charles County); poor biological community.
- *Herbert Run* (021401080754 non-tidal in Charles County); poor biological community.
- *Mill Dam Run* (021401080767 non-tidal in Charles County); poor biological community.

Restoration/Preservation

There are large Green Infrastructure hubs in this watershed, including along Zekiah Swamp Run and Cedarville State Forest, and some smaller connecting corridors (DNR, 2000-2003). Protected areas include Cedarville State Forest and some smaller County-owned properties and METs. The majority of hubs are still unprotected, including Zekiah Swamp, and should be high priority for protection. According to the 2000 Maryland Greenways Commission document, there are three existing or proposed greenways including:

- *Gilbert Swamp Run.*
- *Zekiah Swamp.*
- *Mattawoman Creek Greenway.*

The following information is based on the document *Rural Legacy FY 2003: Applications and State Agency Review*. Zekiah Swamp Run includes approximately 31,000 acres. This area is currently largely undeveloped (84%). This area was chosen in order to: protect the ecology of the Zekiah Swamp (including RTE habitat), create wildlife corridors between already protected areas (e.g. Cedarville State Forest and Allen's Fresh Natural Environmental Area), and protect agricultural land and historic sites. The goal is to protect 9,500 acres (31%). Currently, 4,543 acres (15%) of this land are protected through various methods. The sponsor is Charles 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 three State-designated Nontidal Wetland of Special State Concern (WSSC) and two potential WSSCs in this watershed.

- *Zekiah Swamp/Allens Fresh NHA (DNR combined with Zekiah Swamp Macrosite).* This is a large wetland system following Allens Fresh Run and Zekiah Swamp Run. This wetland complex contains hardwood swamp, shrub swamp, emergent marsh, mudflats, vernal pools, and beaver ponds. This swamp is roughly 15,000 acres, being the largest hardwood swamp in the Western shore. It contains several rare species, including three State-Endangered plant species, a

State-Endangered and Federally Endangered bird, and a globally rare stonefly. The Smithsonian Institute designated this swamp as a "Primary Natural Area Recommended for Protection" in 1974. This wetland also provides habitat for forest interior dwelling birds. Since this wetland is immediately upstream of Allen's Fresh NHA, it provides the functions of water quality improvement, flood abatement, and habitat for the NHA (DNR, 1991). This site is largely unprotected.

- *Bryantown Swamp (DNR combined with Zekiah Swamp Macrosite).* This large diverse wetland complex contains floodplain forest, shrub swamp, emergent marsh, and wet meadow. There is a rare plant species in the wet meadow habitat (DNR, 1991). The main threat is a change in hydrology to the site, including possible hydrological changes from recent road construction at the southern border. Other threats are logging and pollutant runoff (McCarthy et al., 1988). This site is not protected.
- *County Line Trail Seep (DNR combined with Zekiah Swamp Macrosite).* This mature tulip-red maple forest contains diverse habitat and a conspicuous absence of non-native plant species. Seepage from the gravelly slopes creates local wet pockets. This site also contains two rare plant species (DNR, 1991). The main threats are changes in hydrology and forest clearing (including on the wetland, adjacent slopes, or upland areas) (McCarthy et al., 1988). This site is protected by Cedarville State Forest.
- *Potential WSSC.* This site is near Pine Hill Estates and is unprotected.
- *Potential WSSC.* This site is near Charles County Gardens and is mostly unprotected with the exception of a County-owned property at the southern end.

Specific recommendations for restoration:

- Restore "gaps" in the Green Infrastructure network to natural vegetation, especially along waterways.
- KCI Technologies, Inc. prioritized Charles County watersheds based on need for stormwater retrofits, as described in the NPDES Annual Report for Charles County. One of the highest ranked (in need of stormwater retrofits)12-digit watersheds was 021401080766 (Charles County, 2003-2004).
- Acquire land of sensitive areas, including those identified along Zekiah Swamp Run and tributaries (Charles County, 1997).
- Charles County prioritized watersheds for restoration, looking only at watersheds totaling greater than 10% of the County's untreated impervious surface. Of the seven study areas identified to be the focus of future restoration, three were within this watershed: Carrington, Pinefield and Pinefield South (Charles County, 2003-2004).
- Restore the scenic Zekiah Swamp.
- Restrict livestock from the streams and shorelines (DNR, 1994).
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect WSSC and buffers.
- Protect portions of Green Infrastructure that are not currently protected, especially along waterways.

- Protect additional DNR-designated Ecologically Significant Areas containing wetlands that are not already protected.
- Protect land within the designated Rural Legacy Area.
- Protect areas within the Resource Protection Zone, outside of the Critical Area, including Zekiah Swamp watershed (Charles County, 1997).
- Protect floodplain swamp areas to maintain anadromous fish productivity (DNR, 1994).
- Preserve remaining Forest Interior Dwelling Bird Habitat (DNR, 1994).
- Focus conservation for both Charles and St. Mary's Counties in the Wicomico River/Zekiah Swamp watersheds (DNR, 1994).
- Acquire land along Allens Fresh and the Zekiah Swamp, with land adjacent to the Zekiah Swamp Natural Environment Area as highest priority (DNR, 1994).
- Protect wetlands and streams within the headwaters.

Port Tobacco River (02140109)

Background

Based on MDP 2002 GIS land use data, the Port Tobacco River watershed has 2,026 acres of open water and 28,075 acres of land. The land acres are divided as follows: urban 6,387 acres (23%), agriculture 5,664 acres (20%), forest 15,746 acres (56%), wetlands 226 acres (1%) and barren land 52 acres (<1%). Since MDP estimates of wetland acreage are often underestimated, DNR wetland data estimates, as discussed later in this document, are preferred.

This river is roughly 8.5 miles long. Stream velocities in the tidal portions are weak. Coastal shallow freshwater marsh lines the tidal portion of the river (MDE, 1998).

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

- Estuarine
    - Emergent: 226 acres
    - Scrub shrub: 4 acres
- Palustrine
    - Aquatic bed: 2 acres
    - Emergent: 97 acre
    - Scrub shrub: 131 acres
    - Forested: 1,179 acres
    - Unconsolidated bottom: 78 acres
    - Unconsolidated shore: 4 acres
    - Farmed: 13 acres
- Total: 1,735 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 (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02140109	-8.04	21.23	0	0	13.19

A large, for-profit consolidated mitigation site is found in this watershed.

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 II: shellfish harvesting; all estuarine portions of tributaries.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. It is also classified as a "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failing indicators include poor SAV abundance and habitat index and poor non-tidal benthic index of biotic integrity (BIBI). Wetland loss was estimated to be 14,830 acres. Indicators for Category 3 include high imperiled aquatic species indicator, migratory fish spawning areas, high percent headwaters in Interior Forest (29%), and high percent watershed being forested.

According to the 2002 305(b) report, the tidal mainstem and tributaries fail to support all designated uses due to nutrients from municipal discharge and nonpoint sources. A portion of the nontidal wadeable streams (4 miles) fully supports all uses, while the other portion (31 miles) had inconclusive results.

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:

- *Port Tobacco River* (non-tidal); A TMDL has been completed for nutrients within this waterway.
- *Port Tobacco River* (tidal); sediments.

A TMDL was approved for nitrogen and phosphorus for Port Tobacco River, as summarized below. This river is designated Use II in the estuarine portion and Use I in the free flowing portion. However, these designations are not being met due to excessive algal blooms (e.g. near Rte. 6) and low dissolved oxygen levels. The goal is to reduce chlorophyll a concentrations to below 52 ug/l and maintain dissolved oxygen levels at or above 5 mg/l. Sources of total nitrogen within the watershed are agriculture (42%), urban (27%), forest (18%), and point sources (13%). Sources of phosphorus are agriculture

(49%), urban (31%), point sources (16%), and forest (4%). Water quality data from August 1984 (assumed to represent conditions similar to the present) found low chlorophyll a levels at the mouth and higher levels upstream (near the edge of the tidal zone). Inorganic phosphorus and nitrates were low in the tidal section and high above tidal zone (with high values found near La Plata STP). TMDLs were designed for both low flow periods and average annual rates, since it is assumed that nutrient-rich soils may be transported during high flows, resulting in water quality problems at the head of the estuary (at the marina).

Restoration/Preservation

Green Infrastructure hubs and corridors are spread throughout the watershed (DNR, 2000-2003). The only portions that are protected are along the mouth of Port Tobacco River (Chapel Point State Park and Maryland Environmental Trust easements). Since some of the Green Infrastructure corridors are currently in agriculture, it may be desirable to restore these sites to natural vegetation. According to the 2000 Maryland Greenways Commission document, there are two existing or proposed greenways including:

- *Potomac River Greenway.*
- *Potomac River Water Trail.*

There are four small State-designated Nontidal Wetlands of Special State Concern (WSSC) in this watershed.

- *Brentland Woods.* This diverse system includes bottomland forest, mesic deciduous forest, and xeric deciduous forest located along a stream, ravine, and surrounding uplands. This watershed is largely forested, which is now an uncommon condition in the area. It also contains many large old trees. There is a healthy population of a rare plant species. This area also provides Forest Interior Dwelling Species habitat and diverse wildlife. Main threats are from logging, invasion of non-native plants, erosion on the logged southern slopes, development, and human disturbance. The road into the site should be blocked to stop the dumping of trash (McCarthy et al., 1988). This site is not protected.
- *Cat Pond.* This 1.5-2 acre healthy seasonal pond is the only one on the Western Shore dominated by herbaceous vegetation. The fluctuating water regime within the pond, flooded during fall, winter, and spring, and dry during summer, excludes woody vegetation and allows the survival of herbaceous plants that complete their life cycle within the short dry season. While no rare species were found during the 1988 survey, the unique habitat is perfect for rare plants and amphibians and due to the seasonal nature of the pond, several visits will be required to observe all species. This site also provides good habitat for migratory waterfowl. The main threats are hydrological changes in the fluctuating water table, logging the surrounding forest, invasion by non-native plants (at the southeastern end of the area), development, and pollution from the adjacent road (McCarthy et al., 1988). This site is not protected.
- *Port Tobacco Run.* This forested site contains a healthy population of a rare plant species that thrives in circumneutral soils. This area also provides habitat for Forest Interior Dwelling birds, amphibians, and reptiles. Main threats include

fragmentation of the floodplain forest, invasion by non-native plant species, changes in hydrology, and logging. A residential development is located to the north of the sensitive species population (McCarthy et al., 1988). This site is not protected.

- *Thomas Stone National Historic Site (DNR name: Thomas Stone Woods).* This site is adjacent to Hoghole Creek and a tributary. It contains deciduous bottomland forest with circumneutral soils and a State Threatened plant species. Beaver activity has created a series of ponds and emergent marsh. Weedy species (i.e. Japanese honeysuckle and Stinging nettle) are invading the site (DNR, 1991). This site is not protected.

According to the Charles County comprehensive plan, the following area along the Potomac River has shoreline erosion rates greater than two feet per year: the eastern shore of Port Tobacco River to Pope's Creek.

Specific recommendations for restoration:

- Restore "gaps" in the Green Infrastructure network to natural vegetation, especially along waterways.
- Acquire land of sensitive areas, including those identified along Port Tobacco and tributaries (Charles County, 1997).
- Restore/create wetlands that provide water quality improvement functions (e.g. nitrogen and phosphorus removal) for Port Tobacco River.
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect WSSC and buffers.
- Protect portions of Green Infrastructure that are not currently protected, especially along waterways.
- Protect additional DNR-designated Ecologically Significant Areas containing wetlands that are not already protected.
- Protect Port Tobacco (Charles County, 2005).
- Protect wetlands that provide water quality improvement function (e.g. nitrogen and phosphorus removal) for Port Tobacco River.
- Protect wetlands and streams within the headwaters.

<u>Nanjemoy Creek (02140110)</u>

Background

Based on MDP 2002 GIS land use data, the Nanjemoy Creek watershed has 2,627 acres of open water and 46,696 acres of land. The land acres are divided as follows: urban 3,564 acres (8%), agriculture 7,089 acres (15%), forest 34,090 acres (73%), wetlands 1,925 acres (4%) and barren land 28 acres (<1%). Since MDP estimates of wetland acreage are often underestimated, DNR wetland data estimates, as discussed later in this document, are preferred.

Upper Nanjamoy Creek is a designated Natural Heritage Area within this watershed. To get this designation, an area must contain threatened or endangered species and be one of the best Statewide examples. Nanjemoy Creek contains one of the largest blue heron rookeries in the region (Basin Summary Team and CBP, 2004a).

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

- Estuarine
  - Emergent: 1,165 acres
  - Unconsolidated shore: 4 acres
- Palustrine
  - Emergent: 232 acre
  - Scrub shrub: 211 acres
  - Forested: 2,434 acres
  - Unconsolidated bottom: 69 acres
  - Unconsolidated shore: 10 acres
  - Farmed: <1 acre
- Total: 4,125 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 (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02140110	-0.45	0.65	0	0	0.20

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 II - shellfish harvesting; all estuarine portions of tributaries.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. It is also classified as a "Selected" Category 3, a pristine or sensitive watershed most in need of protection. Failing indicators include poor SAV abundance and habitat index, poor non-tidal instream habitat index, and high historic wetland loss (36,432 acres). Indicators for Category 3 include high imperiled aquatic species indicator, migratory fish spawning area, high amount of wetland-dependent species, high percent headwater streams in Interior Forest (49%), and high percent watershed being forested.

According to the 2002 305(b) report, results for the tidal mainstem and tributaries were inconclusive. Of the nontidal wadeable tributaries, a portion (40 miles) failed to support all uses, while the other portion (24 miles) had inconclusive results.

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:

- *Nanjemoy Creek* (tidal); nutrients, sediments.
- *Nanjemoy Creek* (021401100777 non-tidal); poor biological community.
- *Nanjemoy Creek Unnamed Tributary* (021401100776 non-tidal); poor biological community.
- *Hill Top Fork Unnamed Tributary* (021401100775 non-tidal); poor biological community.
- *Beaverdam Creek* (021401100777 non-tidal); poor biological community.
- *Hancock Run* (021401100777 non-tidal); poor biological community.

Restoration/Preservation

Green Infrastructure hubs cover the majority of this watershed, although few areas are protected (DNR, 2000-2003). Protected areas are Nanjemoy Creek Preserve, Doncaster Demonstration State Forest, Blossom Point Proving Grounds, a few METs, and County-owned properties. Since some of the Green Infrastructure corridors are currently in agriculture, it may be desirable to restore these sites to natural vegetation. According to the 2000 Maryland Greenways Commission document, a proposed and existing ecological greenway is along Nanjemoy Creek.

There are two State-designated Nontidal Wetlands of Special State Concern (WSSC) and one potential WSSC in this watershed.

- *Doncaster Forest.* This mature forest is unusual since most mature forests have been cleared. It provides diverse habitat due to its age. There are several intermittent streams running through the site. This site also provides good opportunities for recreation and education. Main threats include logging, invasion by non-native plant species (currently in the northern edges), and cutting of surrounding forest (as the interior habitat will be lost) (McCarthy et al., 1988). The southern portion of this site is owned by the Doncaster Demonstration State Forest, while the northern portion is not protected.
- *Upper Nanjemoy Creek.* This site is within Nanjemoy Creek headwaters. It includes mature bottomland forest, shrub swamp, beaver ponds, seasonal ponds, and seepage area. The forest area contains the largest Great Blue Heron Rookery in Maryland. This site also contains some unusual plant species, including one listed as State Endangered and a Federally Endangered bird. The forest is part of a large contiguous forest block. Since this stream is vulnerable to stream erosion, it is critical that the forested watershed be maintained. This site is important to maintaining the Upper Nanjemoy Creek NHA (DNR, 1991). While this site is mostly unprotected, it is partially protected by County land (at the northern end),

a MET (on the east side), and a TNC property (Nanjemoy Creek Preserve at the southern end).

- *Potential WSSC.* There is a potential WSSC along Beaverdam Creek and Hancock Run, connecting with Upper Nanjemoy Creek WSSC. The only protected portion is a TNC property (Nanjemoy Creek Preserve).

Specific recommendations for restoration:

- Restore "gaps" in the Green Infrastructure network to natural vegetation, especially along waterways.
- Acquire land of sensitive areas, including those identified along Nanjemoy Creek and tributaries (Charles County, 1997).
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect WSSC and buffers.
- Protect portions of Green Infrastructure that are not currently protected, especially along waterways.
- Protect additional DNR-designated Ecologically Significant Areas containing wetlands that are not already protected.
- Protect areas within the Resource Protection Zone, outside of the Critical Area, including Nanjemoy watershed (Charles County, 1997).
- Protect wetlands and streams within the headwaters.

Mattawoman Creek (02140111)

Background

Based on MDP 2002 GIS land use data, the Charles County portion of the Mattawoman Creek watershed has 1,851 acres of open water and 44,599 acres of land. The land acres are divided as follows: urban 14,176 acres (32%), agriculture 4,585 acres (10%), forest 25,276 acres (57%), wetlands 546 acres (1%) and barren land 16 acres (<1%). Since MDP estimates of wetland acreage are often underestimated, DNR wetland data estimates, as discussed later in this document, are preferred.

This 13.5-mile waterway is a shallow tidally influenced embayment with an average depth of five feet (MDE, 2003). The watershed has flat land and wide stream valleys, with a gradual slope through the watershed of about 200 feet. These broad stream valley floodplains provide biological and nutrient cycling, pollutant filtering, habitat connectivity, floodwater storage, and stream stabilization. They also contain extensive wetlands, including a low bottomland forest along much of the creek. These wetlands function to remove nutrients and sediments, provide excellent habitat for aquatic species, birds, and other wildlife (including in the protected State Wildlife Management Areas), and are essential to the foodchain. Even with these large remaining wetland areas, there is a huge amount of hydric soil that has been converted from wetlands (USACE, 2003).

A portion of Mattawoman Natural Environmental Area (1,605 acres) is within the Maryland Wildlands Preservation System, suggesting the protected area has retained its wilderness character and/or contains rare species or habitat. The headwaters of Mattawoman are in Prince Georges County.

In a 1981 MDP document, Mattawoman Creek was designated an Area of Critical State Concern. This swamp forest/stream valley area, including the creek and tributaries, include some of the Potomac's most important spawning areas. The tidal wetlands provide a nursery for many fish species and results in a feeding ground for many large fish-eating birds like Great Blue Herons, Common Egrets, and Black-Crowned Night Herons. The tidal wetlands contain some rare and unusual plant species. Other species include otter, mink, beaver, osprey, and a large population of wood duck (MDP, 1981).

The Chapman State Park and Governor Parris N. Glendening Natural Environment Area is a 2,180 acre area located along the Potomac River and Rte. 210. This site has nationally recognized significance due to its historical, archeological, and ecological values. The site is broken into two tracts. The 800-acre North Tract (Chapman State Park), has over two miles of Potomac River shoreline, open fields, forests, streams, and wetlands. This area ranks in the top 10% for Statewide habitat value and diversity. There are some thirty foot high bluffs along the Potomac that are subject to rapid erosion. The 1,300 acre South Tract (Governor Parris N. Glendening Natural Environment Area) is south of Rte. 210 and contains forest and two major stream valleys. This area ranks in the top 20% for State Coastal Plain forest. There are several wetland types within these areas. Sandy seeps form perennial streams and fern belts that contain wetland vegetation, such as Ground pine and Skunk cabbage, and are important habitat for amphibians and box turtles. There are also forested wetlands and wet meadows (with the largest wet meadow being a designated WSSC. Potomac Swamp is a one-mile long non-tidal marsh along the Potomac shoreline, northwest of Mt. Aventine (DNR, 2003a).

This watershed is a significant natural resource. A large portion is within the County's development district. The high development rate within this watershed is negatively impacting the water quality and habitat of the creek. A watershed study was completed by the U.S. Army Corps of Engineers that evaluated predicted future changes in impervious surface and modeled increases in nutrient and sediment loadings based on several management scenarios. This model found that stream valley protection is the most effective management tool. This means that the Mattawoman stream valley (28% of the watershed) should be removed from the development district, according to the study (USACE, 2003).

Great blue heron rookeries are located on Mattawoman Creek (Charles County, 2005).

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

- Estuarine
    - Emergent: 231 acres
    - Unconsolidated shore: 2 acres

- Palustrine
  - Aquatic bed: 10 acres
  - Emergent: 332 acre
  - Scrub shrub: 290 acres
  - Forested: 6,298 acres
  - Unconsolidated bottom: 241 acres
  - Unconsolidated shore: 6 acres
  - Farmed: 21 acres
- Total: 7,432 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 (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02140111	-24.75	44.52	0	0	19.77

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 within the Charles County portion of this watershed are designated Use I, recreation contact and protection of aquatic life.

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 poor SAV abundance and habitat index, poor non-tidal benthic index of biotic integrity (BIBI), poor non-tidal fish index of biotic integrity (FIBI), high population density, high historic wetland loss (47,616 acres), and high soil erodibility (0.34). Indicators for Category 3 include high imperiled aquatic species indicator, migratory fish spawning area, high anadromous fish index, high percent headwater streams in Interior Forest (34%), high percent watershed being forested, and the presence of designated Wildland Acres.

According to the 2002 305(b) report, the tidal mainstem and tributaries fail to support all designated uses due to nutrients. The nontidal mainstem creek fully supports all uses. Of the nontidal wadeable streams, a portion (68 miles) fails to support all uses due to poor biological community, a portion (5 miles) fully support all uses, while the remaining portion (20 miles) had inconclusive results. Results for Myrtle Grove Lake were inconclusive.

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:

- *Mattawoman Creek* (tidal); sediments, nutrients.
- *Mattawoman North Creek* (021401110781 non-tidal in Charles County); poor biological community.
- *Mattawoman North Creek* (021401110786 non-tidal); poor biological community.
- *Mattawoman North Creek* (021401110787 non-tidal); poor biological community.
- *Mattawoman North Creek* (021401110784 non-tidal); poor biological community.
- *Mattawoman North Creek Unnamed Tributary* (021401110786 non-tidal); poor biological community.
- *Mattawoman North Creek Unnamed Tributary* (021401110783 non-tidal in Charles County); poor biological community.
- *Mattawoman North Creek Unnamed Tributary* (021401110781 non-tidal in Charles County); poor biological community.

A TMDL for nitrogen and phosphorus was completed for Mattawoman Creek. This waterway has signs of eutrophication, high chlorophyll a levels, suspended sediments, and biological impacts. Eutrophication is often found during low flow conditions between the tidal and non-tidal water (between Harrison Cut and Route 225). Point sources include the Town of Indian Head WWTP, discharging into Harrison Cut (a tributary five miles from the mouth), and other smaller point sources like Lackey High School, Brandywine Air Force Facility, and Lingafelt Residence. Sources of total nitrogen are air deposition (5%), WWTPs (5%), urban sources (39%), forest (13%), and agriculture (40%). Sources of total phosphorus are air deposition (4%), WWTPs (16%), urban sources (49%), forest (2%), and agriculture (29%). Water sampling found a reading of high chlorophyll a and low dissolved oxygen between Town of Indian Head WWTP outfall and the confluence of Harrison Cut and Mattawoman Creek. Another reading of low DO was found not too far from this point. The TMDLs were set for low and average flow conditions.

Since all of Mattawoman Creek watershed is within the Development District, it is estimated that 20% of the watershed will be impervious surface at build-out. Since this will likely result in stream quality impairments, it would be desirable to find ways of reducing future impervious surface in this watershed (USACE, 2003).

MBSS sampling found fish and benthic rated fair to poor in the headwater areas, as they are associated with higher amounts of development. These ratings improved going west towards the Potomac. This suggests that the headwaters have poorer habitat conditions than the downstream portions, likely due to the conversion of forest and wetlands to development within the headwater areas (USACE, 2003).

Restoration/Preservation

The majority of this watershed is covered in Green Infrastructure hubs, including along Mattawoman Creek, along the Potomac River, and around Myrtle Grove WMA (DNR, 2000-2003). Areas around the mouth of Mattawoman Creek are better protected than other areas. Protected areas include Indian Head Surface Warfare Center, Smallwood State Park, Mattawoman NEA, Myrtle Grove WMA, and County-owned land. The unprotected Green Infrastructure hub along Mattawoman Creek may be a desirable area for preservation. According to the 2000 Maryland Greenways Commission document, there are three existing or proposed greenways including:

- *Potomac River Greenway.*
- *Indian Head to White Plains Rail Trail.*
- *Mattawoman Creek Greenway.*

There are two State-designated Nontidal Wetlands of Special State Concern (WSSC) and four potential WSSCs in this watershed.

- *Mattawoman Creek.* This area is an important fish spawning area and nursery. It also attracts large numbers of waterfowl, has the largest population of nesting wood duck, and contains three rare plant species. Main threats include runoff and sedimentation from new development (MDP, 1981). This site is protected by the State-owned Mattawoman NEA.
- *Pomonkey School Stream (DNR name: Chapman's Forest).* This bottomland forest contains circumneutral soil and a Highly State Rare plant species (DNR, 1991). This site is not protected.
- *Potential WSSC.* This site connects to Pomonkey School Stream WSSC to the south and is partially protected by the State-owned Mattawoman NEA.
- *Potential WSSC.* This site is south of Mason Springs and is unprotected.
- *Potential WSSC.* These sites are south of Chapman Point and are partially protected by the State-owned Mattawoman NEA.
- *Potential WSSC.* This site is south of Indian Head Manor and is not protected.

Another site called Araby Bog is described as being a diverse 6.5 acre Magnolia Bog along a tributary to Mattawoman Creek. This bog is an acidic seep with unique vegetation. This type of bog is uncommon and generally degraded, making this particular site unique for its pristine condition. At the time this document was created, this site was at risk due to the potential nearby development.

Specific recommendations for restoration:

- Restore "gaps" in the Green Infrastructure network to natural vegetation, especially along waterways.
- KCI Technologies, Inc. prioritized Charles County watersheds based on need for stormwater retrofits, as described in the NPDES Annual Report for Charles County. Some of the worst ranked 12-digit watersheds (most in need of stormwater retrofits) are located around Waldorf (subwatersheds 021401110785, 021401110787, 021401110788) (Charles County, 2003-2004).
- Acquire and restore land of sensitive areas, including those identified along Mattawoman Creek and tributaries (Charles County, 1997).

- Charles County prioritized watersheds for restoration, looking only at watersheds totaling greater than 10% of the County's untreated impervious surface. Of the seven study areas identified to be the focus of future restoration, several were within this watershed: Action/Hamilton, Briarwood, Bryans Road, Marbella Delight (Charles County, 2003-2004).
- Stream erosion was found above Wendy Lane (within Marbella Delight area), suggesting the need for stream restoration (Charles County, 2003-2004).
- Control invasive species within Chapman State Park and Governor Parris N. Glendening Natural Environment Area that are threatening the sensitive species (DNR, 2003a).
- Enhance wildlife habitat within Chapman State Park and Governor Parris N. Glendening Natural Environment Area, including connecting existing Greenways that are wildlife corridors (DNR, 2003a).
- Improve the water quality of tributaries originating or running through the Chapman State Park and Governor Parris N. Glendening Natural Environment Area. There are two major stream valleys within the South Tract. The one near Rte. 210 and north of the Southern Maryland Electric Cooperative power line right of way has the poorer water quality of the two, due to development in the headwaters and stormwater runoff. This tributary also has some severely eroded banks from flooding (DNR, 2003a).
- Restore wetlands associated with streams within the Chapman State Park and Governor Parris N. Glendening Natural Environment Area (DNR, 2003a).
- Restore/create wetlands that provide water quality improvement functions (e.g. nitrogen and phosphorus removal) for Mattawoman Creek.
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect WSSC and expanded buffers.
- Protect portions of Green Infrastructure that are not currently protected, especially along waterways.
- Protect additional DNR-designated Ecologically Significant Areas containing wetlands that are not already protected.
- Protect areas within the Resource Protection Zone, outside of the Critical Area, including Mattawoman and tributaries (Charles County, 1997).
- Protect wetlands that provide water quality improvement functions (e.g. nitrogen and phosphorus removal) for Mattawoman Creek.
- Protect tidal wetlands used as reference sites in the DNR tidal wetland vegetative community studies, since they are high-quality systems (Harrison, 2001; Harrison and Stango, 2003).
- Protect wetlands and streams within the headwaters.

<u>Potomac River Upper Tidal (02140201)</u>

Background

Based on MDP 2002 GIS land use data, the Charles County portion of the Potomac River upper tidal watershed has 3,663 acres of open water and 2,059 acres of land. The land acres are divided as follows: urban 267 acres (13%), agriculture 205 acres (10%), forest 1,568 acres (76%), and wetlands 19 acres (1%). Since MDP estimates of wetland acreage are often underestimated, DNR wetland data estimates, as discussed later in this document, are preferred.

The Potomac and Patuxent Rivers provide spawning area for anadromous fish. This river is also important nursery for spot, croaker, gray trout, and white perch (Charles County, 2005).

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: 96 acre
    - Scrub shrub: 22 acres
    - Forested: 602 acres
    - Unconsolidated bottom: 31 acres
    - Unconsolidated shore: 1 acre
    - Farmed: <1 acre
- Total: 752 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 (acres)	Permittee Mitigation (acres)	Programmatic Gains (acres)	Other Gains (acres)	Net Change (acres)
02140201	-5.32	1.00	0	0	-4.32

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 within the Charles County portion of this watershed are designated Use I, recreation contact and protection of aquatic life.

Water Quality

The 1998 Clean Water Action Plan classified this watershed as Category 1, a watershed not meeting clean water and other natural resource goals and therefore needing restoration. It is also classified as a Category 3, a pristine or sensitive watershed in need of protection. Failing indicators include high nitrogen loadings, poor SAV abundance and habitat index, high percent impervious surface (19%), and high population density.

Wetland loss was estimated to be 10,919 acres. Indicators for Category 3 include high non-tidal instream habitat index and migratory fish spawning areas.

According to the 2002 305(b) report, the tidal mainstem and tributaries fail to support all designated uses due to PCBs. A portion of the nontidal wadeable tributaries (22 miles) fails to support all uses due to poor biological community from urban runoff and hydromodification, while the other portion (10 miles) had inconclusive results.

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:

- *Potomac River Upper Tidal*; copper, sediment, nutrients, high pH (nutrient driven), PCBs (in fish tissue).
- *Potomac River Unnamed Tributary* (021402010792 non-tidal); poor biological community.
- *Henson Creek* (021402010797 non-tidal in Prince Georges County); poor biological community.
- *Henson Creek* (021402010796 non-tidal in Prince Georges County); poor biological community.
- *Henson Creek Unnamed Tributary* (021402010797 non-tidal in Prince Georges County); poor biological community.
- *Henson Creek Unnamed Tributary* (021402010796 non-tidal in Prince Georges County); poor biological community.
- *Hunters Mill Branch* (021402010796 non-tidal in Prince Georges County); poor biological community.

Restoration/Preservation

Green Infrastructure hub covers most of the Charles County portion of this watershed (DNR, 2000-2003). Protected areas include Piscataway National Park, Accokeek Foundation, and a small MET. There is still a portion of unprotected Green Infrastructure hub along the Potomac River. According to the 2000 Maryland Greenways Commission document, there are two existing or proposed greenways including:

- *Potomac River Greenway.*
- *Potomac River Water Trail.*

There is one proposed State-designated Nontidal Wetlands of Special State Concern (WSSC) in this watershed. This site is on the Prince George's County border, within Accokeek Foundation land, and is near the Prince George's County WSSC called Johnson's Gully.

The Oyster Recovery Partnership planted large amounts of oyster spat in the Potomac and Patuxent Rivers between 2000 and 2003 (Charles County, 2005).

Specific recommendations for restoration:

- Restore "gaps" in the Green Infrastructure network to natural vegetation, especially along waterways.
- Restore wetlands and streams within the headwaters.

Specific recommendations for protection:

- Protect portions of Green Infrastructure that are not currently protected, especially along waterways.
- Protect additional DNR-designated Ecologically Significant Areas containing wetlands that are not already protected.
- Protect wetlands and streams within the headwaters.