Deer Creek Watershed Restoration Action Strategy

Harford County, Maryland

July 2007

Prepared for:

Harford County
Department of Planning and Zoning
220 South Main Street
Bel Air, Maryland 21014

Prepared by:

KCI Technologies, Inc.
10 North Park Drive
Hunt Valley, Maryland 21030

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In Consultation with the
Deer Creek Stakeholder Committee

Acknowledgement

Deer Creek Stakeholder Committee

The Deer Creek WRAS was developed with cooperation and input from citizen organizations and local, state and federal agencies that represent the interests of the Deer Creek watershed.

Organization	*Representative*
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Harford County Soil Conservation District	Gary Davis
Deer Creek Scenic Rivers Board	Lee McDaniel
Harford County Forestry Board	Charles Day
Harford County Farm Bureau	Candace Lohr
Harford Land Trust	Stephanie Stone
Deer Creek Rural Legacy Board	Charles Day and Lee McDaniel
Lower Susquehanna Heritage Greenway	Mary Ann Lisanti
Izaak Walton League	Jim Thomas
Watershed Alliance of York (PA)	Gary Peacock
Harford County Agriculture Preservation Board	Gene Umbarger
Susquehanna River Basin Commission	Susan Buda
Homebuilders Association	Tim Hopkins
Eden Mill Nature Committee	Mike Kohler and Lou Etgen
Harford Community College	Tami Imbierowicz
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Maryland Department of the Environment (MDE)	Danielle Lucid (WRAS Program Manager)

Development of the Deer Creek WRAS was supported technically by the following assessments and technical reports:

Technical Report	*Representative*
Synoptic Survey	Niles Primrose MDE
Watershed Characterization	Rita Bruckler, Kathleen Ellis, Danielle Lucid, MDE; Ken Shanks, MDNR
Stream Corridor Assessment	Robin Pellicano, MDE
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Acronyms

ACT	Aquatic Conservation Targets
ACUB	Army Compatible Use Buffer
APG	Aberdeen Proving Grounds
BIBI	Benthic Index of Biotic Integrity
BMP	Best Management Practice
CBCA	Chesapeake Bay Critical Area
CDS	Conservation Development Standards
CIP	Capital Improvement Program
CREP	Conservation Reserve Enhancement Program
CWP	Center for Watershed Protection
CWAP	Maryland Clean Water Action Plan
COMAR	Code of Maryland Regulations
DO	Dissolved Oxygen
DPW	Harford County Department of Public Works
EPA	U.S. Environmental Protection Agency
EQIP	Environmental Quality Incentive Program
FIBI	Fish Index of Biotic Integrity
FIDS	Forest Interior Dwelling Species
GIS	Geographic Information System
GNIS	Geographic Names Information System
HCALP	Harford County Agricultural Land Preservation
HLS	Habitat of Local Significance
LSHG	Lower Susquehanna Heritage Greenway
MACS	Maryland Agricultural Water Quality Cost Share
MALPF	Maryland Agricultural Land Preservation Funding
MBSS	Maryland Biological Stream Survey
MCC	Maryland Conservation Corps
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
MDP	Maryland Department of Planning

MET	Maryland Environmental Trust
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System, Stormwater Permits Program
NRCS	Natural Resources Conservation Service
NTU	Nephelometer Turbidity Units, measure of water clarity
PDR	Purchase of Development Rights
PFA	Priority Funding Area
RESAC	Regional Earth Science Applications Center
SCA	Stream Corridor Assessment
SCD	Harford Soil Conservation District
SRBC	Susquehanna River Basin Commission
SSPRA	Sensitive Species Project Review Area
SWM	Stormwater Management
TDR	Transfer of Development Rights
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WAY	Watershed Alliance of York
WHIP	Wildlife Habitat Incentives Program
WIP	Woodlands Incentive Program
WRAS	Watershed Restoration Action Strategy
WRP	Wetlands Reserve Program
WSSC	Wetland of Special State Concern
WTM	Watershed Treatment Model
YCPC	York County Planning Commission

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Executive Summary

The Deer Creek Watershed Restoration Action Strategy (WRAS) was initiated by the Harford County Department of Planning and Zoning to help restore and protect the Deer Creek Watershed. The goal of the WRAS is to protect water quality, conserve fish and wildlife habitats, and restore those areas found to be impaired. The WRAS program is a statewide program that is implemented at the local level with public input and review. The WRAS is a planning document that defines the issues that affect watershed health and provides potential solutions, or management strategies that watershed and landuse managers can use to correct them. The strategies developed in the WRAS work in concert with other existing state and county programs to restore and protect Maryland's waterways and meet the goals of the Chesapeake 2000 Agreement.

The Deer Creek Watershed is 171 square miles in size and is located in Harford and Baltimore Counties in Maryland and York County Pennsylvania. The Deer Creek flows to a confluence with the Susquehanna River. Close to 80 percent of the Watershed is located in Harford County. The Watershed retains a predominantly rural character with land use that is primarily agricultural (54 percent) and forest (30 percent). Less than one percent of the Watershed area lies within Harford County's development envelope and it has an overall existing imperviousness of only 4.3 percent.

The Deer Creek is a State Scenic River and Stream Use classifications include both natural and recreational trout waters. The Watershed is home to many rare, threatened and endangered species and maintains a high level of biodiversity. Sensitive terrestrial habitats are also present including Critical Areas, non-tidal Wetlands of Special State Concern and Habitats of Local Significance.

The Deer Creek Stakeholder Committee, organized for this Study and broadly representative of interests within the watershed, collaboratively identified the Watershed's current assets and set a vision for the desired condition of the watershed. The Committee articulated a vision for the watershed describing a desired future condition to guide the preparation of the Strategy.

> *We envision a healthy, vibrant Deer Creek Watershed by preserving high quality streams and rivers supportive of diverse aquatic life and conserving our treasured natural resources for this and future generations. We celebrate today's rural legacy of farms, forests, historic villages, and scenic parklands.*

Based on this vision, the Committee then set goals and objectives in the areas of Agriculture, Natural Resources, Development, Outreach and Education and Interjurisdictional Coordination. The Deer Creek WRAS Management Strategies were built around the

framework provided by the goals and objectives and include both specific projects and broad strategies applicable to the entire Deer Creek Watershed.

Development of the Deer Creek WRAS relies heavily on technical studies that are a part of the WRAS process including the Watershed Characterization, Synoptic Survey, Stream Corridor Assessment and Maryland Biological Stream Survey. Using data from these studies as well as additional analysis of land use, impervious cover and pollutant loading as indicators, the Deer Creek's subwatersheds were prioritized to identify those areas that are degraded and most in need of *restoration*, and those areas that are of high quality or vulnerable to change, and most in need of *protection*. The overriding theme is that the management strategies will be *targeted* for implementation whenever possible in the highest priority restoration and protection subwatersheds.

Based on the Deer Creek's conditions the *highest priority* strategies are focused on agricultural BMPs, riparian buffer planting, land preservation, and outreach. Harford County Government and the Harford Soil Conservation District will take the lead role in the implementation phase of the plan and success tracking with major support from the Deer Creek WRAS Stakeholder Committee.

1 Introduction

The Deer Creek Watershed Restoration Action Strategy (WRAS) was initiated by the Harford County Department of Planning and Zoning in 2005 to identify and prioritize those subwatersheds and stream systems that are degraded and in need of management efforts and those resources that are of high quality and are in need of protection.

1.1 Deer Creek Watershed Background

The Deer Creek Watershed is the largest watershed in Harford County, covering 38 percent of the County's land area. Other major watersheds in the County include the Bush River, Broad Creek and the Gunpowder River. The entire watershed covers approximately 109,400 acres (171 square miles) across two states and three counties. In Maryland there are 86,000 acres in Harford County, and 7,160 acres in Baltimore County. The Pennsylvania portion of the watershed lies in York County and covers 16,250 acres (see Maps 1 and 2, below).

The Deer Creek flows from it's headwaters in York and Baltimore Counties in a southeasterly direction to a confluence with the Susquehanna River near Susquehanna State Park. Deer Creek lies in the Piedmont physiographic region and is part of the Upper Western Shore Basin.

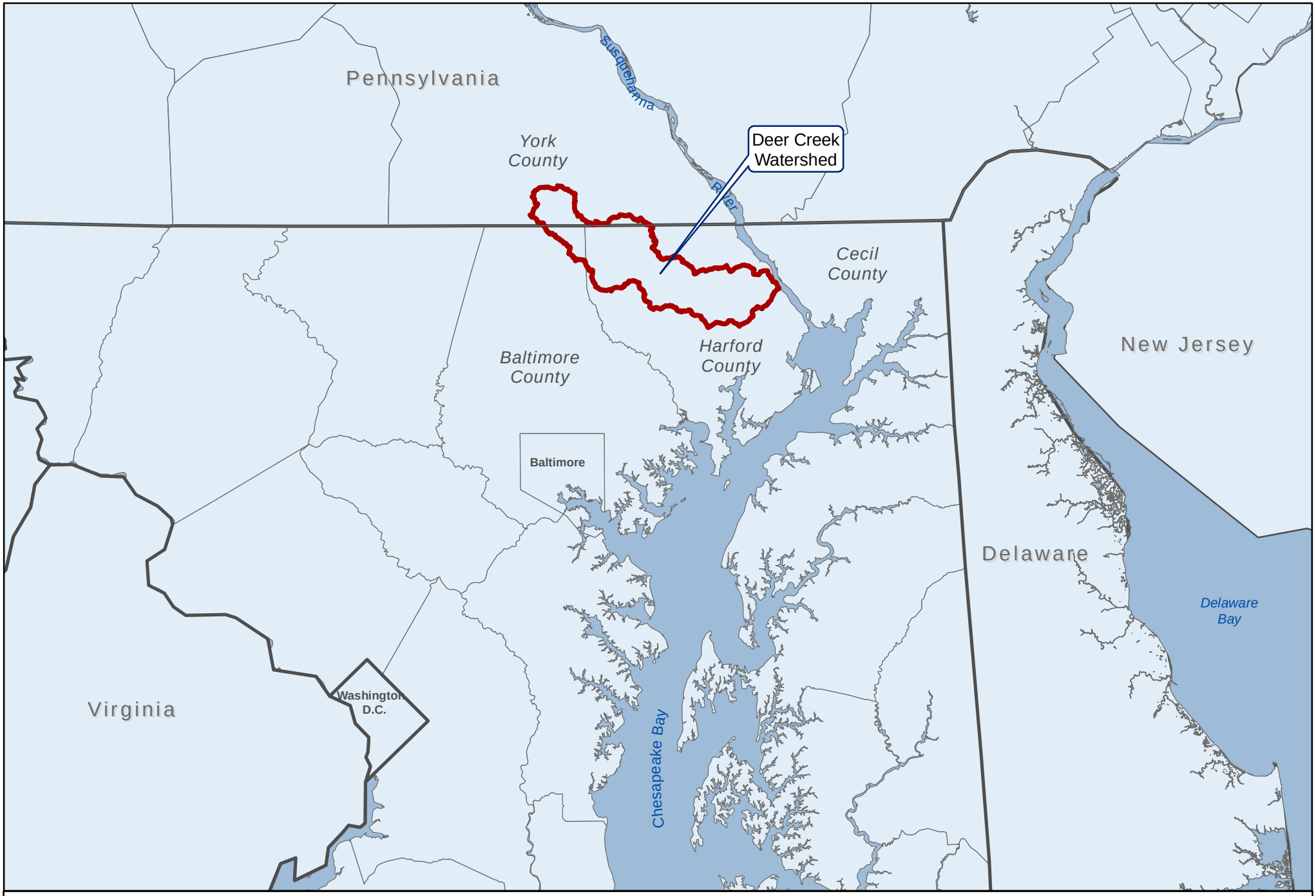
Land use in the Watershed has been historically agricultural. The area retains its agricultural heritage through preservation programs and the watershed lies outside the County's "development envelope." As of 2002 the Harford County portion of the watershed is comprised of agricultural use (54 percent), forest (30 percent) and developed land (15 percent).

Sensitive species in the Watershed include the bald eagle, bog turtle, Davis' sedge, butternut, brook trout, Maryland darter and the logperch. The Deer Creek was named a State Scenic River in 1973; a local Scenic River Advisory Board has been established to promote the protection of the natural and cultural values of Deer Creek. Many streams in the Watershed are designated trout waters.

1.2 WRAS Purpose and Process

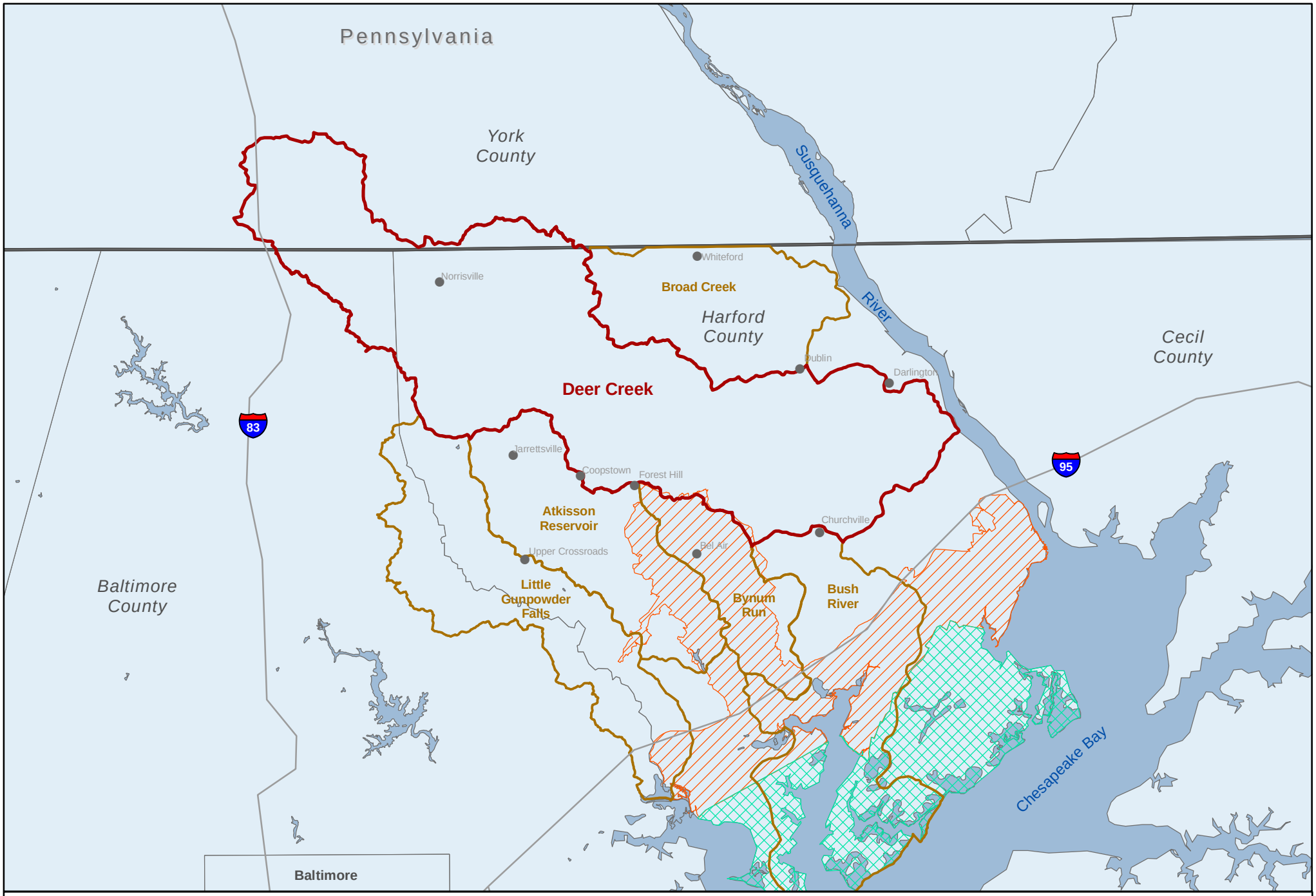
Overview

In 1998, the Maryland Clean Water Action Plan (CWAP) (MDNR, 1998) categorized all 127 of Maryland's eight-digit watersheds for restoration, and protection priority. The Deer Creek was listed as both a Category 1 watershed in need of restoration and a Category 3 watershed indicating that protection measures are also needed. The Deer Creek was further listed as a "Select" Category 3 watershed, which indicates a more pristine or sensitive watershed in need of higher levels of protection.



DEER CREEK
Watershed Restoration Action Strategy

Map 1: Vicinity Map



Deer Creek Watershed

Adjacent 8-Digit Watersheds

Aberdeen Proving Ground

Development Envelope

NORTH

1 inch equals 5 miles

DEER CREEK

Watershed Restoration Action Strategy

Map 2: Watershed Location Map

The CWAP laid the foundation for the WRAS program which was initiated in 2000 as a long term means to characterizing watershed conditions and developing management plans for water quality and habitat restoration and preservation. The WRAS program moves Maryland towards meeting its Chesapeake 2000 Agreement goals.

The WRAS program is intended to work in concert with existing programs such as the Tributary Strategy Program, MDE's Source Water Protection Program, MDE's Total Maximum Daily Load (TMDL) Program and Maryland's National Pollutant Discharge Elimination System (NPDES) Stormwater Permits Program.

The WRAS program is coordinated at the state level by MDE and MDNR and has the support of MDNR's Coastal Zone Division and MDNR's Non Point Source Program. Local governments, with collaboration from citizens and stakeholders hold the primary responsibility for developing the individual WRASs and coordinating implementation. To date, 25 WRASs have either been completed or are in development.

Harford County and Deer Creek

The 2004 Harford County Master Plan and Land Use Element Plan lays out the major policies of the County for addressing future growth and preservation and protection of agricultural and natural resources. The current plan continues the concept of a "Development Envelope", first introduced in the 1977 Master Plan, in which a specific geographic area is designated for planned development. Less than 1 percent of the Deer Creek watershed lies within this "Development Envelope."

Preservation of the rural heritage of the County and protection of the natural environment are major goals addressed in the Land Use Element Plan:

- Goal: Preserve and protect the County's natural environment
- Goal: Protect and preserve the County's agricultural heritage and the continued viability of agriculture

Protection of the County's natural environment focuses on maintaining high quality surface and groundwater resources, and protecting and enhancing the County's wetland and forest resources, open space and greenways, and riparian buffers. Watershed planning is identified as an important tool in this effort.

Protection of its agricultural and rural heritage is of great importance to the County. Many efforts are currently underway to maintain the County's agricultural industry, ranging from a nationally recognized agricultural preservation program to an Agricultural Economic Development initiative addressing the economic viability of agriculture.

The WRAS process supports the goals of the Harford County Master Plan and Land Use Element Plan and strives to address ways to ensure the preservation and protection of the agricultural, water quality and ecological resources of the watershed.

As a means to meet the Plan's guiding principles, Harford County completed a WRAS for the Bush River in 2003. The Bush River Watershed includes approximately 25 percent of the County. With completion of the Deer Creek WRAS, 67 percent of the County will be under current watershed management plans.

The Deer Creek WRAS process began in 2005 with acquisition of grant funding and initiation of the supporting technical studies including the Watershed Characterization, Synoptic Survey and Stream Corridor Assessment (http://dnr.md.gov/watersheds/surf/proj/wras.html). The formation of the Deer Creek Stakeholder Committee followed. The Committee met to collaboratively identify the Watershed's current assets and to develop goals and a vision of the desired future conditions.

2 Vision, Goals and Objectives

2.1 Vision Statement

The Deer Creek Stakeholder Committee adopted the following vision statement that would guide the development of the WRAS.

> *We envision a healthy, vibrant Deer Creek Watershed by preserving high quality streams and rivers supportive of diverse aquatic life and conserving our treasured natural resources for this and future generations. We celebrate today's rural legacy of farms, forests, historic villages, and scenic parklands.*

2.2 WRAS Goals

The goals and vision for the Deer Creek Watershed are based on, and grew out of, the Watershed assets and desired future conditions. The assets and future conditions were developed by the Deer Creek Stakeholder Committee.

Table 1: Deer Creek Watershed Assets

Predominance of agricultural land use	Economic value of Natural Resources
Rural legacy and Agricultural Preservation Areas	Soils – Agricultural productivity and Stormwater Receptor capability
Historical settlement patterns and structures	Forestlands
National Historic Districts	Water resources and source water
Parklands – Rocks State Park, Eden Mill Nature Center, Susquehanna State Park	Unique wetland habitats
Recreational benefits	Neotropical bird habitat
Waterfalls – Kilgore Falls, Falling Branch	Unique flora and fauna
Viewsheds	Lower Susquehanna Heritage Greenway

Table 2: Desired Future Conditions

Maintain rural industries	Improve water quality
Maintain Village character – Darlington and others	Greater Lower Susquehanna Heritage Greenway connections and protection of resources
Additional public lands with greater access	Greater protection of valuable resources
Increased tourism capacity	Greater riparian buffers
Maintain relative distribution of assets	Improve natural hydrologic flows
Continued funding for preservation of agricultural and natural resources	Increased educational opportunities and interpretation of history, culture and natural environment

Broad goals for the WRAS include those developed by the Chesapeake 2000 Watershed Commitments Task Force.

- Address the protection, conservation and restoration of stream corridors, riparian forest buffers and wetlands,
- Improve habitat and water quality,
- Identify implementation objectives, and
- Have demonstrated local support.

In addition the Environmental Protection Agency (EPA) has identified several Watershed Plan Elements (Section 319 of the Clean Water Act) that will be addressed by the WRAS. The elements are listed below with the WRAS sections that address each:

- A. Identification of pollutant causes and sources to achieve load reductions addressed in watershed management plan, (3.2, 3.7, 7.3)
- B. Estimate of load reductions anticipated to be achieved through management measures specified below, (7.3)
- C. Description of non point source management measures necessary to achieve load reductions, (6, 7.3)
- D. Estimate of technical and financial assistance, cost, and authorities necessary to implement the watershed management plan, (6, 7.6)
- E. Information or education component to enhance public understanding of watershed management, (6)
- F. Schedule for implementing the non point source management measures specified in plan, (6)

- G. Interim, measurable milestones to determine implementation of non point source management measures, (6)
- H. Criteria to determine if load reductions are being achieved, and a (6, 7.5)
- I. Monitoring component to evaluate effectiveness of implementation efforts (7.5)

The final goals and objectives of the Deer Creek WRAS are listed below. They are split into several categories; Agriculture, Development, Natural Resources, Education and Outreach, and Interjurisdictional Coordination. The goals and objectives in each of these categories became the framework for which the Management Strategies were constructed. The Deer Creek WRAS is developed based on a 10 year planning horizon.

Table 3: Goals and Objectives

AGRICULTURE	
Goal	Promote the recognition of the value of farming, awareness of best management practices, preservation of farmland and financial resources necessary for their implementation.
Objective 1	Promote the awareness of and implement best management practices in agricultural areas in order to protect water quality.
Objective 2	Preserve agricultural land to maintain the rural character of the watershed and preserve habitats.
NATURAL RESOURCES	
Goal	Manage natural resources on a sustainable basis, including forests, wetlands, stream corridors, sensitive species and wildlife.
Objective 1	Protect and restore stream corridors.
Objective 2	Protect and restore forest and wetland resources.
Objective 3	Protect sensitive species habitat in order to maintain a high level biodiversity.
Objective 4	Undertake additional research in order to protect and improve water quality and natural resources.
DEVELOPMENT	
Goal	Utilize sustainable development and implementation approaches to manage impervious surfaces and protect water quality.
Objective 1	Minimize the impacts of new development.
Objective 2	Reduce the impact of existing development on water quality and natural resources.

EDUCATION AND OUTREACH	
Goal	Develop and promote watershed awareness and stewardship.
Objective 1	Promote a stewardship ethic among residents in the watershed through an understanding of watershed values and issues.
Objective 2	Promote projects that encourage public access and public environmentally-oriented education and recreation.
INTERJURISDICTIONAL COORDINATION	
Goal	Network with regional jurisdictions to address common goals of water quality protection and environmental stewardship.

3 Watershed Conditions

The Deer Creek WRAS development is supported by several technical studies and documents completed in 2005-2006. They include the Deer Creek Watershed Characterization (MDE, 2006a), the Report on Nutrient Synoptic Survey (MDE, 2006b) and the Stream Corridor Assessment (MDE, 2006c) (http://dnr.md.gov/watersheds/surf/proj/wras.html), MDNR provided aquatic condition assessment in the form of an Aquatic Conservation Target analysis (MDNR, 2006) and raw and summarized data from the Maryland Biological Stream Survey (MBSS).

The data collected and analyzed in these studies enhances the WRAS development by providing a watershed-wide assessment of the current status of water quality, biological condition, stream condition, land use and general watershed health. The data was used to prioritize the subwatersheds for restoration and protection and to select specific candidate sites for restoration. The reports are summarized below with additional information added.

3.1 Watershed Characterization

The Deer Creek Watershed Characterization (MDE, 2006a) is a summary of existing data resources and overall characterization of water quality, living resources, habitat and landscape. In addition, the report highlights related projects and restoration targeting tools. The Characterization, as support to the WRAS, meets several objectives:

- Summarize available information and issues,
- Provide preliminary findings based on this information,
- Identify sources for more information or analysis,
- Suggest opportunities for restoration work, and
- Provide a common base of knowledge about the watershed for government, citizens, businesses and other interested groups.

3.1.1 Water Quality

Use Designations

The Maryland Department of the Environment (MDE) has established acceptable standards for several water quality parameters for each designated Stream Use Classification. These standards are listed in the *Code of Maryland Regulations (COMAR) 26.08.02.01-.03 - Water Quality* (MDE 1994). The Deer Creek is classified in portions as Use III-P, which is natural trout waters and public water supply and as Use IV-P, which is recreational trout waters and public water supply. The acceptable standards for Use III-P and Use IV-P are listed below.

Table 4: COMAR Standards

Parameter	Units	Acceptable COMAR Standard
pH	standard pH units	IV-P and III-P: 6.5 to 8.5
Temperature	degrees Celsius, °C	IV-P: maximum of 75°F (23.9°C) or ambient temp. of the surface water, whichever is greater. III-P: maximum of 68°F (20°C) or ambient temp. of the surface water, whichever is greater. IV-P and III-P: a thermal barrier that adversely affects aquatic life may not be established.
Dissolved Oxygen (DO)	milligrams per liter, mg/L	IV-P: may not be less than 5 mg/l at any time. III-P: may not be less than 5 mg/l at any time, minimum daily average not less than 6 mg/l.
Turbidity	Nephelometer Turbidity Units, NTU	IV-P and III-P: maximum of 150 NTUs and maximum monthly average of 50 NTUs
Toxics	na	IV-P and III-P: All toxic substance criteria to protect fresh water organisms, public water supply and the wholesomeness of fish for human consumption.

In the Deer Creek watershed the Use III-P designation is applied to all bodies of water above Eden Mill Dam and the following streams below the dam:

- - Kellogg Branch and all tributaries
- - North Stirrup Run and all tributaries
- - South Stirrup Run and all tributaries
- - Gladden Branch and all tributaries
- - Rock Hollow Branch and all tributaries

Use IV-P is applied from the mouth of Deer Creek to Eden Mill Dam, excluding the streams listed above.

Deer Creek is used as a source of public drinking water supply for about 12,000 people in the Aberdeen Area of Aberdeen Proving Ground (APG). The Source Water Assessment for Deer Creek at the Chapel Hill Water Treatment Plant (MDE, 2005), report indicates that both point and non-point sources of contamination exist in the watershed. Non-point sources are the most significant contributors. From a public drinking water supply perspective, the report indicates that turbidity (sediment), disinfection byproduct precursors and pathogenic microorganisms are the contaminants of most concern. High turbidity levels are associated with erosion and sediment transport during storm flows. *E. coli* and fecal bacteria were present consistently in Deer Creek during a two-year sampling program, with the highest concentrations occurring in association with rainfall.

Impaired Waters 303(d)

Stream and water bodies not meeting their use criteria are listed on MDE's Section 303(d) list of impaired waters. Since 2002 several segments of the Deer Creek watershed have been listed and delisted based on MBSS fish and benthic macroinvertebrate data for biological impairments with unknown causes. As of the current 2006 303(d) list for the Deer Creek, several subwatersheds are included for biological impairment. All are low priority for TMDL development.

Table 5: Deer Creek 303(d) list segments

Listing Category	Code	WRAS Subwatershed Name
2	02120202	Deer Creek
	021202020321	Lower Deer Creek
	021202020322	Lower Deer Creek Tobacco Run Coolbranch and Lower Deer Creek Mill Hopkins Hollands Graveyard
	021202020327	Middle Deer Creek Rock Hollow Wet Stone
	021202020329	Falling Branch
	021202020331	Big Branch
3a	021202020323	Thomas Run
	021202020324	Middle Deer Creek St. Omar, Middle Deer Creek, Middle Deer Creek Kellogg
	021202020326	Stirrup Run
5	021202020325	Stout Bottle Cabbage Run
	021202020330	Upper Deer Creek Jackson Branch and Island Branch
	021202020328	Little Deer Creek Lower and Upper
	021202020332	Upper Deer Creek Plumtree

Listing Categories

2: meeting some standards but insufficient information to determine attainment of other standards

3a: insufficient quantity of data and information to determine waterbody attainment status

5: waterbodies that may require a TMDL

3.1.2 Living Resources and Habitat

Aquatic Resources

Because living resources are dependent on water systems, information on living resources is included as a measure of the water quality and habitat conditions of the Watershed.

Overall the diversity community structure of the fish and benthic macroinvertebrate populations is good. A total of 75 sites were sampled by MBSS from 1995-2005 with 52 sites sampled for fish and 63 sampled for benthic macroinvertebrates. Additionally, 171 sites were sampled by the Stream Waders volunteer program from 2000-2005 (MDNR, 2006). Their Benthic and Fish Indices of Biotic Integrity (BIBI and FIBI) scores and ratings are listed below. The majority of sites were rated as either Good or Fair.

Table 6: Summary MBSS and Stream Waders Data

Type	Source	Sample Number	Good	Fair	Poor	Very Poor
BIBI	MBSS	63	39 (61.9)	20 (31.7)	2 (3.2)	2 (3.2)
BIBI	Stream Waders*	171	45 (26.3)	91 (53.2)	26 (15.2)	9 (5.3)
FIBI	MBSS	52	26 (50.0)	15 (28.8)	4 (7.7)	7 (13.5)

* Stream Waders assessment uses a family level BIBI rather than the genus level BIBI used by MBSS.

MDNR's Fish Passage Program has identified seven current blockages to fish passage and migration in the Deer Creek Watershed. The SCA identified 67 fish passage barriers, although none were more severe than moderate. Thirty of the barriers were considered partial or temporary. Of the 37 considered to be a total blockage, 14 were natural features, 3 were instream ponds, 1 was sandbags, and 19 were road crossings. MDNR Fisheries maintains trout fishery information. Trout areas currently are located on stream segments in 10 of the 20 WRAS subwatersheds

Sensitive Species and Habitats

Sensitive species in the Watershed have been identified by MDNR's Wildlife and Heritage Service. Among those listed in Harford County are the bald eagle, bog turtle, brook trout, Maryland darter and the logperch. Chesapeake Bay Critical Area (CBCA) includes all lands within 1,000 feet of tidal waters or adjacent to tidal wetlands. These areas are subject to more stringent development guidelines. Critical Area in the Deer Creek Watershed is minimal and is concentrated in Lower Deer Creek and primarily in Susquehanna State Park. This area also includes one of two nontidal Wetlands of Special State Concern (WSSC). The other is the Deer Creek Serpentine Barren, which is an area of serpentine rock formations, prairie-like grasses and unique species. The Critical Area Program has also identified Habitats of Local Significance (HLS) in the County that provide specialized habitat to rare threatened or

endangered species. Five habitats have been identified in the Deer Creek Watershed including Deer Creek Hillside, Stafford Road Slopes, the Northern Susquehanna Canal, Elbow Branch, and the Deer Creek Pumping Station.

3.1.3 Landscape

The activities on the land have both direct and indirect impacts on water quality, terrestrial and aquatic habitat, and biota. Analysis of land use and impervious surfaces was completed for the WRAS for the entire Deer Creek Watershed including Baltimore and York Counties. Descriptions of the methods and results are located in sections 3.6 and 3.7. The results of the Characterization Report for growth projections and other landscape issues are summarized below.

Development and Growth

Under Maryland's Planning Act and Smart Growth Initiatives Priority Funding Areas (PFA) were created where development and infrastructure support would be targeted. In Harford County the main PFA is the Development Envelope. Less than 1 percent of the Deer Creek Watershed lies within the envelope at the very southern upstream end of Stout Bottle Cabbage Run, Middle Deer Creek St. Omar and Thomas Run. Rural Villages were also created as PFAs in rural parts of the County. One is located entirely within the Watershed in Upper Deer Creek Plumtree and Upper Deer Creek Jackson Branch. Five other Rural Villages are located on the fringes of the Watershed.

Population growth data has been updated in Harford County since the Characterization for inclusion in the WRAS. According to 2006 data analysis, 11.2 percent of Harford County residents live in the Deer Creek Watershed as of 2005. The watershed saw an increase in population of 19 percent from 1990 to 2000 at an annual growth rate of 1.9 percent. Population is projected to increase by 3,385 persons from 2005 to a total number of 29,925 by 2015.

Table 7: Deer Creek Population Summary (Harford County)

	1990	2000	2005	2015 (projected)
Population	21,100	25,090	26,540	29,925
Households	7,170	8,730	9,435	10,970

Development in the County is concentrated in the Development Envelope; however some residential development does occur in the watershed. An average of 135 building permits were issued each year in the Deer Creek Watershed between 1998 and 2004 representing 7.3 percent of the County total. Based on Harford County Agricultural Land Inventory completed in 2002 there are estimated to be approximately 3, 940 undeveloped residential lots.

According to the Harford County Commercial Land Inventory, which was updated in 2004, there are 416 acres of commercially zoned vacant land.

Protected Lands

Protected lands are any areas that have long-term established limitations on conversions to a developed use. There are many types of protections in Deer Creek varying from public ownership, to the many types of easements. Between State and County Parks, 3,474 acres or 4 percent of the Maryland portion of Deer Creek is public. Permanent easements on private land in Deer Creek are primarily held in agricultural easements. Lesser amounts are held in Conservation easements. The total Deer Creek easement acreage in Maryland as of June 2007 is 27,099 or 29 percent of the watershed in Maryland. Total protected lands are 32 percent of the Maryland watershed.

Maryland's Rural Legacy Program seeks to protect valuable agricultural, forestry and natural and cultural resources. The Lower Deer Creek Valley Rural Legacy Area was established in 1999 to aid protection of the Deer Creek Watershed through easements.

Forest and Wetlands

Forests and wetlands provide critical habitat and environmental benefits such as filtering and cooling air and water, trapping sediment and pollutants and attenuating stream flows. The Maryland portion of the Deer Creek Watershed contains 29,418 acres of forested area. Of this, 12,099 acres (41%) is considered high quality forest interior dwelling species (FIDS) habitat. High quality FIDS habitat is mature forest of at least 100 acres in size with at least 25% of the total area with the forest edge at least 300 feet away. This high-quality forest is preferred by certain species that require a type of habitat isolated from non-forested areas. Additional forest area in the Watershed includes 5,151 acres of large block forest habitat (18% of total forested area) and 12,168 acres (41%) of other forested land.

Deer Creek Watershed contains both riverine and palustrine wetlands. Riverine wetlands are freshwater wetlands generally found on floodplains adjacent to rivers and streams. Palustrine wetlands are freshwater wetlands associated with high water tables and ponding in upland depressions and include inland marshes and bogs. Conservatively, there are an estimated 410 acres of wetlands in the Maryland portion of the Deer Creek Watershed. This includes all types of freshwater wetlands, with the majority being palustrine wetlands. Tracking of wetland permitting by MDE indicates that the Deer Creek Watershed experienced a small net gain in wetlands of 1.12 acres for the period from 1991 to 2005.

3.2 Synoptic Survey

The synoptic survey is a watershed-wide one time sampling of several water chemistry parameters and stream discharge measurements. The sampling and analysis are completed by MDE's Technical and Regulatory Services Administration. Several parameters; nitrate/nitrite yield, pH, conductivity and temperature were utilized in the prioritization of restoration subwatersheds. The following provides a summary of the methods and results of the Nutrient Synoptic Survey (MDE, 2006b) conducted in support of the Deer Creek WRAS.

3.2.1 Methods

The survey was completed in April of 2005 at 104 sites located throughout the watershed. Water quality grab samples were collected mid-stream just below water surface. A 24-hour dry time was observed following rainfall events totaling 0.25 inches. Stream discharge measurements were taken at each site along with physical water quality measures including water temperature, dissolved oxygen, pH and conductivity. Drainage areas to each site were delineated using available mapping.

Each sample was analyzed for concentrations in milligrams per liter (mg/L) of Nitrate/Nitrite (NO_2+NO_3) and Orthophosphate (PO_4). By applying the stream discharge and the drainage area a pollutant yield was calculated in kilograms per hectare per day (Kg/ha/day).

Ratings of ranges for nutrient concentrations and yield were derived from Frink (1991) with lower concentrations developed from forested watersheds and higher concentrations from intensively agricultural watersheds.

Table 8: Nutrient Ranges and Rating (from MDE, 2006b)

Rating	Nitrate/Nitrite Concentration (mg/L)	Nitrate/Nitrite Yield (Kg/ha/day)	Orthophosphate Concentration (mg/L)	Orthophosphate Yield (Kg/ha/day)
Baseline	<1	<0.01	<0.005	<0.0005
Moderate	1 to 3	0.01 to 0.02	0.005 to 0.01	<0.0005 to 0.001
High	3 to 5	0.02 to 0.03	0.01 to 0.015	0.001 to 0.002
Excessive	>5	>0.03	>0.015	>0.002

3.2.2 Results and Conclusions

The following are direct excerpts from the Synoptic Survey Report (MDE, 2006b). In the Synoptic Survey "subwatersheds" refer to drainage areas to each of the sampling sites.

Nitrate/nitrite

Nitrate/nitrite concentrations were found to be excessive (>5 mg/L) in twenty-one subwatersheds, high (3-5 mg/L) in forty-four, moderately elevated (1-3 mg/L) in thirty-five, and baseline (<1 mg/L) in the remaining four subwatersheds. Instantaneous nitrate/nitrite yields were found to be excessive (>.03 Kg/ha/day) in sixty-seven subwatersheds, high (.02-.03 Kg/ha/day) in nine, moderate (.01-.02 Kg/ha/day) in six, and baseline (<.01 Kg/ha/day) in seven. Yields were not calculated in the remaining fifteen subwatersheds.

Orthophosphate

Excessive concentrations (>.015 mg/L) of orthophosphate were found in eleven subwatersheds, high concentrations (.01- .015 mg/L) in thirteen, moderate concentrations (.005- .01 mg/L) in thirty-five, and the remaining forty-five were below baseline (<.005 mg/L). Orthophosphate yields were found to be moderate (.0005-.001 Kg/ha/day) in two watersheds, and baseline (<.0005 Kg/ha/day) in eighty-seven. Yields were not calculated in the remaining fifteen subwatersheds.

Physical Water Quality

No significant anomalies were found in the in situ measurements of dissolved oxygen. Marginally depressed ph values (<6.5) were found in four subwatersheds. Six subwatersheds in the Deer Creek watershed had low specific conductivity (<100 mS/cm). Relatively high temperatures (>18 C) were found in 2 subwatersheds.

Summary

Moderately elevated nitrate/nitrite concentrations may be associated with row crop and animal agriculture, and communities on well and septic. Elevated ground water discharges due to a wet spring appear to be responsible for the elevated nitrate/nitrite yields. The nutrient concentrations found in the Deer Creek watershed are very similar to those found in neighboring and similar watersheds across the state.

The results of this nutrient synoptic survey indicate that nutrients, especially nitrate/nitrite, could be considered a water quality problem in the Deer Creek watershed. The source of these nutrients appears to be a combination of row crop and animal agriculture, and residential septic. The minor anomalies found in the in situ measurements of pH, specific conductivity, and temperature are not current threats to water quality, but should be considered when formulating a watershed management plan.

3.3 Stream Corridor Assessment

The Stream Corridor Assessment (SCA) provides an on-the-ground descriptive inventory with spatial locations of various instream and riparian features related to stream and riparian

condition and restoration potential. The SCA was carried out by staff from MDE, Maryland Conservation Corps (MCC) and Harford County Government. The SCA data collected for the Deer Creek was utilized in selecting Candidate Sites for restoration measures. The following provides a summary of the methods and results of the SCA (MDE, 2006c) conducted in support of the Deer Creek WRAS.

3.3.1 Methods

The SCA methodology (MDNR, 2001) was developed by the MDNR Watershed Services and has been used on non-tidal streams for nearly all WRASs completed in Maryland. The main objectives of the SCA are to provide:

- A list of observable environmental problems present within a stream system and along its riparian corridor.
- Sufficient data on each problem in order to make a preliminary determination of both the severity and correctability of each problem.
- Sufficient data to prioritize restoration efforts
- A quick assessment of both in- and near-stream habitat conditions to make comparisons among the conditions of different stream segments.

Each problem site was mapped and rated (1-5) for Severity, Correctability and Accessibility where 1 represents the most severe, the most easily correctable and the most readily accessible problem sites. Conversely a rating of 5 represents a minor problem with very difficult correctability and access.

Due to Deer Creek's large watershed size and time/funding constraints, the SCA was completed for only a portion of the Watershed. Several areas were targeted for the SCA based on the 2002 303(d) listing, their level of development, and location of sensitive resources. Additionally, property owner permission limited access to the stream network.

Fieldwork was completed on 58 miles of streams between March 2005 and June 2005 for streams in the Tobacco Run, Coolbranch Run, Mill Brook, Hopkins Branch, Hollands Branch, Graveyard Creek and Big Branch. In February of 2006 the 15 additional miles were completed on Little Deer Creek, Rock Hollow Branch, Elbow Branch and two unnamed tributaries.

3.3.2 Results and Conclusions

Erosion sites and inadequate buffers were the most prevalent type of problem and together made up 65 percent of the 305 total problems sites identified. A high percentage of the problems were in the minor to moderate range. Overall 89 percent of problems were minor to

moderate. Other than erosion sites and inadequate buffers no other problems were rated higher than moderate. Only 1.8 percent of erosion sites were severe and a total of 32 inadequate buffers, 35.6 percent, were rated severe and very severe.

Table 9: SCA Summary Results (from MDE, 2006c)

Potential Problems Identified	Number	Estimated Length	Very Severe	Severe	Moderate	Low Severity	Minor
Erosion Sites	109	100,968 feet (19.13 miles)	0	2	55	34	18
Inadequate Buffers	90	108,125 feet (20.46 miles)	24	8	23	10	25
Fish Barriers	67		0	0	8	11	48
Pipe Outfalls	16		0	0	8	1	7
Unusual Conditions	8		0	0	4	3	1
Channel Alteration	6	940 feet	0	0	1	0	5
Trash Dumping	6		0	0	1	1	4
Exposed Pipes	3		0	0	1	1	1
Total	305		24	10	101	61	109

The spatial distribution of sites indicates that the majority of problems were located in Big Branch (91) and Tobacco Run (41) with fewer problems in Coolbranch Run (29) and Hollands Branch (22). Even fewer problems were identified in Hopkins Branch (14), Graveyard Creek (11) and Mill Brook (10).

Overall the absence of severe and very severe ratings in the SCA data for Deer Creek reinforces the current picture of the Watershed as one of good biological health. Additionally the data indicates that inadequate buffers are perhaps having the greatest impact on the streams that were assessed. The procedures for incorporating the SCA data into Restoration Candidate Sites is described in section 5.

3.4 Subwatershed Delineation

It is difficult to develop a specific understanding of conditions and specific recommendations of measurable management strategies at the scale of the Deer Creek Watershed without breaking the study area into smaller more manageable units. The Deer Creek Watershed, which is 171 square miles, is an 8-digit Maryland watershed (02120202) that includes 12, 12-digit watersheds. This breakdown was used in the Watershed Characterization. The 12-digit watersheds include only the Maryland portion, which excludes Pennsylvania, and range in

size from 5.8 square miles to 24.3 square miles. For the purposes of the WRAS the Pennsylvania portion of the watershed was added and the original 12-digit subwatersheds were modified to develop a final total of 20 subwatersheds ranging in size from 6.27 square miles to 14.11 square miles with a an average size of 8.5 square miles. Each of the 20 subwatersheds was given a numerical ID from 1-20 that was used throughout the development of the WRAS. In large part the original 8-digit boundary was not adjusted during the delineation. The final subwatershed delineation is shown on Map 3.

Table 10: Deer Creek WRAS Subwatersheds

ID	Subwatershed	Area (acres)	Area (mi^2)	Stream length (miles)	County
1	Big Branch	5,145	8.04	12.37	H, Y
2	Falling Branch	4,749	7.42	9.90	H, Y
3	Island Branch	4,179	6.53	12.10	H, Y
4	Little Deer Creek Lower	5,143	8.04	14.20	H
5	Little Deer Creek Upper	3,879	6.06	11.16	H
6	Lower Deer Creek	6,462	10.10	21.40	H
7	Lower Deer Creek Mill Hopkins Hollands Graveyard	9,033	14.11	27.24	H
8	Lower Deer Creek Tobacco Run Cool Branch	5,382	8.41	15.81	H
9	Middle Deer Creek	4,012	6.27	9.50	H
10	Middle Deer Creek Kellogg	4,386	6.85	12.94	H
11	Middle Deer Creek Rock Hollow Wet Stone	5,825	9.10	17.34	H
12	Middle Deer Creek St. Omar	7,123	11.13	17.62	H
13	Stirrup Run	4,199	6.56	12.66	H
14	Stout Bottle Cabbage Run	4,653	7.27	11.48	H
15	Thomas Run	5,290	8.27	12.82	H
16	Upper Deer Creek 1	4,898	7.65	15.83	B, Y
17	Upper Deer Creek 2	6,215	9.71	17.15	Y
18	Upper Deer Creek Ebaughs Creek	4,404	6.88	13.59	B, Y
19	Upper Deer Creek Jackson Branch	6,663	10.41	22.22	H, B
20	Upper Deer Creek Plumtree	7,705	12.04	25.56	H, B, Y

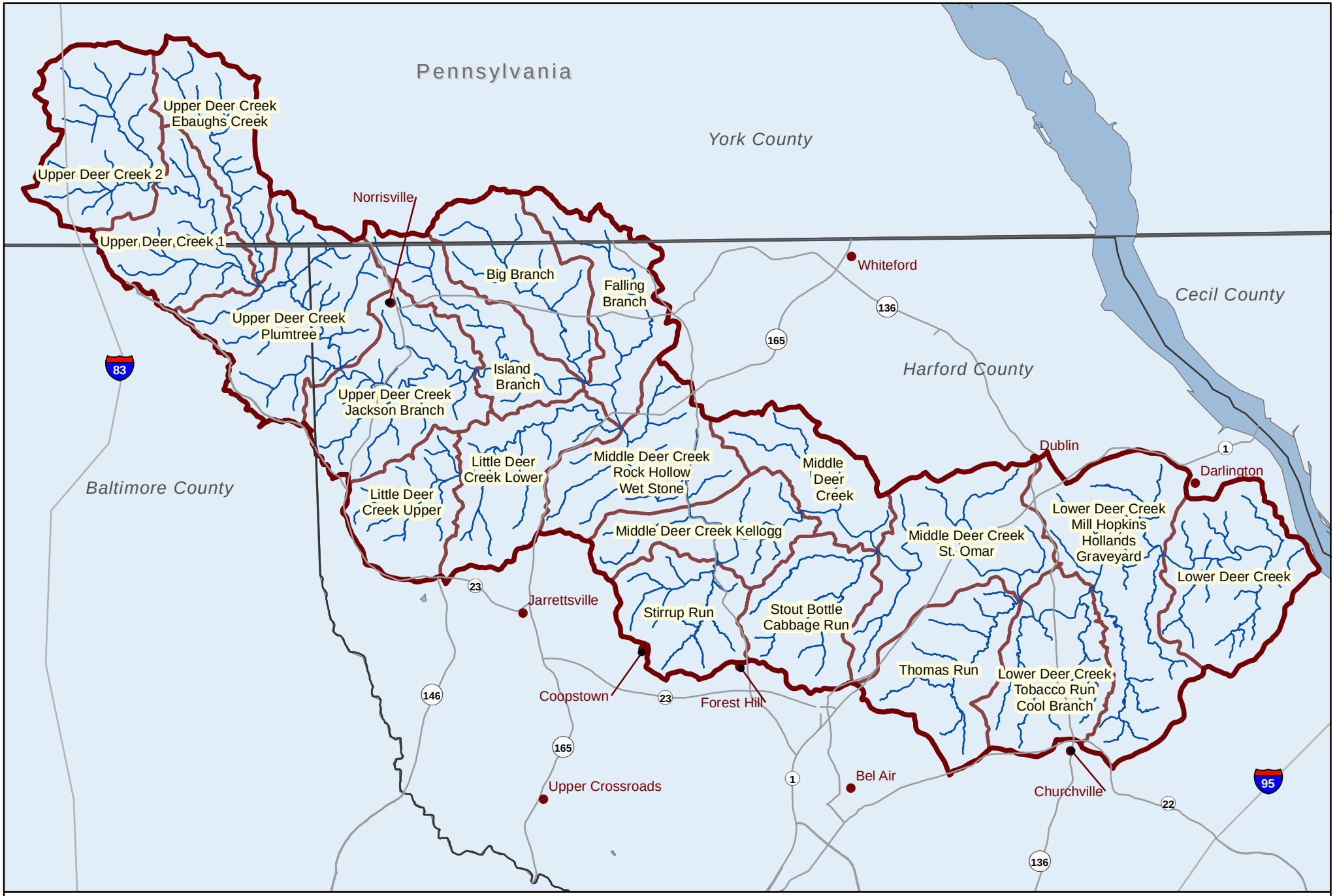
3.5 Land Use

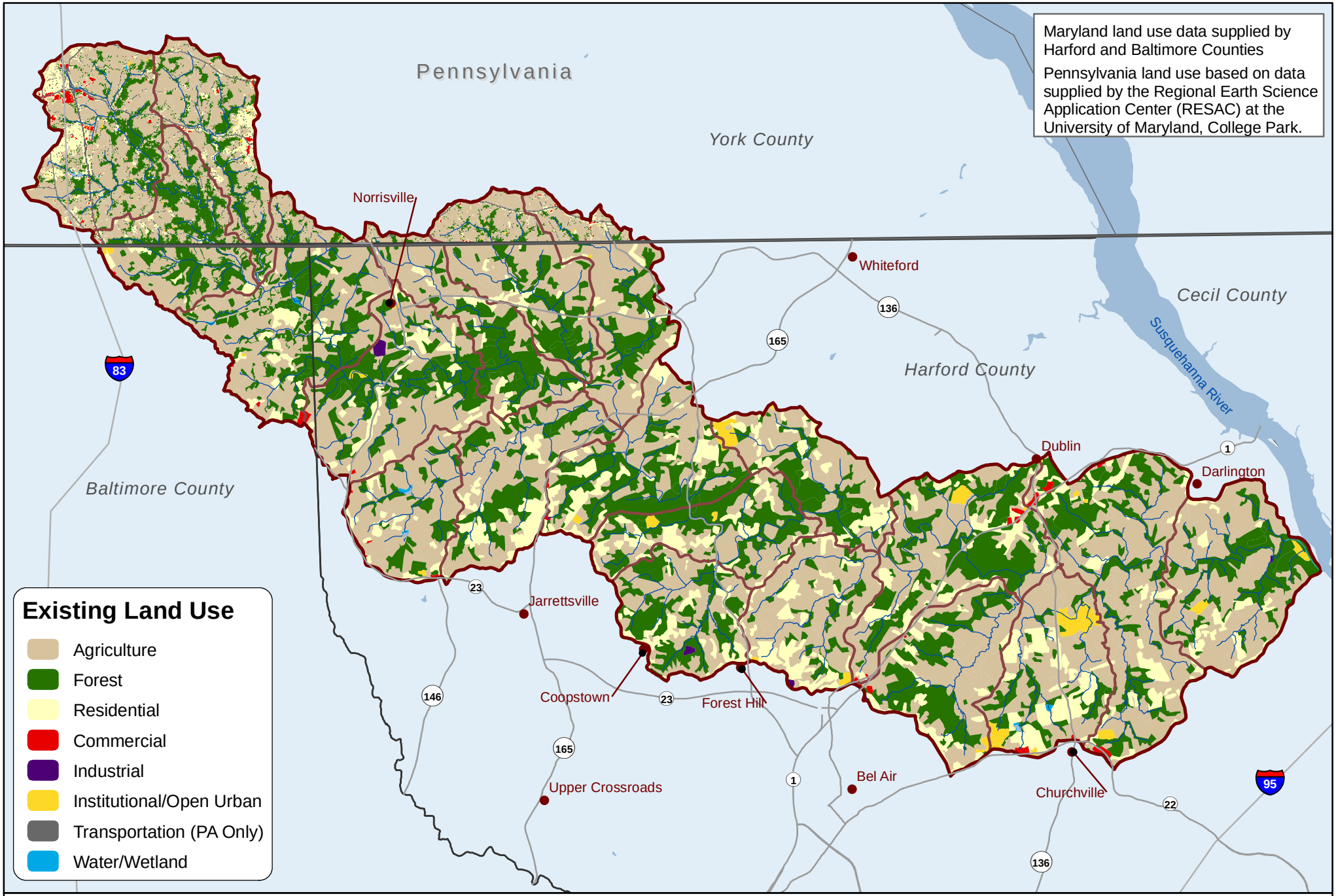
Analysis of the changes in land use from existing to future conditions is used as a screening tool to distinguish those areas of the Watershed that may be impacted currently from existing land use, and in the future from development pressures.

3.5.1 Methods

GIS land use layers were supplied by Harford and Baltimore Counties for the Maryland portion of the Watershed. Baltimore and Harford Counties use standard Maryland Department of Planning (MDP) land use codes which identifies 24 separate land use classifications (Anderson Level II system). For Pennsylvania the York County Planning Commission (YCPC) supplied land use data; however, there were only seven classifications and the data did not meet the needs of the study. Instead a raster based land cover dataset from the Regional Earth Science Applications Center (RESAC) at the University of Maryland was used for Pennsylvania. The RESAC land cover map was developed for the entire Chesapeake Bay Watershed (RESAC, 2003) using 30 meter grids and a land cover classification using 21 separate classes modified from the Anderson Level II system. Land use classifications in the Pennsylvania portions of Deer Creek were matched as closely as possible to those in the Maryland portion of the watershed. Map 4 shows the existing Maryland and Pennsylvania land use in the Deer Creek Watershed.

Zoning mapping was used to determine future land use conditions (see Map 5). For the Maryland portions of the Watershed, zoning GIS layers were supplied by Harford and Baltimore Counties. For the Pennsylvania portions of the watershed, data was supplied by the YCPC for townships and boroughs in York County. Baltimore County zoning codes and the zoning codes for those townships and boroughs in York County were matched as closely as possible to standard Harford County zoning codes (see Appendix C for the codes and conversions).


Pennsylvania
York County
Cecil County
Harford County
Baltimore County
Upper Deer Creek Ebaughs Creek
Upper Deer Creek 2
Upper Deer Creek 1
Upper Deer Creek Plumtree
Norrisville
Big Branch
Falling Branch
Island Branch
Upper Deer Creek Jackson Branch
Little Deer Creek Upper
Little Deer Creek Lower
Middle Deer Creek Rock Hollow Wet Stone
Middle Deer Creek Kellogg
Middle Deer Creek
Middle Deer Creek St. Omar
Stirrup Run
Stout Bottle Cabbage Run
Thomas Run
Lower Deer Creek Tobacco Run Cool Branch
Lower Deer Creek Mill Hopkins Hollands Graveyard
Lower Deer Creek
Whiteford
Dublin
Darlington
Jarrettsville
Coopstown
Forest Hill
Upper Crossroads
Bel Air
Churchville
83
146
165
23
1
136
95
22
Subwatershed Outline
Streams
Roads
Towns
NORTH
1 inch equals 3 miles
DEER CREEK
Watershed Restoration Action Strategy
Map 3: Subwatersheds



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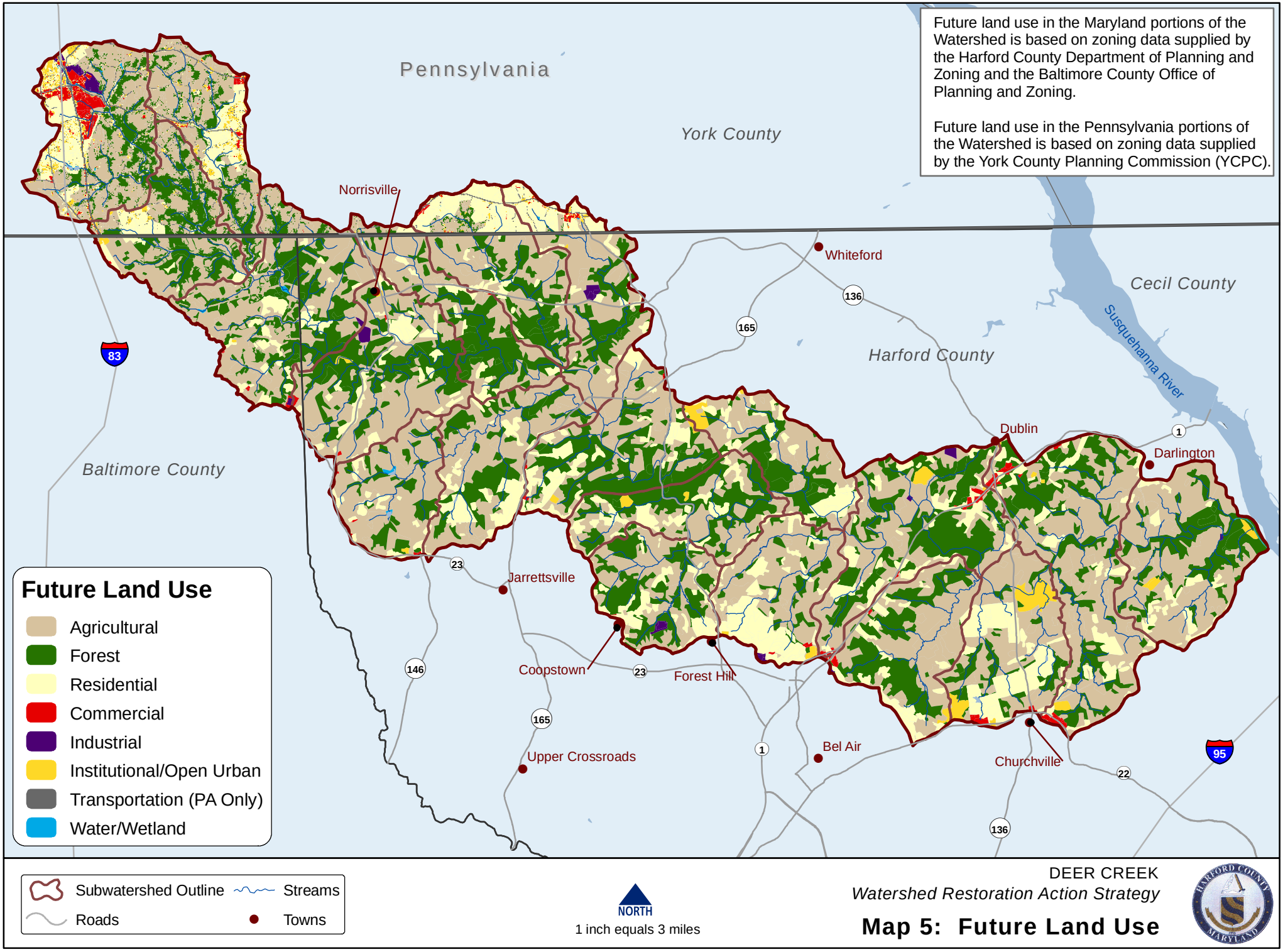
Map 4: Existing Land Use



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Watershed Restoration Action Strategy

Map 5: Future Land Use

In general the future land use layer was derived by overlaying the zoning on the existing land use layer and updating the land use to reflect full build out conditions. If the zoning for a particular parcel was zoned for a more intense use, the future land use classification was changed to reflect the zoning. The resulting values are only estimates and in many ways represent a worst case scenario as the method assumes that all areas zoned for a higher intensity would be developed to that intensity. Conversely the method may underestimate by not considering future piece meal zonings, potential changes through Comprehensive rezoning, future Rural Village expansions or development envelope adjustments. Several modifying criteria were used in various scenarios (see Appendix C). General criteria are listed below:

- Residential land uses (codes 11, 12 and 13) were assumed to remain at the same level of residential land use regardless of future zoning.
- All areas with a “water” or “wetland” (codes 50 and 60) land use were assumed to maintain the same land use for future scenarios.
- Several areas were zoned for agricultural uses that are not currently in agricultural use. It was assumed that additional areas of agriculture would not be created in the future. Those areas, therefore, were assumed to retain the present land use under future scenarios.
- Agricultural and forest land uses that are zoned at a higher intensity were assumed to be allowed to develop to that intensity. These areas received a future land use code consistent with the zoning so long as they were not in an easement.
- Areas of cropland in Harford County that are zoned for rural residential uses were assumed to be allowed to be built out to 1 dwelling unit per 2-acre lot. This is in accordance with Harford County zoning guidance.
- These rules were also applied to the areas of Deer Creek in Pennsylvania. For areas in Pennsylvania, best professional judgment was used to convert land use and zoning codes to match Maryland Department of Planning codes.
- There are small areas where the above rules were not applied. These are areas where discrepancies between the aerial photography and land use layers were noted and corrected for future land use. The current land use layer was not modified.

3.5.2 Results

Deer Creek is a rural watershed, with over 54 percent of the total area primarily in rural or agricultural uses. Another 30 percent of the total area is forested. Residential land uses make up just over 12 percent of the total subwatershed area. These residential areas are evenly dispersed throughout the Watershed with a few more heavily concentrated areas located in Little Deer Creek Upper and Little Deer Creek Lower subwatersheds near Jarrettsville, Stout Bottle Cabbage Run and Stirrup Run near Forest Hill, Lower Deer Creek Tobacco Run Cool Branch near Churchville and in the Pennsylvania township of Shrewsbury along Interstate 83 in the Upper Deer Creek 2 subwatershed. Concentrations of commercial areas are limited to areas near Churchville and just south of Dublin in the Middle Deer Creek St. Omar and Lower Deer Creek Mill Hopkins Hollands Graveyard subwatersheds. There are also more extensive commercial areas in Pennsylvania along the I-83 corridor in the Upper Deer Creek 2 subwatershed.

The future conditions generally at the Watershed level do not show major shifts in land use type under the current zoning for each jurisdiction. An increase in residential and commercial/institutional use is mirrored by decreases in rural/agricultural use and forested areas.

Table 11: Summarized Landuse

Land Use (Combined*)	Existing Percent of Watershed	Future Percent of Watershed	Change Percent
Residential	12.3	16.0	+3.7
Commercial/Institutional	1.2	2.2	+1.0
Road	0.7	0.7	0.0
Industrial	0.1	0.4	+0.3
Forest	30.5	29.3	-1.2
Rural/Agricultural	54.7	51.1	-3.6
Open Urban/Bare Ground	0.4	0.3	-0.1
Water/Wetland	0.1	0.1	0.0

*land use categories have been combined for descriptive purposes

The most significant areas of change in Harford County are near the communities of Forest Hill in the Stout Bottle Cabbage Run subwatershed and Churchville in the Lower Deer Creek Tobacco Run Cool Branch subwatershed where the agricultural land currently separating existing residential communities could eventually develop to residential land uses under current zoning plans.

Much more significant changes in land use are expected to occur in the Pennsylvania portions of the Watershed. Upper Deer Creek 2, which lies entirely in Pennsylvania and is currently just over 75 percent in forest and agricultural land uses, may experience large increases in residential and commercial land uses. Currently, just over 8 percent of the Upper Deer Creek 2 subwatershed is in residential land use and just over 2 percent is in commercial land use. This may increase to over 18 percent residential and 7 percent commercial under current zoning plans. The Pennsylvania portions of Upper Deer Creek Ebaughs Creek (9% current to 18% future residential), Big Branch (5% current to 24% future residential), Falling Branch (6% current to 20% future residential), and Upper Deer Creek 1 (5% current to 10% future residential) will also experience large increases in residential land uses but with less commercial development than is planned in Upper Deer Creek 1 along I-83.

Table 12 - Change in Land Use

ID	Subwatershed	Commercial/ Institutional (acres)	Forest (acres)	Industrial (acres)	Open Urban/Bare Ground (acres)	Residential (acres)	Rural/ Agricultural (acres)	Water/ Wetland (acres)
1	Big Branch	+41	-135	---	-3	+959	-863	---
2	Falling Branch	+60	-92	+64	+56	+657	-684	+1
3	Island Branch	+5	-6	---	-1	+47	-45	---
4	Little Deer Creek Lower	---	-66	---	---	+71	-5	---
5	Little Deer Creek Upper	+2	---	---	---	---	-2	---
6	Lower Deer Creek	---	-1	---	---	+15	-13	---
7	Lower Deer Creek Mill Hopkins Hollands Graveyard	+53	-38	---	---	+15	-30	---
8	Lower Deer Creek Tobacco Run Cool Branch	+22	-135	---	---	+328	-187	-27
9	Middle Deer Creek	---	-48	---	---	+102	-54	---
10	Middle Deer Creek Kellogg	+3	---	---	---	---	-3	---
11	Middle Deer Creek Rock Hollow Wet Stone	+5	-32	---	---	+62	-36	---
12	Middle Deer Creek St. Omar	+35	-23	+45	+45	+41	-99	---
13	Stirrup Run	+2	-84	+18	+18	+82	-18	---
14	Stout Bottle Cabbage Run	+16	-86	+11	+11	+488	-429	---
15	Thomas Run	+16	-47	_1	+1	+103	-73	---
16	Upper Deer Creek 1	+58	-112	---	-11	+238	-174	---
17	Upper Deer Creek 2	+655	-187	+125	+77	+312	-865	+9
18	Upper Deer Creek Ebaughs Creek	+201	-216	+1	-19	+373	-342	+2
19	Upper Deer Creek Jackson Branch	+3	-45	+1	+1	+87	-60	---
20	Upper Deer Creek Plumtree	-8	-26	+25	+18	+3	-24	---
	Grand Total	1,168	-1,380	+290	+195	+3,983	-4,004	-15

3.6 Impervious Surface Analysis

There is evidence to suggest that total levels of impervious surface in a watershed are directly related to a watershed's overall condition. Imperviousness is the most important contributor to increased storm water runoff, thermal pollution, and a number of pollutants, particularly those related to automotive uses.

Generally subwatersheds with higher levels of imperviousness have correspondingly lower levels of water quality and biological health. Because of this relationship, the existing impervious cover estimates were used as indicators of prioritization at the subwatershed level.

Analysis of the existing imperviousness and changes from existing to future conditions are used to distinguish those areas of the Watershed that may be impacted currently from high levels of impervious surface and in the future from development pressures.

3.6.1 Methods

Impervious surface estimates were calculated using a land use approach using the results of the land use analysis described in the previous section. Imperviousness was derived based on land use for Harford and Baltimore Counties. Impervious surfaces for areas of the Deer Creek watershed in Pennsylvania were based on the RESAC land cover layer. Values for percent impervious by land use were derived from the Center for Watershed Protection's "Impervious Cover and Land Use in the Chesapeake Bay Watershed" (CWP, 2001). An impervious factor for each land use type is applied to the acreage of that land use in each subwatershed and then summarized for each subwatershed and for the entire Deer Creek.

Future impervious conditions are based on the future land use layer derived for the WRAS and described in previous sections. The method involves applying a full build out condition to the land use layers based on their current zoning classifications. The impervious factors are applied to the future land use layer to derive future imperviousness following the same methods used to generate existing imperviousness.

Table 13: Impervious Factors

Code	LU Name	Impervious Factor	Code	LU Name	Impervious Factor
Maryland			Pennsylvania		
11	Low-density residential	14%	RAS 1	Open Water	0%
12	Medium-density residential	28%	RAS 10	Urban/Residential Deciduous Tree	14%
13	High-density residential	41%	RAS 11	Urban/Residential Evergreen Tree	14%
14	Commercial	72%	RAS 12	Urban/Residential Mixed Trees	14%
15	Industrial	53%	RAS 15	Urban/Residential Rec. Grass	34%
16	Institutional	34%	RAS 17	Extractive	9%

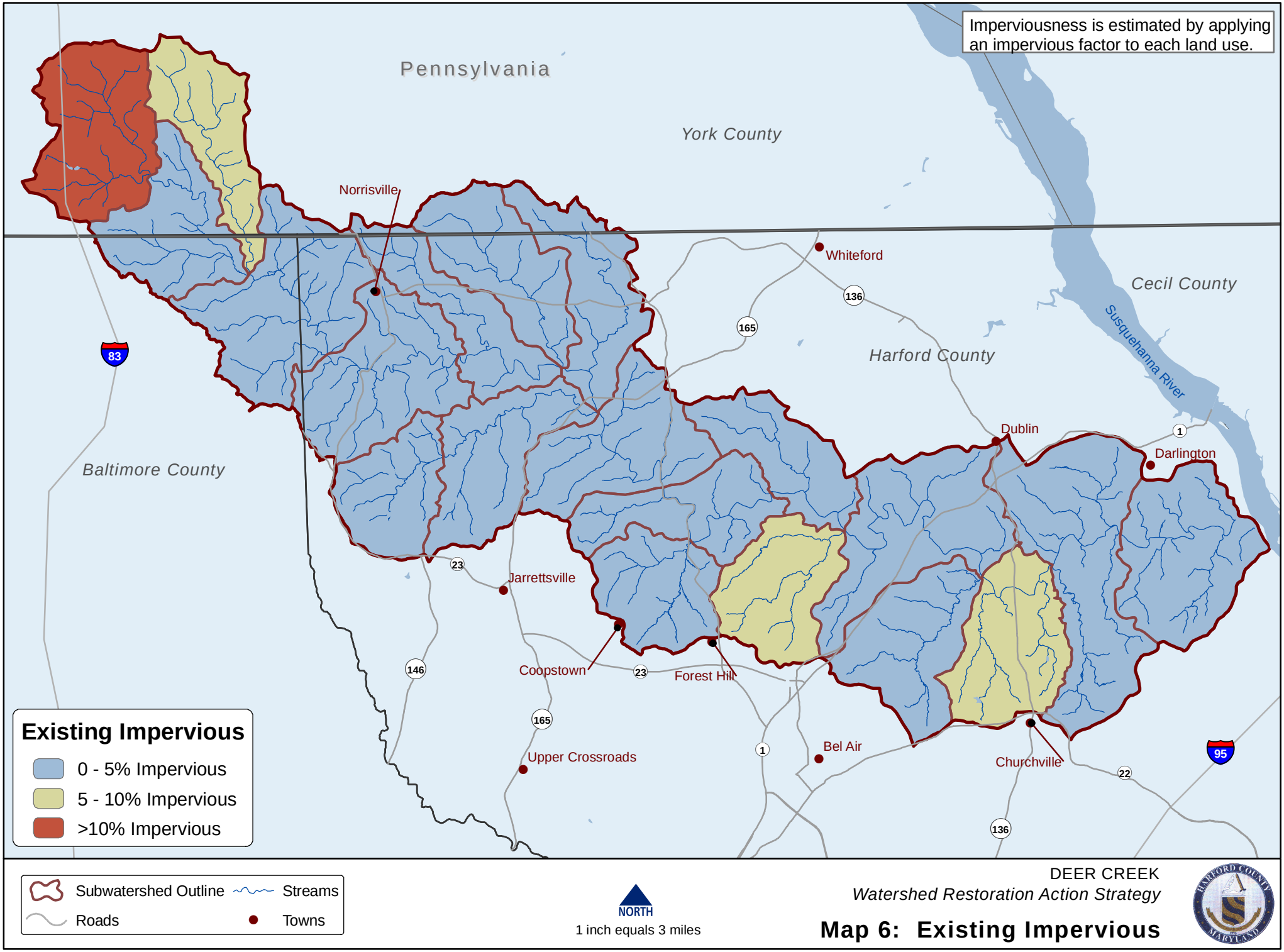
Code	LU Name	Impervious Factor	Code	LU Name	Impervious Factor
Maryland			Pennsylvania		
18	Open urban land	9%	RAS 18	Barren	9%
21	Cropland	2%	RAS 20	Deciduous Forest	0%
22	Pasture	2%	RAS 21	Evergreen Forest	0%
23	Orchards/vineyards/horticulture	2%	RAS 22	Mixed Forest	0%
25	Row and garden crops	2%	RAS 25	Pasture/Hay	2%
41	Deciduous forest	0%	RAS 26	Croplands	2%
42	Evergreen forest	0%	RAS 3	Low Intensity Developed	14%
43	Mixed forest	0%	RAS 30	Natural Grass	0%
44	Brush	0%	RAS 35	Deciduous Wooded Wetland	0%
50	Water	0%	RAS 36	Evergreen Wooded Wetland	0%
60	Wetlands	0%	RAS 37	Emergent (sedge-herb) wetland	0%
73	Bare ground	9%	RAS 38	Mixed Wetland	0%
241	Feeding operations	2%	RAS 4	Medium Intensity Developed	34%
242	Agricultural buildings	2%	RAS 5	High Intensity Developed	72%
			RAS 8	Transportation	95%

3.6.2 Results

The Deer Creek Watershed and subwatersheds have relatively low levels of impervious surface, which would be expected for a Watershed with a predominance of agriculture and forest use. The Deer Creek Watershed's overall existing imperviousness is 4.3 percent (see Map 6, below). Imperviousness is less than 5 percent in 16 of the 20 subwatersheds. Subwatersheds under 3 percent include Island Branch and Lower Deer Creek.

Subwatersheds between 5 and 10 percent impervious include two in Harford County and two in York County. Lower Deer Creek Tobacco Run Coolbranch is 7.38 percent impervious with contributions from commercial and residential areas along Churchville Road (Rte 22) and Priestford Road (Rte 138). Stout Bottle Cabbage Run is 5.10 percent impervious due largely to 23 percent of its area being residential in use. Upper Deer Creek Ebaughs Creek is almost entirely in York County and is 7.97 percent impervious. Upper Deer Creek 2 is entirely in York County and has the highest percentage of imperviousness in the watershed at 11.00 percent. This area includes the I-83 corridor and commercial development in Shrewsbury.

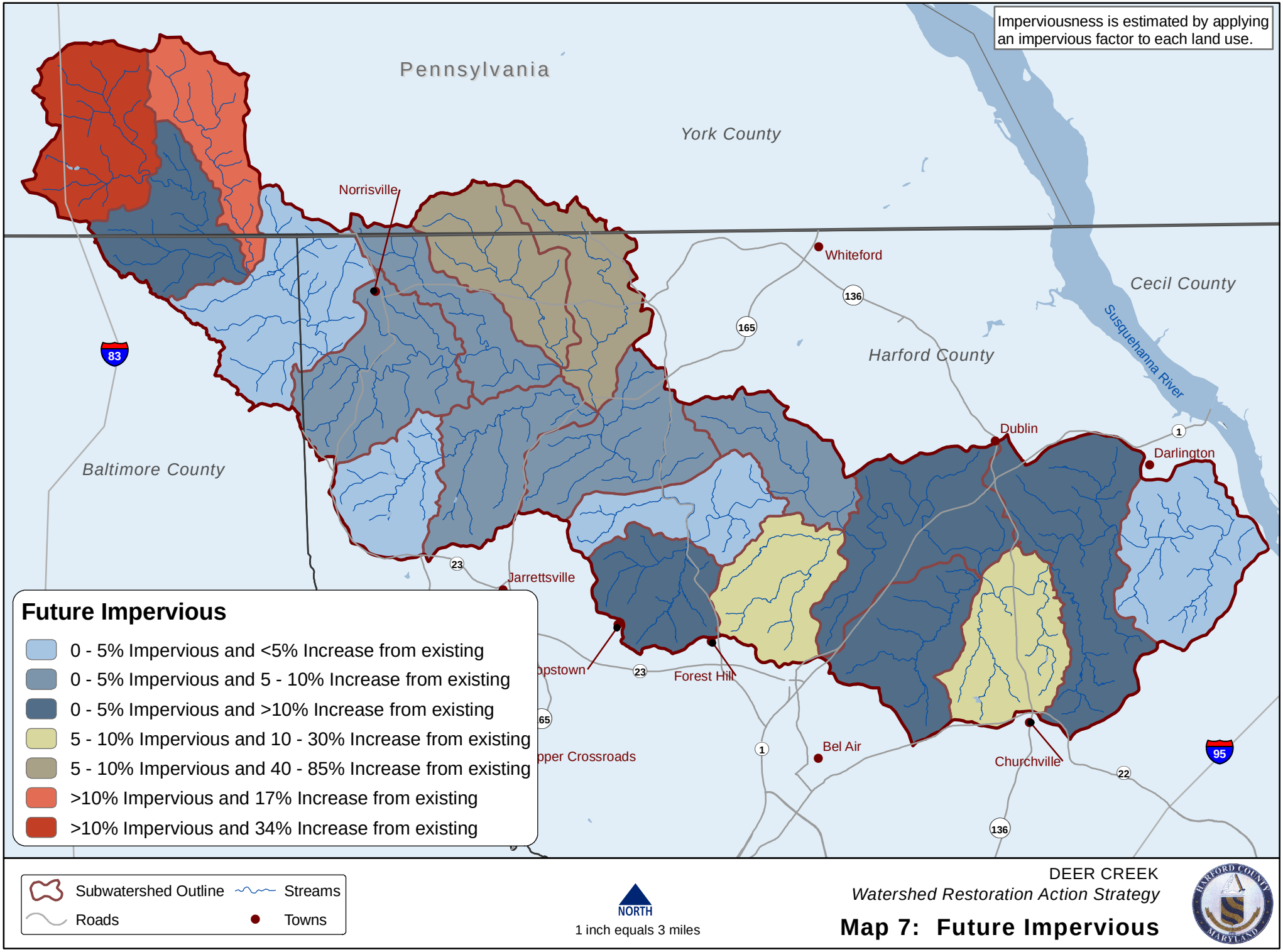
The future imperviousness estimate for the entire Deer Creek Watershed is 5.3 percent, an increase in 1120 acres (see Map 7). The results for each subwatershed are listed on Table 14 below as both increases in impervious acres and the change in impervious percent. It is important to analyze both increase measures to fully understand the severity of the changes.



DEER CREEK

Watershed Restoration Action Strategy

Map 6: Existing Impervious



DEER CREEK

Watershed Restoration Action Strategy

Map 7: Future Impervious

Fourteen of the 20 subwatersheds are estimated to remain under 5 percent impervious. The two subwatersheds that increased to over 5 percent are Big Branch and Falling Branch. These subwatersheds also experienced the highest percent acreage increases as a result of existing agricultural areas that are zoned in York County for residential use. The largest increases in impervious acres are estimated to be in Upper Deer Creek 2 with the potential for 354.72 additional acres of impervious surface and a future imperviousness of 16.70 percent.

Table 14: Impervious Surface Summary

ID	Subwatershed	Existing Imp. Area (acres)	Future Imp. Area (acres)	Change (acres)	Percent Change of acres	Ex. Imp. Percent	Future Imp. Percent	Change in Percent
1	Big Branch	160.34	295.28	134.94	84.16	3.12	5.74	2.62
2	Falling Branch	181.35	314.63	133.28	73.49	3.82	6.62	2.80
3	Island Branch	97.02	105.14	8.12	8.38	2.32	2.52	0.20
4	Little Deer Creek Lower	185.92	195.81	9.89	5.32	3.61	3.81	0.20
5	Little Deer Creek Upper	118.71	120.26	1.55	1.31	3.06	3.10	0.04
6	Lower Deer Creek	173.07	176.33	3.26	1.88	2.68	2.73	0.05
7	Lower Deer Creek Mill Hopkins Hollands Graveyard	361.64	403.36	41.72	11.54	4.00	4.47	0.47
8	Lower Deer Creek Tobacco Run Cool Branch	399.62	457.77	58.15	14.55	7.43	8.51	1.08
9	Middle Deer Creek	144.99	158.23	13.24	9.14	3.61	3.94	0.33
10	Middle Deer Creek Kellogg	162.65	164.42	1.77	1.09	3.71	3.75	0.04
11	Middle Deer Creek Rock Hollow Wet Stone	205.09	217.01	11.92	5.81	3.52	3.73	0.21
12	Middle Deer Creek St. Omar	249.04	302.06	53.02	21.29	3.50	4.24	0.74
13	Stirrup Run	157.33	180.20	22.87	14.53	3.75	4.29	0.54
14	Stout Bottle Cabbage Run	237.34	317.80	80.46	33.90	5.10	6.83	1.73
15	Thomas Run	190.57	215.56	24.99	13.11	3.60	4.07	0.47
16	Upper Deer Creek 1	176.58	215.73	39.15	22.17	3.61	4.40	0.79
17	Upper Deer Creek 2	683.38	1038.10	354.72	51.91	11.00	16.70	5.70
18	Upper Deer Creek Ebaughs Creek	350.85	457.40	106.55	30.37	7.97	10.39	2.42
19	Upper Deer Creek Jackson Branch	226.04	240.21	14.17	6.27	3.39	3.61	0.22
20	Upper Deer Creek Plumtree	222.92	228.77	5.85	2.62	2.89	2.97	0.08

3.7 Pollutant Loading

Estimates of pollutant loads for several parameters were developed to provide a watershed wide measure of the impact of land use on the stream system. By analyzing the existing loads, future loads and the change in loading, areas in need of restoration and areas that may be vulnerable to land use changes can be defined. The pollutant loading results were used in prioritization of both restoration and protection subwatersheds.

3.7.1 Methods

The Watershed Treatment Model (WTM) was developed by the Center for Watershed Protection and offers a spreadsheet tool for assessing pollutant loads and treatment options in a single drainage area. The model calculations are based on land use and it is set up to provide estimates of loads for total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS). Individual models with no connectivity were run for each of the 20 subwatersheds. The models were run for both existing and future conditions. Future land use (based on county zoning) is entered to determine the change between existing pollutant load and future loads.

Pollutant Sources

Pollutant Sources estimates the pollutant loads from two types of sources. Primary sources are estimates of loads from stormwater runoff, and secondary sources are loads from a variety of other sources, most of them are active in both dry weather and during storm events.

For *primary sources*, GIS is used to calculate areas of each land use within a subwatershed. For urban land uses, an impervious factor is applied to each land use to provide an estimate of total impervious area in the subwatershed and calculate an annual loading. For rural land uses, an export coefficient for annual loading in pounds per acre for each land use is entered.

Secondary sources include data on sewers, septic systems, construction activities, channel erosion, soil type, farm practices (including number of animals) and point-source pollution. Values for these are not easily determined by land use alone. The information entered for secondary sources is much more site-specific than that provided by land use alone. Agricultural and livestock data was developed from 2003 Maryland Agricultural Statistics Service data. The ability to enter information on secondary sources provides greater user control of a diverse set of pollutant sources than is commonly found in complex models.

3.7.2 Results

Results for modeled existing and future loads for total nitrogen (TN), total phosphorus (TP) and total suspended solids (TSS) in the Watershed are considered high (see Table 15). Existing loads for TN ranged from a low of 5.0 lbs/ac/yr to a high of 10.3 lbs/ac/yr. The highest TN loads are found in the Upper Deer Creek 2 and Upper Deer Creek Ebaughs Creek subwatersheds which lie almost entirely in Pennsylvania. The high loading in those subwatersheds is likely attributable to their high impervious surface percentages. The lowest values are in the Middle Deer Creek Kellogg and Middle Deer Creek Rock Hollow Wet Stone portion of the Watershed.

Modeled TP loads for existing conditions are similarly high in the Upper Deer Creek 2 and Upper Deer Creek Ebaughs Creek subwatersheds, with values of 1.9 and 1.8 lbs/ac/yr, respectively. The lowest expected TP loads were in the Thomas Run and Lower Deer Creek Mill Hopkins Hollands Graveyard subwatersheds, both of which had values below 1 lb/ac/yr.

These high modeled nutrient ranges are similar to the spring 2005 sampling results reported in the Deer Creek Synoptic Survey which was completed as part of the Deer Creek WRAS process.

Existing modeled TSS values are highest in the central portion of the Watershed. Middle Deer Creek, Middle Deer Creek Rock Hollow Wet Stone and Middle Deer Creek Kellogg all have expected TSS values just under 500 lbs/ac/yr. The highest value was in the Lower Deer Creek Tobacco Run Cool Branch subwatershed at just over 500 lbs/ac/yr.

Future values are not significantly different than existing. There is an overall decrease in the TP load attributable to the expected decrease in farmland as the County's population expands. TN loads increase only slightly while TSS loads are expected to remain unchanged.

Table 15: Pollutant Load Summary

			Existing			Future (no management)			Change		
ID	Subwatershed	Area (acres)	TN lb/ac/yr	TP lb/ac/yr	TSS lb/ac/yr	TN lb/ac/yr	TP lb/ac/yr	TSS lb/ac/yr	TN Percent	TP Percent	TSS Percent
1	Big Branch	5,145	7.38	1.60	485.12	7.45	1.54	485.14	0.93	-4.02	0.00
2	Falling Branch	4,749	7.82	1.66	483.96	7.82	1.60	484.05	0.08	-3.92	0.02
3	Island Branch	4,179	6.59	1.48	487.84	6.59	1.47	487.88	-0.02	-0.50	0.01
4	Little Deer Creek Lower	5,143	6.54	1.48	490.94	6.57	1.48	490.95	0.52	0.00	0.00
5	Little Deer Creek Upper	3,879	6.80	1.57	489.35	6.80	1.57	489.39	0.01	-0.01	0.01
6	Lower Deer Creek	6,462	6.50	1.52	494.29	6.51	1.52	494.31	0.03	-0.05	0.00
7	Lower Deer Creek Mill Hopkins Hollands Graveyard	9,033	6.48	0.71	491.44	6.48	0.71	491.46	0.05	-0.20	0.00
8	Lower Deer Creek Tobacco Run Cool Branch	5,382	6.07	1.46	501.15	6.17	1.45	501.64	1.56	-0.41	0.10
9	Middle Deer Creek	4,012	5.77	1.40	498.42	5.81	1.40	498.44	0.64	-0.34	0.00
10	Middle Deer Creek Kellogg	4,386	5.02	1.27	498.98	5.01	1.27	498.98	-0.03	-0.02	0.00
11	Middle Deer Creek Rock Hollow Wet Stone	5,825	5.36	1.32	497.28	5.37	1.32	497.29	0.27	-0.20	0.00
12	Middle Deer Creek St. Omar	7,123	5.67	1.37	493.42	5.67	1.36	493.43	0.04	-0.38	0.00
13	Stirrup Run	4,199	5.66	1.35	493.19	5.70	1.35	493.19	0.73	0.00	0.00
14	Stout Bottle Cabbage Run	4,653	6.91	1.54	490.59	6.95	1.51	490.60	0.63	-2.30	0.00
15	Thomas Run	5,290	6.41	0.68	489.85	6.43	0.68	489.84	0.32	-0.69	0.00
16	Upper Deer Creek 1	4,898	7.27	1.56	482.77	7.29	1.54	482.81	0.35	-1.07	0.01
17	Upper Deer Creek 2	6,215	10.28	1.89	472.85	10.33	1.83	472.87	0.46	-3.01	0.00
18	Upper Deer Creek Ebaughs Creek	4,404	9.56	1.82	473.36	9.65	1.79	473.42	0.93	-1.61	0.01
19	Upper Deer Creek Jackson Branch	6,663	5.78	1.40	493.53	5.79	1.40	493.35	0.06	-0.41	-0.04
20	Upper Deer Creek Plumtree	7,705	7.13	1.56	484.61	7.11	1.55	484.16	-0.25	-0.17	-0.09

4 Subwatershed Prioritization

The prioritization is an attempt to synthesize current and historical watershed data to quantify the relative overall condition of each subwatershed. The prioritization will identify those areas that are degraded and most in need of *restoration*, and those areas that are of high quality or vulnerable, and most in need of *protection*. The results will allow for targeted study of the identified subwatersheds and targeted implementation of management strategies.

4.1 Methods

The prioritization was completed as a collaborative and iterative process with Stakeholder Committee review and input. Generally the procedure consisted of the following steps:

- Indicators: Choose two sets of indicators (restoration and protection), that characterize watershed condition with a minimum of duplication within each set,
- Scoring: Quantify or score each indicator, preferably in a normalized fashion so that one subwatershed's score could be directly compared with that of another,
- Weights: Weight the indicators against each other so that the ones that are most important in establishing watershed health or vulnerability would have the highest consideration.

Indicator Selection

Indicators are specific measures of environmental features that have a relationship to watershed condition such as water temperature or fish community data. The approach taken in Deer Creek was to use two sets of indicators, one to prioritize areas for restoration, and the other to prioritize areas for protection. Restoration indicators were generally data from existing conditions. Protection indicators are used to determine if areas that are currently in good condition are vulnerable to degradation in the future. These indicators are derived either from GIS analysis or modeling and are measures of potential change. Subwatersheds can score high in both prioritization schemes, which would indicate that part of the subwatershed is in good condition and needs to be protected whereas part is in poor condition and needs to be restored.

The indicator selection was initiated by reviewing existing data sources including the Watershed Characterization, Synoptic Survey, Stream Corridor Assessment, MBSS, Harford Planning and Zoning and Public Works and data from the Susquehanna River Basin Commission (SRBC).

The best data would fit the following criteria:

- Data is available watershed wide and applicable at the subwatershed level,
- Data is developed following a standard method or protocol,
- Data is spatially variable and has a known watershed condition response,
- Data are not duplicative,
- Data is relatively current, and
- Data allows scoring either as an absolute value or as a normalized quantity with known or developable category breakpoints.

An initial list of potential indicators was developed and submitted for Stakeholder Committee review. Indicators fell into broad Type categories of Stream Condition, Water Quality, Landscape and Sensitive Species.

The indicators were reviewed by the Stakeholder Committee for the data source, spatial completeness, duplication, and how they would be scored and measured across the 20 subwatersheds. During the meeting several indicators were removed or decided to be used in later phases of the WRAS. SCA data, because of its limited spatial coverage was not used in the prioritization, but was used to identify Candidate sites for restoration. Maryland's 303(d) list of impaired waters was also not used as an indicator but was used to determine where efforts would be focused and will be a guiding factor in implementation. A final list of indicators was developed with 12 restoration indicators and 12 protection indicators. They are listed below in Table 16.

Indicator Scoring

Subwatershed prioritization can either be conducted using absolute values, with scoring against known category breakpoints, or it can be developed as a relative ranking system. The absolute type has the ability to determine which areas are in good condition or poor condition as compared to known values. A relative ranking compares the subwatersheds against themselves and determines which ones have greater need for management.

As the prioritization was being developed it became clear that with a high quality watershed such as the Deer Creek, with generally homogeneous land use, imperviousness and stream quality that a relative ranking would be the best method to discriminate between subwatersheds. An absolute system would preclude many of the indicators from being used since the majority would fall in good ranges.

Table 16: Final Prioritization Indicators

Indicator	Type	Data Source	Spatial Coverage, Counties and Subwatersheds	Potential Scoring	Data conversion/Normalized Unit
Restoration					
Instream Habitat Quality	Stream Condition	MBSS	H, B 19/20	Range of values (Poor 0-5; Fair 6-15, Good 16-20)	Average for subwatershed
		SRBC	H, B, Y 4/20	Range of percent comparability values (Excellent >90; Supporting 89-75; Partially Supporting 74-60; Nonsupporting <60)	Supplement to MBSS, 4 sites along MD-PA border
Fish	Stream Condition	MBSS	H, B 19/20	Range of IBI scores (Very Poor 1.0-1.9 Poor 2.0-2.9; Fair 3.0-3.9; Good 4.0-5.0)	Average for subwatershed
Benthic Macroinvertebrates	Stream Condition	MBSS	H, B 19/20	Range of IBI scores (Very Poor 1.0-1.9 Poor 2.0-2.9; Fair 3.0-3.9; Good 4.0-5.0)	Average for subwatershed
		SRBC	H, B, Y 4/20	Range of percent comparability values (Nonimpaired >83; Slightly Impaired 79-54; Moderately Impaired 50-21; Severely Impaired <17)	Supplement to MBSS, 4 sites along MD-PA border
Riparian Stream Buffers	Landscape	MDP	H, B 19/20	Length of stream	Miles of stream with no riparian buffer
Nitrogen (NO_2+NO_3) loads	Water Quality	Synoptic	H, B 19/20	Range of values (Baseline <0.01; Moderate 0.01-0.02; High 0.02-0.03; Excessive >0.03)	Kg/ha/day (converted to lb/ac/yr)
pH	Water Quality	Synoptic	H, B 19/20	Range of values (Low <5.5; Marginal 5.5-6.5; Neutral 6.5-7.5; Basic >7.5)	Average for subwatershed
Conductivity	Water Quality	Synoptic	H, B 19/20	Range of mmohs/cm values (<100, 100-200, 200-300, >300)	Average for subwatershed
Temperature	Water Quality	Synoptic	H, B 19/20	Range of degrees Celsius values (<10, 10-14, 14-18,>18)	Average for subwatershed
Nitrogen loads	Water Quality	WTM	H, B, Y 20/20		lb/ac/yr
Phosphorus loads	Water Quality	WTM	H, B, Y 20/20		lb/ac/yr
Sediment loads	Water Quality	WTM	H, B, Y 20/20		lb/ac/yr
Imperviousness	Landscape	MDP and RESAC	H, B, Y 20/20	Range of percentage.	Percent of subwatershed area

Indicator	Type	Data Source	Spatial Coverage, Counties and Subwatersheds	Potential Scoring	Data conversion/Normalized Unit
Protection					
Change in Nitrogen loads	Water Quality	WTM future conditions	H, B, Y 20/20	Range of percentages	Percent change, lb/ac/yr
Change in Phosphorus loads	Water Quality	WTM future conditions	H, B, Y 20/20	Range of percentages	Percent change, lb/ac/yr
Change in Sediment loads	Water Quality	WTM future conditions	H, B, Y 20/20	Range of percentages	Percent change, lb/ac/yr
Development Pressure	Landscape	Harford Zoning	H, B, Y 20/20	Range of percentages	Percent change in impervious area
Wetland	Landscape	MDNR	H, B 19/20	Range of percentages	Percent of subwatershed area with wetlands outside of Protected Lands
Agriculture/Rural Legacy	Landscape	Harford Cnty	H, B 19/20	Range of percentages	Percent of subwatershed area with agricultural use and Rural Legacy outside of Protected Lands
Prime Soils	Landscape	Harford Cnty/USDA	H, B 17/20	Range of percentages	Percent of subwatershed area with prime agricultural soils outside of Protected Lands
Forest cover	Landscape	MDP	H, B 19/20	Range of percentages	Percent of subwatershed area with forest (lu code 40, 41, 42 and 43) outside of Protected Lands
Trout Habitat	Sensitive Species	MDE, MDNR	H, B 19/20	Yes or No	Identified trout spawning areas present in subwatershed
SSPRA	Sensitive Species	MDNR	H, B 19/20	Range of percentages	Percent of subwatershed area
Aquatic Conservation Targets	Sensitive Species	MBSS	H, B 19/20	ACT1, ACT2, ACT3, ACT4	Indicator is a composite of aquatic biodiversity indicators – fish, macroinvertebrate, physical habitat, water quality, land use data from MBSS and Stream Waders are used.
High quality Forest Interior Habitat	Sensitive Species	MDNR	H, B 19/20	Range of percentages	Percent of subwatershed with high quality forest interior habitat outside of protected lands

A relative system needs only a high end and low end of the parameters range to determine condition. The raw values are translated by a percentile rank function to a score from 0-10. For example the best Instream Habitat score in the dataset of 17.5 (raw values are 0-20) receives a score of 0.0, while the lowest Instream Habitat score of 7 receives a score of 10.0. Once the raw values for each indicator were scored with the percent rank function the weight could be applied.

Indicator Weighting

The last step in developing the prioritization of each subwatershed is to determine weights for each of the indicators. By weighting the indicators against each other, the ones that are most important to the stakeholders and the indicators most important in establishing watershed condition or vulnerability will be given the highest consideration. The weights were derived using a *Paired Comparison technique* with Stakeholder Committee input. The technique allows for side by side comparisons of each indicator and is useful when trying to rank items that are numerous and complex.

Each member of the Stakeholder Committee was given the opportunity to 'vote' using matrices of restoration indicators and protection indicators. The total number of selections was tabulated and a final weight was calculated by figuring the percentage that each indicator was selected out of all of the possible selections.

The results are shown below in Figures 1 and 2 with the number of total selections. Each color on the bar chart indicates the number of selections of that indicator from a different stakeholder.

Figure 1: Protection Indicators, Paired Comparison Results

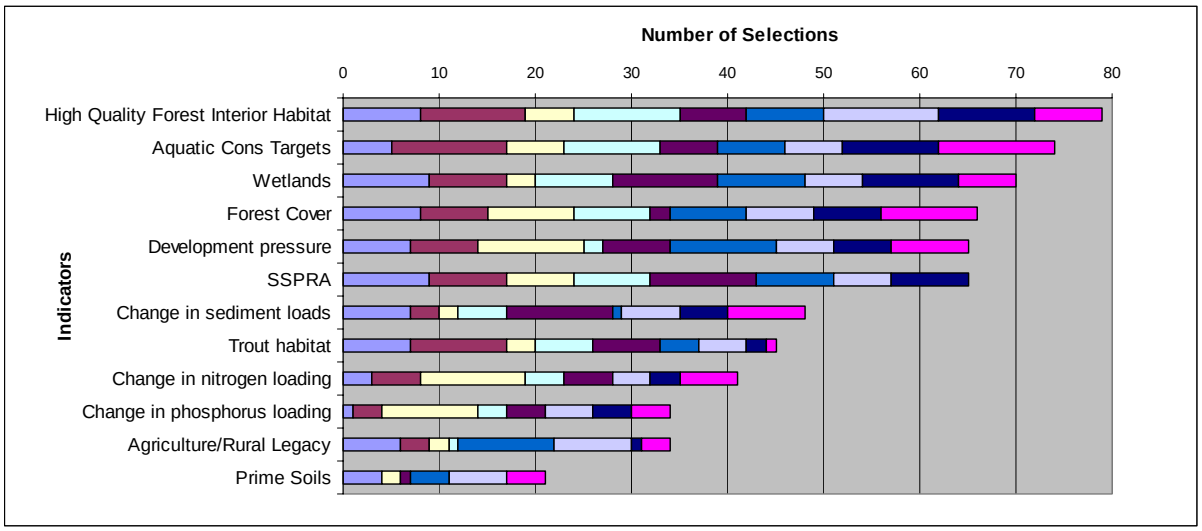
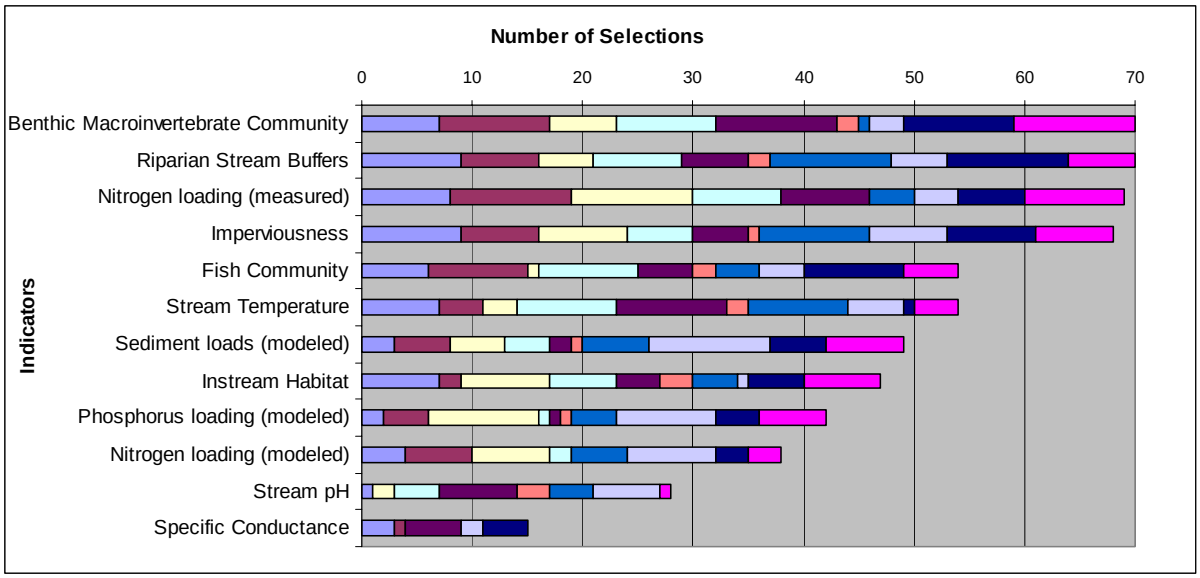


Figure 2: Restoration Indicators, Paired Comparison Results



The final indicator weighting is shown in the table below.

Table 17: Final Indicator Weights

Restoration Indicator	Weight	Protection Indicator	Weight
Benthic Macroinvertebrates	11.6	High quality Forest Interior Habitat	12.0
Riparian Stream Buffers	11.6	Aquatic Conservation Targets	11.3
Nitrogen loads (sampled)	11.4	Wetland	10.7
Imperviousness	11.3	Forest cover	10.1
Fish	8.9	Development Pressure	10.0
Temperature	8.9	SSPRA	10.0
Sediment loads (modeled)	8.1	Change in Sediment loads	7.5
Instream Habitat Quality	7.8	Trout Habitat	7.1
Phosphorus loads (modeled)	7.0	Change in Nitrogen loads	6.5
Nitrogen loads (modeled)	6.3	Change in Phosphorus loads	5.5
pH	4.6	Agriculture/Rural Legacy	5.5
Conductivity	2.5	Prime Soils	3.7

The weights are then applied to each indicator and a total score for each subwatershed is summed. The total score is converted to a 0-100 scale and then the subwatersheds are ranked based on their scaled score.

4.2 Results

Restoration and protection priorities are shown in the table below and on Maps 8 and 9. While restoration and protection efforts can be effective and may be necessary across the watershed, the prioritization results can be used to target resources in the areas that will benefit the most.

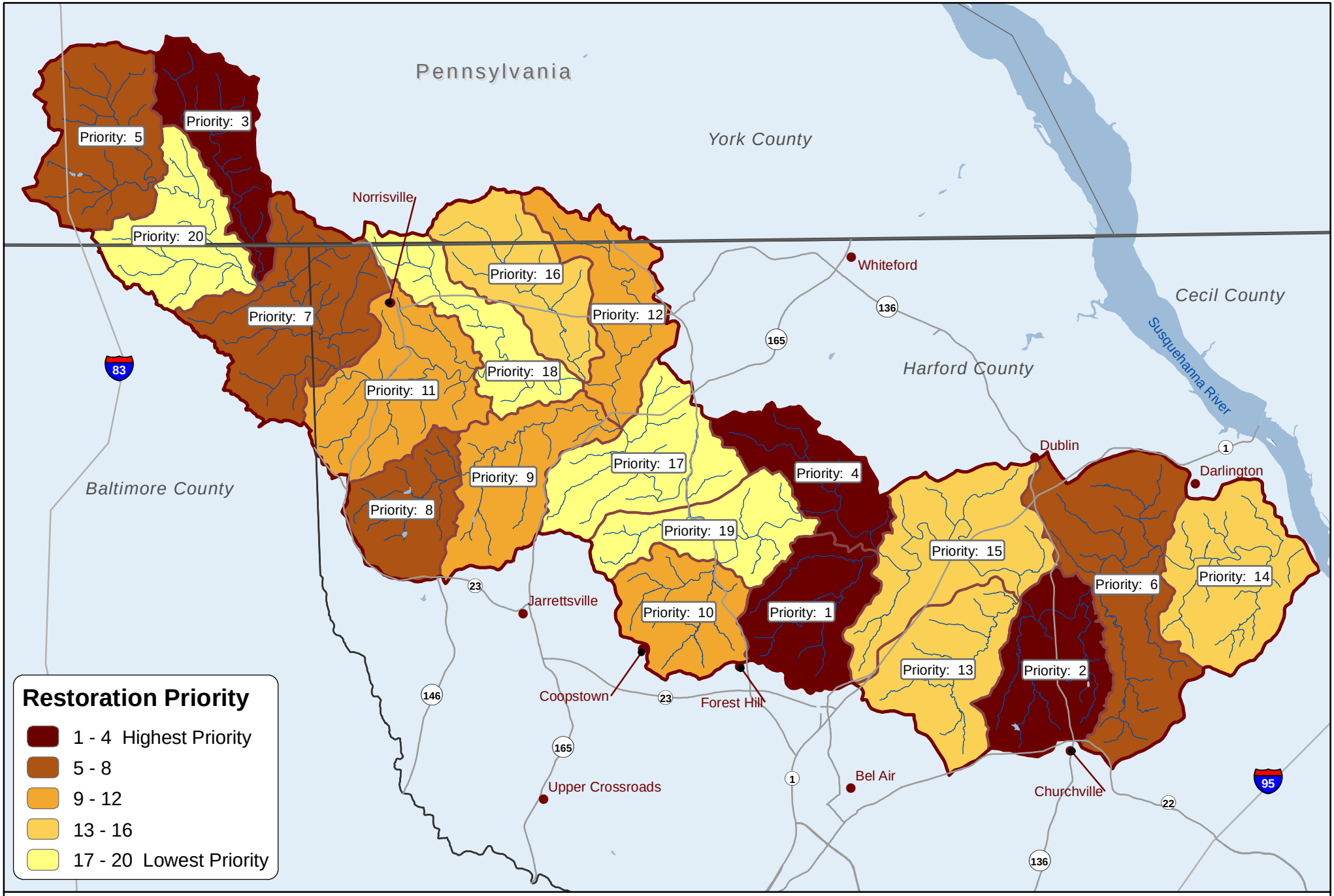
The top restoration subwatersheds are Stout Bottle Cabbage Run (1) and Lower Deer Creek Tobacco Run Cool Branch (2). These subwatersheds are both in Harford County and have relatively higher levels of development and less forest cover than other portions of the Watershed. Middle Deer Creek was ranked high (4) for restoration as well as protection (2).

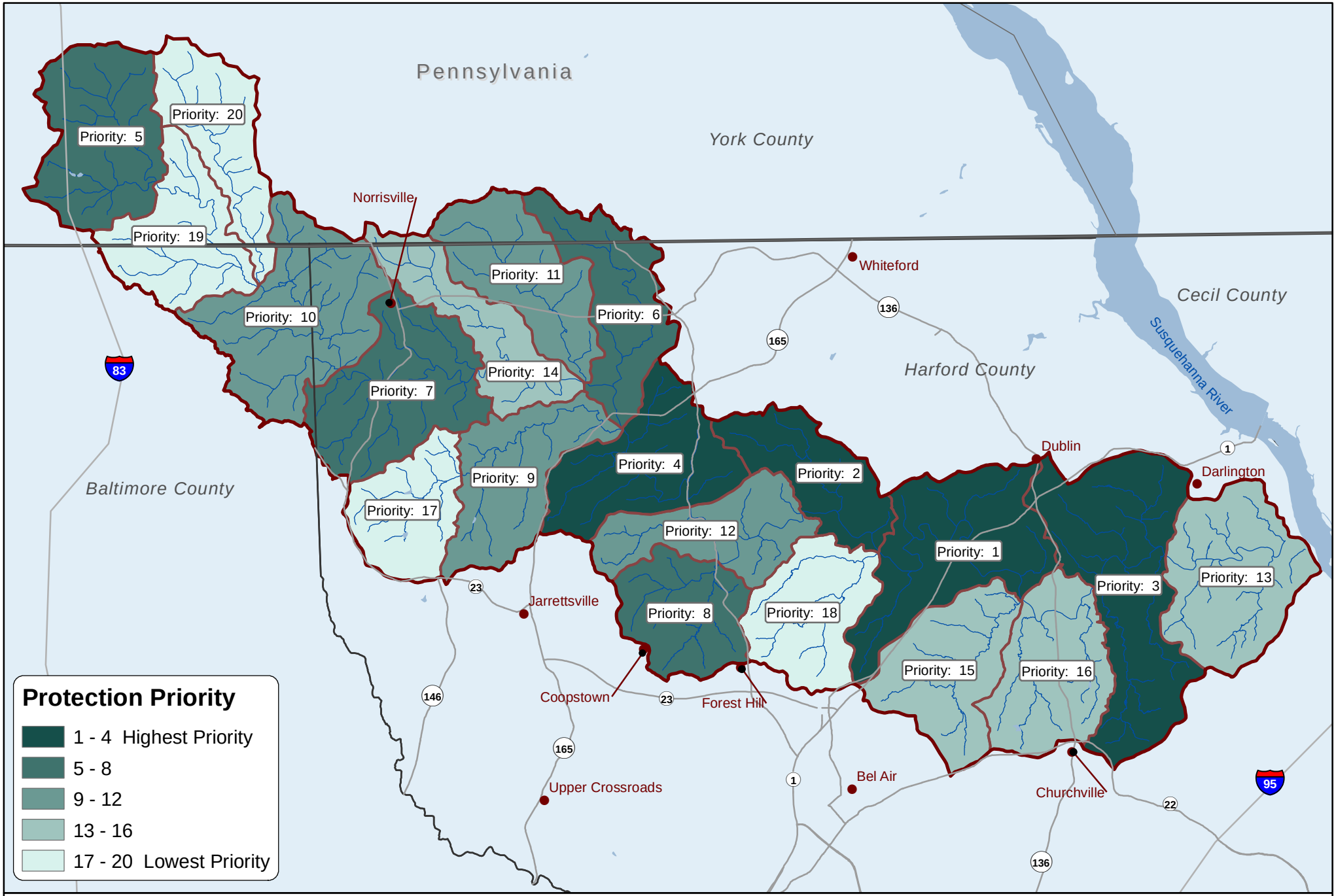
Upper Deer Creek Ebaughs Creek (3) and Upper Deer Creek 2 (5) are located in Pennsylvania and have experienced substantial development. Based on zoning they are expected to see significant future development. Upper Deer Creek 2 is ranked number 5 for restoration and protection. This indicates that conditions may be degraded, but that the area is also vulnerable.

The highest priority protection subwatersheds are Middle Deer Creek St. Omar (1), Middle Deer Creek (2) Lower Deer Creek Mill Hopkins Hollands Graveyard (3) and Middle Deer Creek Rock Hollow Wet Stone (4).

Table 18: Subwatershed Prioritization Results

ID	Subwatershed	Restoration	Protection
1	Big Branch	16	11
2	Falling Branch	12	6
3	Island Branch	18	14
4	Little Deer Creek Lower	9	9
5	Little Deer Creek Upper	8	17
6	Lower Deer Creek	14	13
7	Lower Deer Creek Mill Hopkins Hollands Graveyard	6	3
8	Lower Deer Creek Tobacco Run Cool Branch	2	16
9	Middle Deer Creek	4	2
10	Middle Deer Creek Kellogg	19	12
11	Middle Deer Creek Rock Hollow Wet Stone	17	4
12	Middle Deer Creek St. Omar	15	1
13	Stirrup Run	10	8
14	Stout Bottle Cabbage Run	1	18
15	Thomas Run	13	15
16	Upper Deer Creek 1	20	19
17	Upper Deer Creek 2	5	5
18	Upper Deer Creek Ebaughs Creek	3	20
19	Upper Deer Creek Jackson Branch	11	7
20	Upper Deer Creek Plumtree	7	10


Pennsylvania
York County
Cecil County
Harford County
Baltimore County
Susquehanna River
Norrisville
Whiteford
Dublin
Darlington
Jarrettsville
Coopstown
Forest Hill
Upper Crossroads
Bel Air
Churchville
Priority: 1
Priority: 2
Priority: 3
Priority: 4
Priority: 5
Priority: 6
Priority: 7
Priority: 8
Priority: 9
Priority: 10
Priority: 11
Priority: 12
Priority: 13
Priority: 14
Priority: 15
Priority: 16
Priority: 17
Priority: 18
Priority: 19
Priority: 20
Restoration Priority
1 - 4 Highest Priority
5 - 8
9 - 12
13 - 16
17 - 20 Lowest Priority
Subwatershed Outline
Streams
Roads
Towns
NORTH
1 inch equals 3 miles
DEER CREEK
Watershed Restoration Action Strategy
Map 8: Restoration Priority



DEER CREEK

Watershed Restoration Action Strategy

Map 9: Protection Priority

5 Candidate Sites

Candidate sites are specific areas needing restorative action. They were derived from several data sources and fit three different categories; riparian buffer restoration, stream restoration, and stormwater management. Selection of the sites and prioritization of them for field visits were targeted first in the highest priority restoration subwatersheds and on public lands. Due to the limited scope of the WRAS, agricultural BMP specific candidate sites were not targeted during the study. Agricultural BMPs are an important focus of the WRAS and are under the responsibility of the Harford Soil Conservation District (SCD). See sections 6.1 and 7.2 for a complete discussion of agricultural BMPs.

5.1 Stream Buffers

Riparian stream buffers provide many benefits to overall watershed health including retention of runoff and pollutants, streambank stabilization and providing terrestrial and instream habitat. Inadequate or deficient buffers were identified for the WRAS using two methods; a GIS based land use method and the SCA method. The land use method includes the entire Deer Creek Watershed and is based simply on the land use code. Areas coded as a natural vegetation type, for example Forest, Brush, Wetland, are assumed to have adequate riparian buffer. Areas coded with any type of development, for example Industrial, Cropland, are assumed to have deficient stream buffer. A land use based method can result in false positives and false negatives in that areas coded as a forest type, may in fact have areas of deficient buffer and areas of development are not necessarily devoid of buffer. However with the size of the watershed and in the scope of the WRAS a planning level estimate can be obtained.

The land use method identified a total of 151.7 miles of ‘unforested’ streams split between 129.3 miles in agricultural lands and 22.4 miles in developed areas. In this method the total stream length for the entire Deer Creek Watershed is 311.5 miles and 158.5 miles are considered to be forested. By this method, the subwatersheds with the greatest lengths of buffer deficiency are Lower Deer Creek Mill Hopkins Hollands Graveyard (12.4 miles) and Upper Deer Creek Plumtree (9.8 miles).

The SCA allows for specific field verified data but is only relevant for the 73 stream miles walked during the assessment. SCA data were analyzed to determine the land uses where the identified inadequate buffer was located. Of the total 21.7 miles of inadequate buffer, 15.1 miles were located in Agricultural use, 1.3 miles were located in Developed use and 5.4 miles were located in areas with a land use code of Forest.

The SCA identified 4.1 miles of inadequate buffer in Lower Deer Creek Mill Hopkins Hollands Graveyard, 3.7 miles in Lower Deer Creek Tobacco Run Cool Branch, and 2.5 miles in Big Branch. Table 20 lists the miles of stream with inadequate buffer listed by the method,

land use or SCA, and by the land use where the deficient buffer occurs. Map 10 shows segments of stream identified by the SCA as lacking adequate buffer and the correctability associated with that segment. It also depicts segments of stream that flow through areas where the land use is unforested.

All of the inadequate buffer sites identified through the SCA can be considered candidate sites. These areas did not receive a visit beyond the SCA, as the SCA data provides enough information to begin developing priorities for buffer enhancement and restoration. In general sites identified from the SCA or by other means should be prioritized by the following factors:

- Sites with at least moderate severity, correctability and access scores,
- sites in the highest priority restoration subwatersheds,
- sites on public lands, and
- sites on headwater streams and fill gaps in forested buffer.

Inadequate buffer sites were first selected with severity, correctability and access scores of 1, 2 or 3. Each problem site was mapped and rated with a score of 1 through 5 during the SCA for Severity, Correctability and Accessibility. A score of 1 represents the most severe, the most easily correctable and the most readily accessible problem sites. A score of 3 would be moderate Severity, Correctability and Access. There are 52 total sites identified by the SCA that meet these criteria totaling 16.2 miles. To further prioritize, the sites with scores of either 1 or 2 for all criteria total 2.9 miles. These 10 sites are listed below in Table 19. In the final project ranking, site 041101 was removed because the inadequate buffer was a natural floodplain. Stream buffer priorities for the nine buffer sites are discussed in section 7, implementation.

Table 19: Potential Stream Buffer Projects

ID		Severity	1	1	1	2	2	
		Correctability	1	2	2	2	2	Total
		Access	1	1	2	1	2	
1	Big Branch		---	041101	---	041301	---	2
7	Lower Deer Creek Mill Hopkins Hollands Graveyard		067201 115202	---	077102	071301	---	4
8	Lower Deer Creek Tobacco Run Cool Branch		---	---	106102 112103	---	---	2
9	Middle Deer Creek		---	---	---	387106	386104	2
	Totals		2	1	3	3	1	10

Table 20: Inadequate Stream Buffer Summary

ID	Subwatershed	Restoration Priority	LU[1] Agriculture (miles)	LU[1] Development (miles)	SCA[2] Agriculture (miles)	SCA[2] Developed (miles)	SCA[2] Forest (miles)
1	Big Branch	16	5.5	0.4	2.5	0.2	0.9
2	Falling Branch	12	3.9	0.3	---	---	---
3	Island Branch	18	4.8	0.4	---	---	---
4	Little Deer Creek Lower	9	8.6	1.0	0.2	0.0	0.0
5	Little Deer Creek Upper	8	6.5	0.6	1.5	0.1	0.3
6	Lower Deer Creek	14	7.5	0.9	0.9	0.2	0.4
7	Lower Deer Creek Mill Hopkins Hollands Graveyard	6	12.4	1.3	4.1	0.3	1.5
8	Lower Deer Creek Tobacco Run Cool Branch	2	6.2	3.3	3.7	0.4	1.0
9	Middle Deer Creek	4	3.9	1.5	1.0	0.1	0.9
10	Middle Deer Creek Kellogg	19	3.1	1.4	---	---	---
11	Middle Deer Creek Rock Hollow Wet Stone	17	6.2	0.7	0.2	0.0	0.3
12	Middle Deer Creek St. Omar	15	8.5	0.8	---	---	---
13	Stirrup Run	10	4.9	0.9	---	---	---
14	Stout Bottle Cabbage Run	1	8.5	0.9	---	---	---
15	Thomas Run	13	6.5	0.3	---	---	---
16	Upper Deer Creek 1	20	4.3	0.5	---	---	---
17	Upper Deer Creek 2	5	5.8	2.7	---	---	---
18	Upper Deer Creek Ebaughs Creek	3	4.7	1.5	---	---	---
19	Upper Deer Creek Jackson Branch	11	7.8	1.4	0.8	0.0	0.0
20	Upper Deer Creek Plumtree	7	9.8	1.7	---	---	---
	Totals		129.3	22.4	15.1	1.3	5.4

Notes: 1 – Calculated using the Landuse; 2 – Derived from Stream Corridor Assessment data; not all streams were walked during the assessment due to time/resource constraints and property owner permissions, records with "---" were not assessed.

5.2 Stream Restoration

Candidate sites for stream restoration were identified primarily using the results of the SCA. Subwatersheds not included in the SCA work were not included in the candidate site effort for stream restoration. The SCA database was reviewed and problem sites sorted by their scores for Severity, Correctability and Accessibility. Only problems with a Severity of Moderate or greater were retained for further study. Inadequate Buffer sites were excluded and are assessed separately.

Eighty sites were initially identified from the 305 total SCA sites. These sites were further reviewed using mapping, site data and site photographs. From this analysis 57 sites were identified for field visit. Map 11 shows the location of the stream candidate sites. Because most of the sites were on private property, notification letters were delivered and 38 sites were returned with positive results. Field visits were planned for the 38 sites which included erosion (30), fish barriers (3), pipe outfalls (2), trash dumping (1) and unusual condition (2). Only one problem site had a Severity rating greater than Moderate. Field visits were completed for 15 of the 38 sites including erosion sites (10), fish barriers (2), and pipe outfalls (2). The results are shown below in table 21. Only subwatersheds where the SCA was conducted are shown.

Table 21: Stream Restoration Candidate Sites

ID	Subwatershed	Restoration Priority	Visit Planned	Visit Completed	Potential Project
1	Big Branch	16	7	0	0
4	Little Deer Creek Lower	9	0	0	0
5	Little Deer Creek Upper	8	7	3	2
6	Lower Deer Creek	14	0	0	0
7	Lower Deer Creek Mill Hopkins Hollands Graveyard	6	6	3	2
8	Lower Deer Creek Tobacco Run Cool Branch	2	9	4	3
9	Middle Deer Creek	4	5	5	5
11	Middle Deer Creek Rock Hollow Wet Stone	17	1	0	0
19	Upper Deer Creek Jackson Branch	11	3	0	0
	Totals		38	15	12

A total of 12 projects were identified in four subwatersheds. The projects are listed below in Table 22 with a brief description of the concept for each. The project number uses the site ID from the SCA with a modifier if more than one project resulted from an individual site. The 12 potential stream projects are further prioritized in section 7, Implementation.

Table 22: Potential Stream Restoration Projects

Project No.	Problem (SCA)	Note / Concept	Subshed ID	Rest. Priority	Length
073101	Erosion	Stream restoration, livestock fencing	7	6	2,000
115201	Erosion	Stream restoration, buffer planting	7	6	1,500
121102a	Erosion	Bank stabilization, buffer planting	8	2	1,500
121102b	Erosion	Wetland creation site in floodplain	8	2	NA
122101	Erosion	Stream restoration, buffer planting	8	2	1,000
359103	Erosion	Bank stabilization, buffer planting, invasive species control, livestock fencing	5	8	1,500
358208	Erosion	Buffer planting, filter strip, trash removal	5	8	800[1]
367103	Fish Barrier	Correct two fish passage barriers	9	4	NA
406101	Erosion	Restoration/bank stabilization	9	4	500
406102	Pipe Outfall	Replace in conjunction with 406101	9	4	NA
406103	Fish Barrier	Improve fish passage with 406101	9	4	NA
406104	Pipe Outfall	Replace in conjunction with 406101	9	4	NA
		Totals			8,000

Note: 1 – excluded from total because no stream restoration proposed

5.3 Stormwater Management

Areas for potential stormwater management were identified from mapping using Harford County's GIS data. Areas of concentrated impervious surfaces, roadways, buildings, stormdrain locations and existing stormwater management facilities were identified. Areas were selected and tagged as either 'new' or 'retrofit' depending on whether stormwater facilities were currently in place. The developed recommendations are preliminary and potential projects will be analyzed in greater detail before moving forward with design and construction.

Table 23: SWM Candidate Sites

ID	Subwatershed	Restoration Priority	Visit Completed		Potential Project	
			New	Retrofit	New	Retrofit
1	Big Branch	16	0	0	0	0
2	Falling Branch	12	0	0	0	0
3	Island Branch	18	0	0	0	0
4	Little Deer Creek Lower	9	3	0	2	0
5	Little Deer Creek Upper	8	0	0	0	0
6	Lower Deer Creek	14	0	0	0	0
7	Lower Deer Creek Mill Hopkins Hollands Graveyard	6	0	1	0	1
8	Lower Deer Creek Tobacco Run Cool Branch	2	11	7	8	6

ID	Subwatershed	Restoration Priority	Visit Completed		Potential Project	
			New	Retrofit	New	Retrofit
9	Middle Deer Creek	4	0	0	0	0
10	Middle Deer Creek Kellogg	19	0	0	0	0
11	Middle Deer Creek Rock Hollow Wet Stone	17	2	0	1	0
12	Middle Deer Creek St. Omar	15	0	0	0	0
13	Stirrup Run	10	2	0	1	0
14	Stout Bottle Cabbage Run	1	1	6	1	6
15	Thomas Run	13	6	5	1	3
16	Upper Deer Creek 1	20	0	0	0	0
17	Upper Deer Creek 2	5	0	0	0	0
18	Upper Deer Creek Ebaughs Creek	3	0	0	0	0
19	Upper Deer Creek Jackson Branch	11	1	0	1	0
20	Upper Deer Creek Plumtree	7	0	0	0	0
	Totals		26	19	15	16

Initially, 34 areas were identified across the Watershed with particular focus in the highest priority restoration subwatersheds. Map 12 shows the SWM candidate sites. These areas were investigated further using mapping to determine if a project would be necessary (using SCA and MBSS data) or feasible due to site constraints. Several areas were eliminated and field visits were planned for 20 areas. Each of these areas had several specific sites within them totaling 45. Site visits included visual inspection of receiving channels for signs of degradation, local topography and runoff flow patterns, existing SWM facilities including inlets, and site constraints including utilities, land ownership, and site access. The overall necessity and project benefit was estimated.

Field visits were accomplished for a total of 15 areas and 45 sites, 26 new sites and 19 retrofit sites. The sites were distributed across the watershed but focused on the highest priority subwatersheds. Refer to Map 12 for the locations of the SWM candidate sites. A total of 25 sites were located in the top two priority restoration subwatersheds.

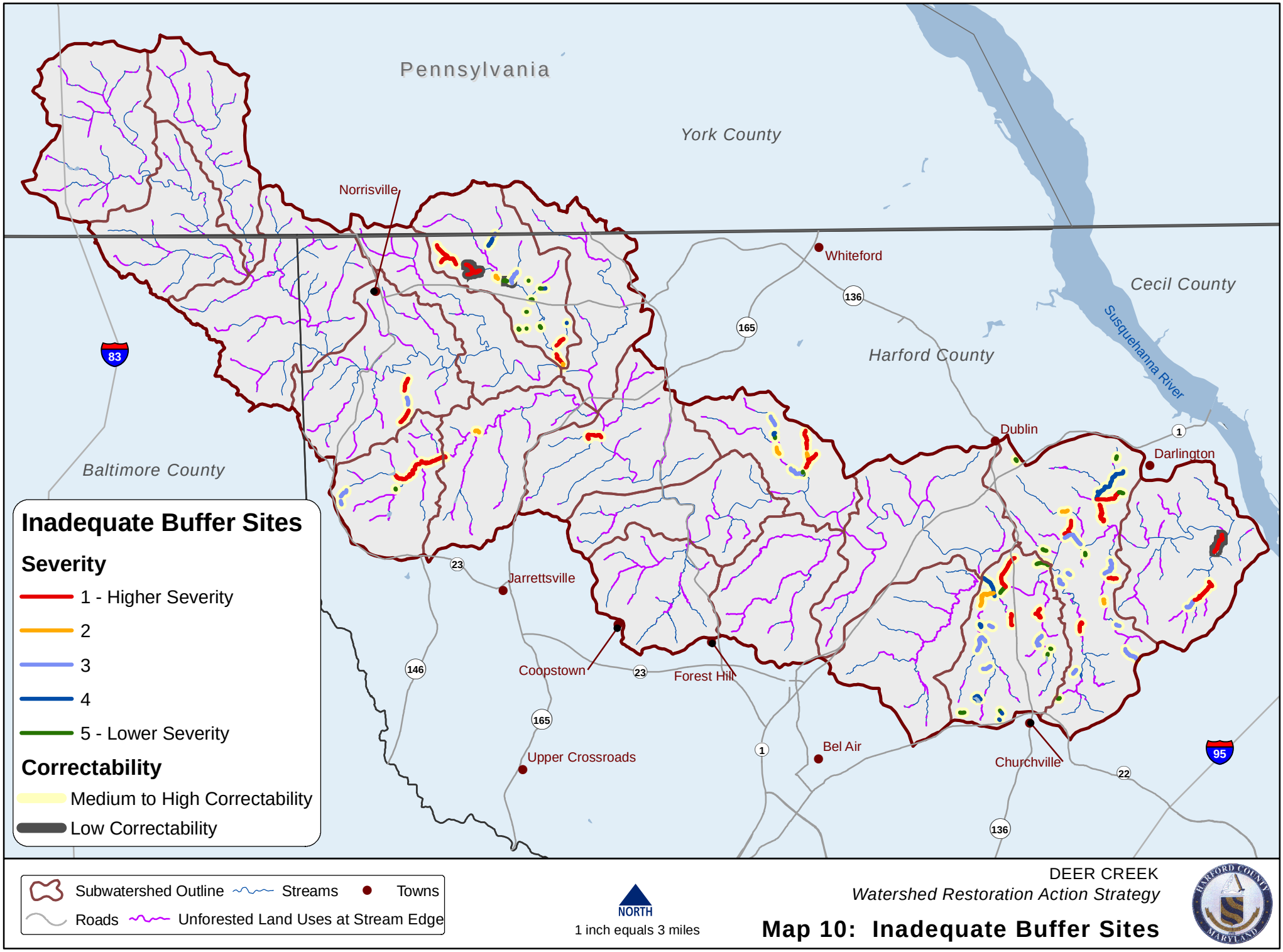
Following the site visits, a total of 31 potential projects were identified, 15 new SWM sites and 16 retrofit sites. The potential projects were targeted in the highest priority restoration subwatersheds with a total of 21 in the highest two priority subwatersheds. The sites are listed below in Table 24 with a brief description of the concept and calculations of the treated areas. Impervious areas were calculated using land use codes and impervious factors for pond sites. Projects immediately adjacent to and treating parking lot runoff such as sand filters and bioretention are assumed to treat an impervious area equal to the drainage area. The 31 potential SWM projects are further prioritized in section 7, Implementation.

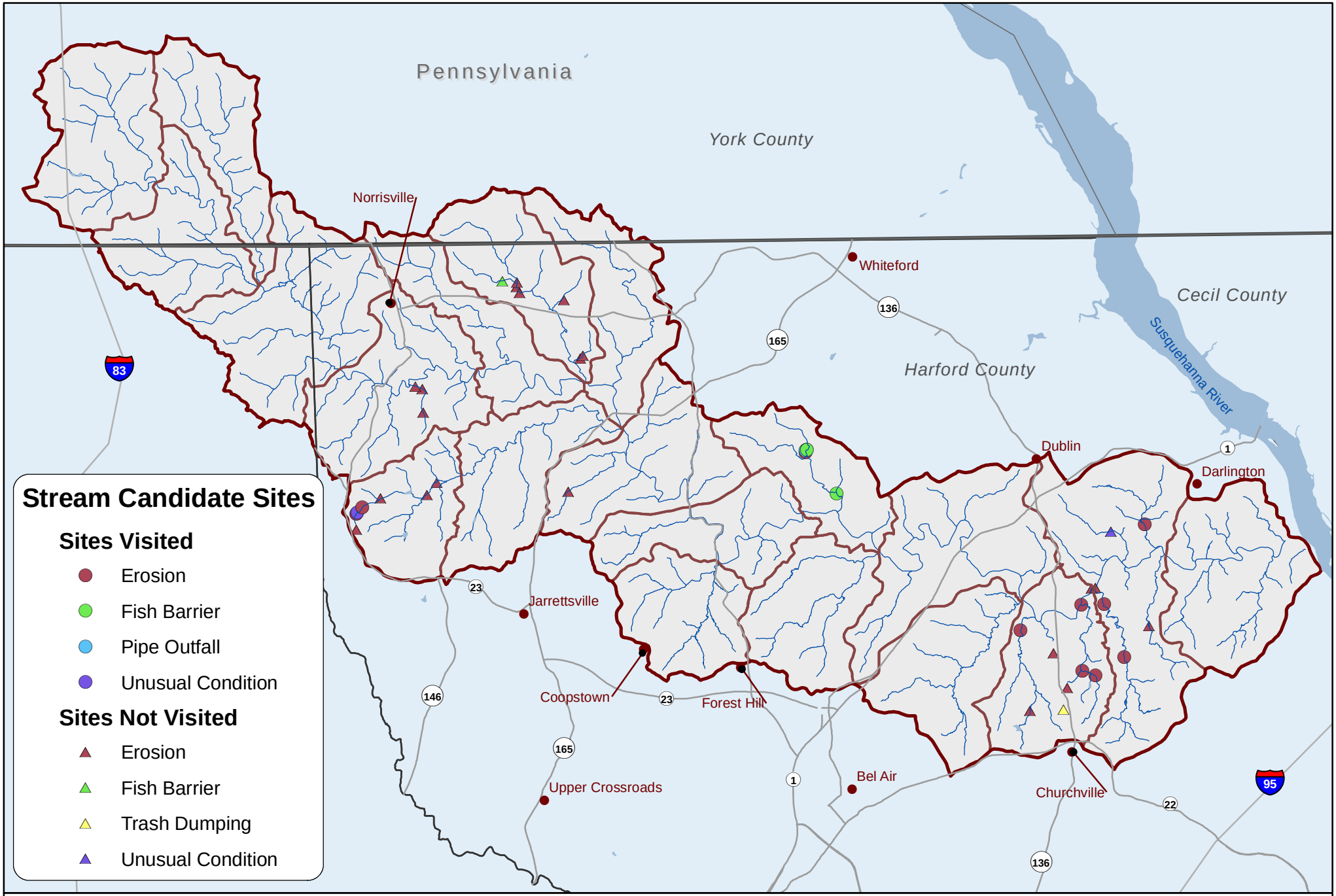
Table 24: Potential SWM Projects

Proj.No.	Project Type	Note / Concept	Subshed ID	Restoration Priority	Area Treated (acres)	Imp. Area Treated (acres)
1A	Bioretention	Forest Hill ES, treat parking lot	14	1	1.2	1.2
1B	Pond Retrofit	Add forebay, dry swale, micropool, adjust riser	14	1	10.2	1.4
1C	Pond Retrofit	Enhance marsh, add forebay, micropool	14	1	15.8	2.0
1D	Pond Retrofit	Add swale, forebay, low flow channel, buffer, riser	14	1	23.5	2.2
2AB	Bioretention	Hickory ES, treat parking lots	14	1	1.6	1.6
2C	Pond Retrofit	Hickory ES site dry swales and pond retrofit	14	1	10.7	3.9
3	Dry Swale	Two swales to pretreat pond inflow	14	1	11.1	1.6
8A	New Pond	Redirect street runoff to new pond	8	2	24.7	3.5
8B	New Pond	Field at downstream end of Tobacco Run Drive	8	2	22.2	3.0
9A	Inlet Treatment	Treat road runoff in Cool Spring Community	8	2	134.9	18.2
9B	NewPond/Wetland	Offline pond or wetland mitigation site	8	2	33.5	1.9
10	Pond Retrofit	Add aquatic bench, forebays, modify riser	8	2	254.5	18.8
12ABC	Bioretention	Harford CC, treat parking lots (12A, B and C)	8	2	3.73	3.73
12D	New Pond	Harford CC, wet pond and adjacent sand filter	8	2	6.40	1.9
12EF	New Pond	Harford CC, and sand filter/bioretention parking lot treatment (12E and F)	8	2	19.2	6.7
12G	Sand Filter	Harford CC, treat parking lot, also buffer planting	8	2	0.8	0.8
13	Inlet Treatment	Treat road runoff in Bramblewood Community	8	2	67.9	13.1
14AB	Bioretention	Campus Hill Shopping Center	8	2	10.1	10.1
14C	Pond Retrofit	Convert for channel protection / water quality volume	8	2	8.4	0.3
15A	Pond Retrofit	Add forebay and shoreline stabilization	8	2	152.9	18.3
15B	Inlet Treatment	Treat road runoff in Rolling Green Community	8	2	43.8	6.1
18	Pond Retrofit	Provide channel protection	7	6	2.1	1.5
20	Inlet Treatment	Treat road runoff in Harford Heritage Community	4	9	39.3	5.5
23	Inlet Treatment	Treat road runoff in Madonna Manor Community	4	9	53.0	7.1

Proj.No.	Project Type	Note / Concept	Subshed ID	Restoration Priority	Area Treated (acres)	Imp. Area Treated (acres)
24AB	New Pond	Treat residential runoff, also linear micropool feature	13	10	25.3	4.5
26	Inlet Treatment	Treat road runoff in Meadow Stream Community	19	11	80.1	10.0
27AB	Pond Retrofit	Saint Margaret's Mission, also bioretention	15	13	3.6	2.1
28AB	New Pond	Prospect Mill ES, also sand filter	15	13	12.8	3.0
28C	New Pond	Shallow marsh, forebay, swales, buffer	15	13	14.7	3.5
28DE	Pond Retrofit	Harford Tech HS, also sand filter and bioretention	15	13	3.2	2.6
33	Bioretention	North Bend ES, treat parking lot	11	17	1.3	1.3
		Totals			1,092.5	161.4

Note: nc – not calculated if another downstream project also treats flow

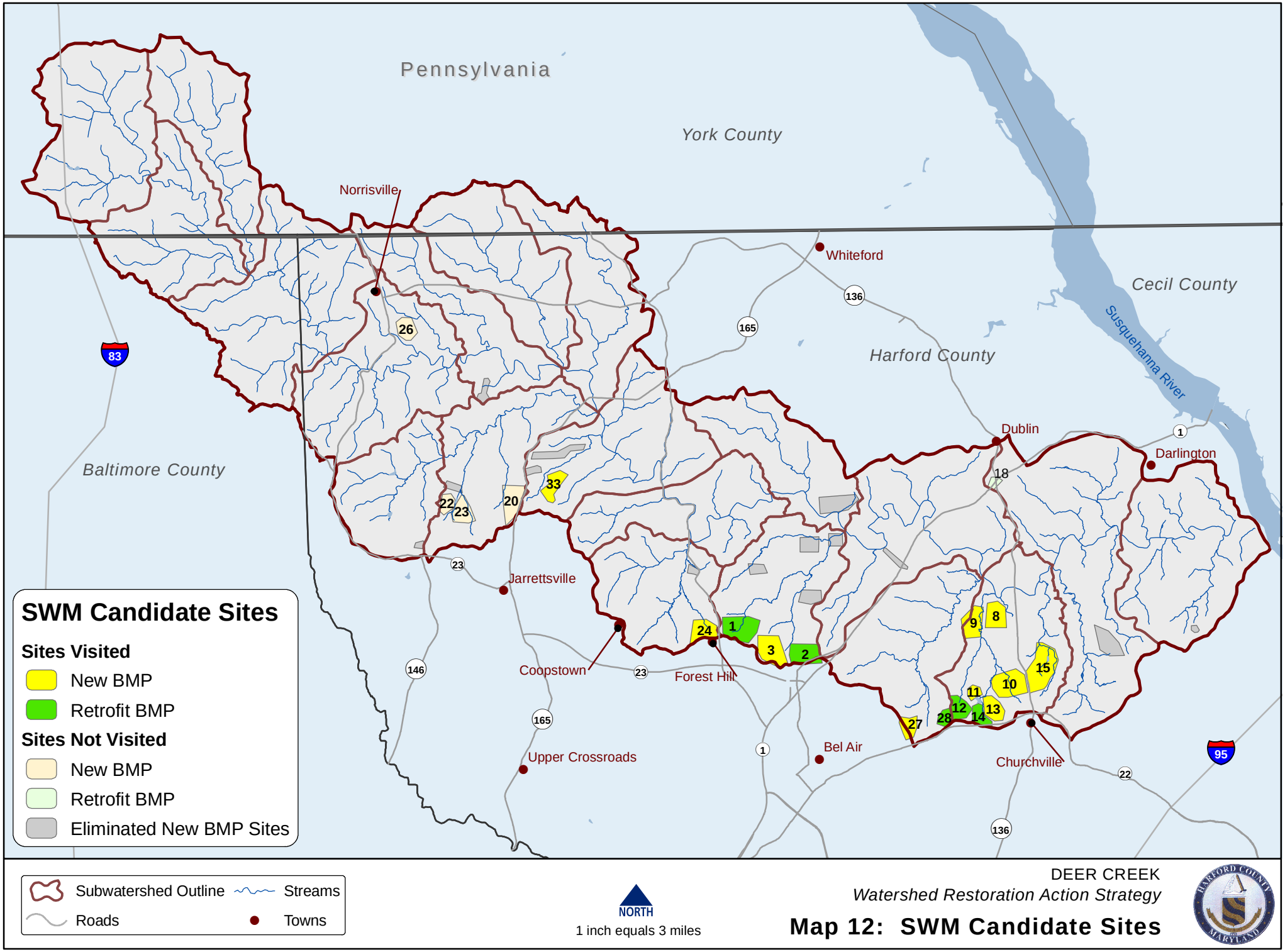

Pennsylvania
York County
Norrisville
Whiteford
Cecil County
Susquehanna River
Harford County
Baltimore County
Dublin
Darlington
Jarrettsville
Coopstown
Forest Hill
Upper Crossroads
Bel Air
Churchville
83
136
165
23
146
1
95
22
Inadequate Buffer Sites
Severity
1 - Higher Severity
2
3
4
5 - Lower Severity
Correctability
Medium to High Correctability
Low Correctability
Subwatershed Outline
Streams
Towns
Roads
Unforested Land Uses at Stream Edge
NORTH
1 inch equals 3 miles
DEER CREEK
Watershed Restoration Action Strategy
Map 10: Inadequate Buffer Sites



DEER CREEK

Watershed Restoration Action Strategy

Map 11: Stream Candidate Sites


Pennsylvania
York County
Cecil County
Harford County
Baltimore County
Susquehanna River
Norrisville
Whiteford
Dublin
Darlington
Jarrettsville
Coopstown
Forest Hill
Upper Crossroads
Bel Air
Churchville
83
95
136
165
146
1
18
22
23
20
33
26
24
3
2
9
8
15
10
11
12
13
14
27
28
SWM Candidate Sites
Sites Visited
New BMP
Retrofit BMP
Sites Not Visited
New BMP
Retrofit BMP
Eliminated New BMP Sites
Subwatershed Outline
Streams
Roads
Towns
NORTH
1 inch equals 3 miles
DEER CREEK
Watershed Restoration Action Strategy
Map 12: SWM Candidate Sites

6 Management Strategies

The Deer Creek WRAS Management Strategies were built around the framework provided by the overarching 'goals' and 'objectives' of the WRAS. Therefore they follow the main categories of Agriculture, Natural Resources, Development, Education / Outreach, and Interjurisdictional Coordination. Due to the nature of watershed issues, many strategies could be appropriately placed in several categories, however to be concise the strategies were placed in the category deemed most appropriate.

The strategies were developed by the Stakeholder Subcommittees with input, revision and consensus from the entire Stakeholder Committee. It should be noted that the local Deer Creek Scenic River Advisory Board has review and approval authority over any new construction within 150 feet of the Creek. Coordination will occur with this Board related to any of these activities requiring their approval.

The management strategies are specific, when possible, within the scope of the project. Each strategy is listed with the following parameters:

- Benefit – The primary watershed quality benefit provided by the strategy,
- Responsible Party – The group or agency with the primary responsibility of implementing the strategy, several strategies list more than one party that will work collaboratively,
- Timeline – The general timeline to either initiate or complete the management strategy, several strategies are detailed with initiation, design and construction, while others are broader recommendations, some strategies exist in some form and have been listed as 'ongoing',
- Success / Performance Measure – How the strategy will be tracked or monitored to determine success,
- Outreach and Education Component – Describes how the strategy will incorporate community involvement, and
- Cost and Funding – Planning level costs and funding sources are provided for most strategies, the costs do not include detailed design or project scoping, and many strategies will be accomplished within the existing staffing and resources of the responsible party and are listed as such.

While many of the management strategies are broad and applicable to the entire Deer Creek, the overriding theme is that the efforts will be *targeted* whenever possible in the highest

priority restoration and protection subwatersheds and in subwatersheds on Maryland's 303(d) list of impaired waters.

Whereas many of the management strategies presented in the WRAS are focused in Harford County, which has 80 percent of the watershed area, effort was made to include strategies that could be implemented across jurisdictions. Coordination will continue, and a stronger partnership pursued, with both Baltimore County and Pennsylvania.

6.1 Agriculture

Goal: Promote the recognition of the value of farming, awareness of best management practices, preservation of farmland and financial resources necessary for their implementation

Objective 1: Promote the awareness of and implement best management practices in agricultural areas in order to protect water quality

Management Strategy	Benefits	Responsible Party	Timeline	Success / Performance Measure	Outreach and Education Component	Cost and Funding Sources
Maintain Deer Creek Planner position at the Harford Soil Conservation District	Development of Soil Conservation and Water Quality Plans which reduce farming impact on the stream system	Harford Soil Conservation District	Ongoing	Staffing level sustained	The Planner position duties involve promoting the implementation of best management practices through public meetings, newsletters and press releases	Cost: $88,000 Funding: Continue §319 grant funding for a Deer Creek Planner in the Soil Conservation District office
Increase Soil Conservation and Water Quality Plan participation among farmers to 80 percent in each of the 12-digit subwatersheds	The plans outline strategies for agricultural best management practices	Harford Soil Conservation District	Ongoing	Monitor numbers of farmers and acres of agricultural land with new and revised plans	Targeted outreach to individual landowners using mailings and by farmers with successfully implemented plans	Cost and Funding: §319 grant funding (overlaps Deer Creek Planner funding)
Plant and maintain 45 acres of riparian buffer per year on Agricultural lands 45 acres translates roughly to 3.7 miles of 100 foot wide buffer	Improves streambank stability and instream/riparian habitat, provides shading and nutrient loading reduction, addresses directive 06-1 of the Chesapeake 2000 Bay Agreement	Harford Soil Conservation District MDNR Forestry Service	Ongoing	Monitoring acres planted per year and survivability of plant material, Stream Corridor Assessment identified 15 miles of deficient buffer on Agricultural land, GIS analysis identified 129 miles in entire Deer Creek Watershed	Targeted outreach through mailing and personal communication with individual landowners	Cost: $660 per acre, $29,700 for 45 acres (flat rate max cost share for planting) Funding: Maryland's Conservation Reserve Enhancement Program (CREP), NRCS's Wildlife Habitat Incentives Program (WHIP), Additional funding sources will be researched for outreach

Management Strategy	Benefits	Responsible Party	Timeline	Success / Performance Measure	Outreach and Education Component	Cost and Funding Sources
Fence 5,000 feet of stream from livestock per year Locations identified in the Stream Corridor Assessment or by Harford Soil Conservation District	Improves streambank stability, reduces pollutant loading and erosion, improves herd health	Harford Soil Conservation District	Ongoing	Monitor feet of fencing planned and installed and the number of livestock operations and head involved	Targeted outreach through mailing and personal communication with individual landowners Workshop with a veterinarian to describe herd health benefits	Cost: $3.60 per foot, $18,000 for 5000 feet (flat rate max cost share for minimum fencing requirements) Funding: Maryland's Conservation Reserve Enhancement Program (CREP)
Increase the use of winter cover crop 10 percent from 3,000 acres per year to 3,300 acres per year with flexibility for planting dates and final crop disposition	Reduce nitrogen loading and erosion	Harford Soil Conservation District Maryland Department of Agriculture	Ongoing	Monitor area of cover crop and number of farms participating	Targeted outreach through mailing and personal communication with individual landowners Education on benefits of cover crop usage	Cost: Range of $66,000 to $165,000 depending on planting schedule, average $115,500 Funding: Maryland Agricultural Water Quality Cost Share (MACS) and funds allocated through the Chesapeake Bay Restoration Fund
Educate specialized agricultural operations (such as equine, greenhouse) on best management practices	Implementation will reduce pollutant loading	Natural Resources Conservation Service, Maryland Cooperative Extension, Harford Soil Conservation District, Maryland Department of Agriculture	0-2 yrs: Research 3-5 yrs: Plan and conduct workshop 5-10 yrs: Implement practices	Monitor public response, workshop attendance, and number of best management practices planned and installed	Conduct a workshop for specialized agricultural operations to introduce the management practices and funding opportunities available	Cost: $10,000 for workshop and materials Funding: Chesapeake Bay Trust, Chesapeake Bay Small Watershed Grant

Management Strategy	Benefits	Responsible Party	Timeline	Success / Performance Measure	Outreach and Education Component	Cost and Funding Sources
Provide stream restoration/stabilization on agricultural land (potential sites have been identified in the Stream Corridor Assessment and the WRAS)	Improves streambank stability and instream/riparian habitat, reduces erosion and nutrient loading	Harford Soil Conservation District	0-2 yrs: Site selection and research of grant funding opportunities If funding is obtained, 3-5 yrs: Design and Construction 5-10 yrs: Monitoring	Monitor site and downstream conditions during pre and post restoration phases	Coordination with landowners Publicize the work in Deer Creek Watershed Association newsletter	Cost: $500 per linear foot Funding: Chesapeake Bay Small Watershed Grant, §319 Funding
Promote Local, State and Federal agriculturally based cost-share and incentive programs, includes but not limited to Nutrient Management Plans, Environmental Quality Incentive Program (EQIP), Conservation Reserve Enhancement Program (CREP), Maryland Agricultural Water Quality Cost-Share (MACS), Wildlife Habitat Incentive Program (WHIP), C-GRAZE	Programs provide opportunities for implementing BMPs for improving water quality and wildlife habitat	Harford Soil Conservation District, Natural Resource Conservation Service, MDNR, Maryland Department of Agriculture	Ongoing	Monitor number of contacts made and participation rates in each program	Deer Creek Planner, Deer Creek Watershed Association newsletter, EnviroNews, Outreach to farmers through mailings, workshops, presentations and exhibits	Cost and Funding: Existing staff and program resources

Objective 2: Preserve agricultural land to maintain the rural character of the watershed and preserve habitats

Management Strategy	Benefits	Responsible Party	Timeline	Success / Performance Measure	Outreach and Education Component	Cost and Funding Sources
Expand the Deer Creek Rural Legacy Area to include the entire Deer Creek Watershed	Preserves productive agricultural, forest and environmentally sensitive land	Harford County Planning and Zoning	0-2 yrs	Submittal of Rural Legacy application in 2008 indicating expanded boundary	Post information on County website, press release to local news, send letter of interest to property owners	Cost and Funding: Existing staff and program resources
Target lands within high priority protection subwatersheds for preservation through easement programs	Preserves productive agricultural and environmentally sensitive land	Harford County Planning and Zoning	Ongoing	Acres or types of acres per year	Targeted mailings to distribute information Personal contact	Cost: Easement purchase cost is variable, rate will be determined at time of purchase. Funding: Harford County Rural Legacy Allocation, Maryland Agricultural Land Preservation Funding (MALPF), Harford County Agricultural Land Preservation (HCALP)
Designate a portion of the lower Deer Creek watershed as a Priority Preservation Area per the Agricultural Stewardship Act of 2006	Preserves productive agricultural and environmentally sensitive land	Harford County Planning and Zoning	0-2 yrs	Designation of area as State Priority Preservation Area	NA	Cost and Funding: Existing staff and program resources
Continue to conduct annual (or bi-annual) workshop for landowners in the watershed to promote the preservation of agricultural, forest and natural resources	Preserves productive agricultural and environmentally sensitive land	Harford County Planning and Zoning	Ongoing	Number of participants	Workshop with targeted advertisement in high priority Deer Creek areas	Cost and Funding: Existing Planning and Zoning Budget; MALPF

Management Strategy	Benefits	Responsible Party	Timeline	Success / Performance Measure	Outreach and Education Component	Cost and Funding Sources
Maintain collaborative land preservation partnerships	Preserves productive agricultural and environmentally sensitive land	Harford County Planning and Zoning, Maryland Environmental Trust, Harford Land Trust, Manor Conservancy	Ongoing	Monitor acres preserved Collaborative projects	Publicize the work in Deer Creek Watershed Association newsletter, EnviroNews, Agriculture Extension Office newsletter and on County website	Cost and Funding: Existing staff and program resources
Develop promotional materials, such as a video and outreach materials, to promote the conservation of agricultural and forest resources	Agricultural and forest land conservation	Harford County Planning and Zoning	0-2 yrs	Video completed and distributed/advertised Number of promotional materials developed and contacts made	Outreach to media and politicians	Cost: $15,000 to develop video, $2,000 annually for promotional materials Funding: Section 319 Grant and Maryland Agricultural Land Preservation Funding (MALPF)
Education on tax benefits for conservation easement donations	Encourage more conservation easements due to tax relief	Harford County Planning & Zoning in cooperation with tax attorneys/ accountants	Ongoing	50-60 farmers/ landowners contacted per year	General seminars Meetings with individual landowners & tax advisors	Cost and Funding: Existing staff and program resources, possible donation of time from tax attorneys and accountants
Research other land preservation tools, in addition to Purchase of Development Rights (PDR) to encourage land preservation	Preservation of land without PDR cost	Harford County Planning and Zoning	0-2 yrs	Acreage preserved by other tools	Public meetings will provide education on Zoning code updates and provide venue for citizen review	Cost and Funding: Existing staff and program resources

6.2 Natural Resources

Goal: Manage natural resources on a sustainable basis, including forests, wetlands, stream corridors, sensitive species and wildlife

Objective 1: Protect and restore stream corridors

Management Strategy	Benefits	Responsible Party	Timeline	Success / performance measure	Outreach and Education Component	Cost and Funding Sources
Plant 7,000 to 10,000 feet per year of riparian buffers along streams that have been identified through the Stream Corridor Assessment and with GIS in non-Agricultural use	Improves streambank stability and instream/riparian habitat, reduces erosion and nutrient loading, addresses directive 06-1 of the Chesapeake 2000 Bay Agreement	Harford County Planning and Zoning and MDNR (Stream Releaf); Harford County Public Works	0-2 yrs: Identify sites and property owner contact 3-10 yrs: Implement	Monitoring acres planted per year and survivability of plant material, SCA found 6.7 miles in non-Ag, 22 miles using Land Use based estimate	Involve volunteer groups for riparian buffer plantings (Boy Scouts, 4H, North Harford High Environmental Magnet, Eden Mill Nature Committee)	Cost: $60,000 per linear mile (assumes 100 foot buffer) total cost $115,000 Funding: Stream Releaf; DPW (Stream valley buffers); Forest Conservation Fund, Buffer Incentive Program
Research options for and encourage the use of riparian buffers on streams and wetlands within new and existing conservation easements such as Rural Legacy or Agricultural	Improves streambank stability and instream/riparian habitat, reduces erosion and nutrient loading	Harford County Planning and Zoning, Harford Land Trust, Maryland Environmental Trust, Harford Soil Conservation District	0-2 yrs	Monitor the number of contacts made	Develop informational materials for distribution to citizens in the easement process Distribute results of research for review and implementation	Cost and Funding: Existing staff and program resources, additional $2,000 for printing materials

Management Strategy	Benefits	Responsible Party	Timeline	Success / performance measure	Outreach and Education Component	Cost and Funding Sources
Correct 3 fish passage barriers on trout streams identified in the Stream Corridor Assessment or through the Department of Natural Resources and conduct further research on other barriers	Connects and makes accessible fish habitat and spawning areas	MDNR Fish Passage Program, Harford County Public Works	0-2 yrs: fully investigate SCA data and County Crossing Inspections, design correction plan 3-5 yrs: Implement corrections	Monitor fish populations before and after the barriers are removed	Property owner contact, Articles in EnviroNews, MDNR website	Cost: To be determined Funding: Chesapeake Bay Trust, Chesapeake Bay Small Watershed Grant

Objective 2: Protect and restore forest and wetland resources

Management Strategy	Benefits	Responsible Party	Timeline	Success / performance measure	Outreach and Education Component	Cost and Funding Sources
Protect forest with conservation easements on lands that have been identified as either hub or corridor (approximately 12,000 total unprotected hub and corridor forest acres in Harford County)	Improves water quality and wildlife habitat; addresses directive 06-1 of the Chesapeake 2000 Bay Agreement	MDNR, Maryland Environmental Trust (MET), Harford County Planning and Zoning, Harford Land Trust	0-2 yrs: Identify properties and conduct outreach 3-10 yrs: Pursue easements	Monitor number of contacts made and properties/acres preserved	Contact property owners with large tracts of forest land within hubs and corridors	Cost: Easement purchase cost is variable, rate will be determined at time of purchase. Funding: Harford County Rural Legacy Allocation, Harford County Forest Legacy Allocation
Promote existing forest conservation programs such as the Forest Stewardship Program and the Woodland Assessment Program	Improves water quality and wildlife habitat	Harford County Forestry Board	Ongoing	Monitor number of contacts made, outreach materials distributed and citizen participation	Deer Creek Watershed Association Newsletter, Enviro-News article, Targeted mailings	Cost and Funding: Existing staffing and program resources

Management Strategy	Benefits	Responsible Party	Timeline	Success / performance measure	Outreach and Education Component	Cost and Funding Sources
Conduct on a biennial basis the "Get the Most From Your Woodlands" seminar, or a similar forest management class for landowners in the watershed	Improved management of forest resources	Harford County Forestry Board, MDNR, MD Cooperative Extension	3-5 yrs	Monitor number of participants enrolled in seminar	Advertise seminar through targeted mailings to property owners with conservation easements, fliers and notices in community newsletters	Cost: Seminar $1,000 Funding: Existing staffing and program resources and Chesapeake Bay Trust
Research grant funding to assist woodland owners to develop Forest Management Plans to effectively manage their forestland for water quality and habitat benefits	Improved management of forest resources	Harford County Planning and Zoning, Harford County Forestry Board	0-2 yrs	Monitor number of grant funding opportunities identified and utilized	NA	Cost and Funding: Existing staffing and program resources
Seek conservation easements for current and potential future Wetlands of Special State Concern (WSSC) that are not in public ownership	Protection of critical wetland resources and habitats	Harford County Planning and Zoning, Harford Land Trust	Current WSSCs: 0-2 yrs Potential future WSSCs: Ongoing as needed	Monitor number of contacts made and sites preserved	Include educational materials in contact with property owners	Cost: Easement purchase cost is variable, rate will be determined at time of purchase. Funding: Existing staffing and program resources for outreach, Harford County Rural Legacy Allocation, Maryland Environmental Trust (MET)
Promote and implement wetlands restoration/ enhancement projects	Restoration of wetland resources and habitats, water quality improvements	Natural Resource Conservation Service, Harford Soil Conservation Service, Izaak Walton League, MDNR	Ongoing	Monitor number of sites and acres restored or enhanced	Partnership with citizen groups such as the Izaak Walton League	Cost: $40,000 per acre Funding: Wetlands Reserve Program, CREP

Objective 3: Protect sensitive species habitat in order to maintain a high level of biological diversity

Management Strategy	Benefits	Responsible Party	Timeline	Success / performance measure	Outreach and Education Component	Cost and Funding Sources
Restore or enhance cold water fisheries streams (native brook or brown trout) and their buffers by planting riparian buffers on these priority streams	Improve fish habitat by reducing stream water temperatures and sedimentation	MDNR	0-2 yrs: Identify Project Sites 3-5 yrs: Implement restoration efforts	Monitor water temperatures and fish populations	Seek partnership with Trout Unlimited	Cost: $60,000 per linear mile (assumes 100 foot buffer) Funding: Stream Releaf; DPW (Stream valley buffers); Forest Conservation fund, Buffer Incentive Program
Restore and enhance sensitive species habitat on private land (such as bog turtle habitat)	Improve sensitive species habitat	Harford County Planning and Zoning, MDNR Wildlife and Heritage, Maryland Biological Stream Survey, Natural Resource Conservation Service	0-2 yrs: Begin outreach 3-5 yrs: Complete 2 restoration or enhancement projects	Monitor number of contacts made, interest generated and number of completed projects	Targeted mailing with information on the Landowner Incentive Program and sensitive species and habitat preservation	Cost: $1,000 per acre Funding: MDNR Landowner Incentive Program, USFWS Partners for Fish and Wildlife Program, Wildlife Habitat Incentive Program

Objective 4: Undertake additional research in order to protect and improve water quality and natural resources

Management Strategy	Benefits	Responsible Party	Timeline	Success / performance measure	Outreach and Education Component	Cost and Funding Sources
Continue Stream Corridor Assessments in subwatersheds not yet assessed and listed in the 2006 303(d) list of Impaired Waters as category 5 – Waterbodies that may require a TMDL (100 miles currently in Deer Creek)	Identifies overall stream condition and specific problem areas/potential restoration sites	MDNR, Maryland Conservation Corps, Harford County Planning and Zoning, Harford County Public Works	5-10 yrs (when TMDL required)	Monitor number of subwatersheds and stream miles completed	Include educational materials in outreach mailings to property owners requesting permission for private property access	Cost: $700 per mile assessed, includes fieldwork, preparation and reporting of findings, approximately 100 miles unassessed miles on 303(d) list, total $70,000 Funding: Chesapeake Bay Small Watershed Grant, §319 Funding
Develop detailed management plans for the 2 highest priority restoration and protection subwatersheds	Provides specific recommendations within each subwatershed	Harford County Planning and Zoning, Harford County Public Works	5-10 yrs	Completion and acceptance of management plans	Plans will develop specific outreach programs tailored to the subwatersheds	Cost: $100,000 per subwatershed (approx 8 square miles each) Funding: Chesapeake Bay Trust, Chesapeake Bay Small Watershed Grant

6.3 Development

Goal: Utilize sustainable development and implementation approaches to manage impervious surfaces and protect water quality

Objective 1: Minimize the impacts of new development

Management Strategy	Benefits	Responsible Party	Timeline	Success / performance measure	Outreach and Education Component	Cost and Funding Sources
Incorporate Builders for the Bay recommendations into the Harford County Ordinances	Reduce new development impacts on water quality	Harford County Department of Planning and Zoning	0-2 yrs	Adoption into County ordinances	Public meetings and County Council hearings will alert residents of changes	Cost and Funding: Existing staff and program resources
Promote, through incentives or other means, the use of the Conservation Development Standard (CDS) for rural subdivisions	Reduce new development impacts on water quality and habitats	Harford County Department of Planning and Zoning	Ongoing	Increased use of CDS in agriculturally zoned areas	Workshop for plan reviewers and developers	Cost and Funding: Existing staff and program resources
Explore the use of various zoning tools, such as, Transfer of Development Rights (TDR) to minimize the impacts of new development	Reduce new development impacts on water quality and habitat	Harford County Planning & Zoning	0-2 yrs	Changes to the Harford County development regulations	Public meetings and County Council hearings will alert residents of changes	Cost and Funding: Existing staff and program resources

Objective 2: Reduce impact of existing development on water quality and the natural resources

Management Strategy	Benefits	Responsible Party	Timeline	Success / performance measure	Outreach and Education Component	Cost and Funding Sources
Provide stormwater BMPs in communities lacking stormwater management	Reduce runoff volume and pollutant loading	Harford County Department of Public Works	0-3 yrs: Identify sites for incorporation into CIP 4-10 yrs: Design and construct 1 facility	Monitor baseflow and stormwater quantity and quality	Community notice of project through fliers or community meeting	Cost: to be determined Funding: Section 319 grant, Stormwater Pollution Control Cost Share Program (MDE), Small Creeks and Estuary Water Quality Restoration Program (MDE)
Provide stormwater BMP retrofits in communities with under-designed under-performing stormwater management	Reduce runoff volume and pollutant loading	Harford County Department of Public Works	0-3 yrs: Identify sites for incorporation into CIP 4 - 10 yrs: Design and construct 1 facility	Monitor baseflow and stormwater quantity and quality	Community notice of project through fliers or community meeting	Cost: to be determined Funding: Section 319 grant, Stormwater Pollution Control Cost Share Program (MDE), Small Creeks and Estuary Water Quality Restoration Program (MDE)
Evaluate and identify stormwater management projects on public properties	Reduce pollutant loading	Harford County Department of Public Works, Parks and Recreation, Harford Community College	0-2 yrs: Identify sites for incorporation into CIP 3-5 yrs: Design and construct 1 site 5-10 yrs: Design and construct 2 sites	Monitor baseflow and stormwater quantity and quality	Use sites as demonstration projects Signage provided at sites will describe project benefits	Cost: to be determined Funding: Section 319 grant, Stormwater Pollution Control Cost Share Program (MDE), Small Creeks and Estuary Water Quality Restoration Program (MDE)

Management Strategy	Benefits	Responsible Party	Timeline	Success / performance measure	Outreach and Education Component	Cost and Funding Sources
Educate residents on the proper maintenance and upgrade of septic systems	Reduce nitrogen and bacteria loading	Harford County Health Department	3-5 yrs	Monitor the number of people contacted Track website visits and requests for additional information	Targeted mailing by subwatershed, current Health Dept. video, provide information on County website, articles in local newsletters	Cost: $10,000 to develop and distribute materials and articles Funding: Chesapeake Bay Trust grant
Increase reforestation efforts on large lot subdivisions, especially adjacent to streams	Reduce stream temperatures, restore natural hydrology, improve habitat and water quality	Harford County Planning and Zoning, MDNR	3-5 yrs	Monitor number of projects and number of acres of forest restored	Provide information on County website Develop and distribute informational brochure on topics such as proper Natural Resource District maintenance	Cost: $5,000 per acre for reforestation, $4,000 to develop and distribute brochure Funding: Forest Conservation Program, Chesapeake Bay Trust grant
Educate residential property owners about impacts of fertilizer and pesticide/herbicide use in the watershed	Reduce pollutant loading	Eden Mill Nature Committee Harford County Department of Public Works	Ongoing	Monitor numbers of citizens contacted, survey types of lawn care practices over time	Provide information on County website Distribute information (Streamside Neighbor, Bayscapes), Articles in local newsletters and newspapers	Cost: $5,000 for information packets Funding: Chesapeake Bay Trust grant

6.4 Education / Outreach

Goal: Develop and promote watershed awareness and stewardship

Objective 1: Promote a stewardship ethic among residents in the watershed through an understanding of watershed values and issues

Management Strategy	Benefits	Responsible Party	Timeline	Success / performance measure	Cost and Funding Sources
Establish a stream naming program for currently unnamed tributaries (through USGS Geographic Names Information System GNIS)	Raises watershed awareness and promotes stewardship	Harford Glen Environmental Education Center	0-5 yrs	Monitor participation	Chesapeake Bay Trust could possibly provide funding through a small watershed grant for posting signs at streams
Undertake a "Capacity Building" initiative by the Deer Creek Watershed Association	Enhances capabilities of the watershed association to address water quality and habitat issues	Deer Creek Watershed Association	0-2 yrs: Initiate process	Increased membership, grant application to accomplish strategy, create website, list events in Bay Journal, develop a Watershed Association logo	Cost: $25,000 Funding: Chesapeake Bay Trust, Chesapeake Bay Small Watershed Grants Program,
Establish a riparian forest buffer demonstration area at Eden Mill Nature Center	Provide awareness of importance of riparian buffers	Eden Mill Nature Committee, MDNR, Harford Parks and Recreation	0-2 yrs: Site selection, planning 3-5 yrs: Planting Completed	Monitor visits to the demonstration area	Cost and Funding: To be determined, will use volunteers when possible
Conduct watershed education programs targeted to Deer Creek	Provides education on watershed related issues	Eden Mill Nature Committee, Harford Community College	0-5 yrs	Monitor citizen involvement	Cost and Funding: To be determined, will use volunteers when possible
Update and expand the Deer Creek WRAS webpage on the Harford County website	Dissemination of information on the watershed and implementation of strategies.	Harford County Planning & Zoning	Ongoing	Updated/maintained webpage	Cost and Funding: Existing staff and program resources

Objective 2: Promote projects that encourage public access and public environmentally-oriented education and recreation

Management Strategy	Benefits	Responsible Party	Timeline	Success / performance measure	Cost and Funding Sources
Join public land corridors along Deer Creek and promote projects to increase public access to Deer Creek	Linkage of public lands and increased opportunities for access and recreation	MDNR and Harford County Parks and Recreation, Lower Susquehanna Heritage Greenway (LSHG)	Ongoing as opportunities arise	Monitor land ownership and land use, track parcels and area joined	Cost: Land purchase cost is variable, rate will be determined at time of purchase Funding: Program Open Space
Increase canoe launch opportunities along Deer Creek	Increased awareness and interest in the watershed, increase recreation opportunities	MDNR and Harford County Parks and Recreation, Lower Susquehanna Heritage Greenway (LSHG)	0-2 yrs	Additional canoe launch site(s)	Cost: Land acquisition $100,000, parking and launch development $100,000 Funding: Program Open Space
Develop and distribute water trail maps for Deer Creek and the Susquehanna River, install interpretative signage along water trail	Provides education and increases awareness and interest in the watershed	Lower Susquehanna Heritage Greenway (LSHG), Chesapeake Bay Gateways, MDNR, Harford and Cecil Counties	0-2 yrs	Water trail map printed and distributed, interpretive signage installed	Cost: $50,000 Funding: LSHG, MDNR, Chesapeake Bay Gateways
Research strategies to address ATV use in the watershed (signage, education)	Reduce impact of ATVs on stream corridors	MDNR and Harford County Parks and Recreation	3-5 yrs	Development of strategy	Cost and Funding: Existing staff and program resources
Research potential for an additional nature center in the eastern portion of the Deer Creek Watershed	Provides environmental education opportunities	Harford County Parks and Recreation	5-10 yrs	Creation of nature center	Cost: $6 million Funding: Program Open Space
Research options for establishing a volunteer monitoring program in the Deer Creek watershed, partnerships with schools/community groups	Provides supplemental watershed condition information, increases public awareness and participation in environmental issues	Deer Creek Watershed Association, Harford Community College	3-5 yrs	Report findings and final strategy for a coordinated volunteer effort	Cost and Funding: Existing staff and program resources, volunteer time to research options

Management Strategy	Benefits	Responsible Party	Timeline	Success / performance measure	Cost and Funding Sources
Install stream signage at County road stream crossings and watershed boundaries	Increase public awareness and promote stewardship	Harford County Department of Public Works; Izaak Walton League	0-5 yrs	Monitor number of crossings signed	Cost: $250 per sign Funding: Chesapeake Bay Trust
Develop a National Scenic Byways Corridor Management plan that includes the Deer Creek watershed.	Increase awareness of the natural, historic, cultural and recreational resources, for national scenic byway designation; funding for restoration strategies	Lower Susquehanna Heritage Greenway (LSHG), MDNR and Harford County Planning and Zoning	0-2 yrs	Designation as a National Scenic Byway	Cost: $120,000 Funding: LSGH and Maryland Scenic Byway Program

6.5 Interjurisdictional Coordination

Goal: Network with regional jurisdictions to address common goals of water quality protection and environmental stewardship

Management Strategy	Benefits	Responsible Party	Timeline	Success / performance measure	Outreach and Education Component	Cost and Funding Sources
Participate in the yearly Watershed Awareness Day sponsored by the Watershed Alliance of York	Promote stewardship	Eden Mill Nature Committee, Deer Creek Watershed Association, Harford Community College	Ongoing/annually	Monitor numbers of programs and level of participation	Coordinate with local community groups, advertise the events in local media	Cost and Funding: To be determined
Explore a regional Forest Sustainability Program with the MDNR and Baltimore County	Conservation of forest resources and water quality and habitat benefits	MDNR, Harford County Planning and Zoning, Harford County Forestry Board, Baltimore County	0-5 yrs	Attendance at workshops, Regular communication	Report work and findings on existing programs websites, and in local media	Cost and Funding: Existing staff and program resources
Coordinate with Aberdeen Proving Grounds in developing Army Compatible Use Buffer (ACUB)	Provide additional buffer restoration opportunities	Harford Planning and Zoning, Aberdeen Proving Grounds	Ongoing	Monitor any buffer plantings, track sites and amount planted	NA	Cost and Funding: to be determined

Management Strategy	Benefits	Responsible Party	Timeline	Success / performance measure	Outreach and Education Component	Cost and Funding Sources
Explore opportunities with the Department of Defense for natural area conservation	Address source water protection and mitigation for impacts associated with BRAC	Harford County, Aberdeen Proving Grounds, Department of Defense, National Park Service	0-2 yrs	Department of Defense support for various water and land protection projects	NA	Cost and Funding: Existing staff and program resources
Establish an Implementation Committee to oversee and promote implementation progress of Management Strategies in the Deer Creek WRAS	Promote and coordinate implementation of WRAS Strategies	Harford Planning and Zoning, Deer Creek WRAS Stakeholder Workgroup organizations	0-10 yrs	Establishment of Committee and successful implementation of strategies	Report and adjustments to the WRAS and implementation progress on WRAS website	Cost and Funding: Existing staff and program resources

7 Implementation

The Deer Creek WRAS is a planning level document that will help target program resources over the 10-year planning horizon of the WRAS. Harford County Government and the Harford Soil Conservation District will take the lead role in the implementation phase of the plan and tracking success with major support from the Deer Creek WRAS Implementation Committee, which will be comprised of current Stakeholder Committee members and other interested parties. Implementation opportunities on public land (parks, schools, landfill site) will be sought in order to foster the Chesapeake 2000 Bay Agreement goal that government lead by example. In order to foster implementation of the WRAS, the county should consider seeking grant funding to hire a watershed coordinator.

There are other watershed analysis and planning efforts that will be incorporated into the WRAS implementation phase. The Susquehanna River Basin Commission (SRBC) is working on a consumptive water use study that includes the Deer Creek Watershed and the York County Conservation District is developing the Kreutz-Deer-Gunpowder-Susquehanna Tribs Watershed Conservation Plan, under the Community Conservation Partnership program, of the Pennsylvania Department of Conservation & Natural Resources.

In this section, the implementation of the WRAS is broken into several sections dealing with Program Changes, Project Prioritization, Pollutant Loads, Constraints, Monitoring, Funding, and Items Requiring Further Study.

7.1 Program Change

Implementation of the recommendations of the Deer Creek WRAS may result in a number of institutional changes to current Harford County programs and/or ordinances. Strategies identified in the WRAS in section 6, Management Strategies, which may result in program changes are:

- Proposed expansion of the Deer Creek Rural Legacy Area to include all of the Deer Creek Watershed;
- Designation of a portion of the lower Deer Creek Watershed as a high priority preservation area per the Agricultural Stewardship Act of 2006;
- Incorporation of recommendations of the Builders for the Bay into the Harford County Zoning Code update, and
- Potential changes to the Harford County Zoning Code to minimize impacts of new development, such as revised Transfer of Development Rights language.

7.2 Watershed Priorities

The Deer Creek is a rural and agricultural watershed with high quality water resources. The Watershed currently has low levels of development and imperviousness; however based on water quality sampling and modeling, it also has elevated levels of nutrient loading. Land use changes and potential impervious surface increases based on current zoning are not expected to be dramatic; however increases in residential areas and loss of farmland and forest can be expected.

Based on these conditions the *highest priority* strategies are focused on agricultural BMPs, riparian buffer planting, land preservation, and outreach. Strategies of *lower priority* include new or retrofit stormwater BMPs in currently developed areas and stream restoration. When possible, strategies will be implemented on public lands to provide examples of positive change and the commitment to the Deer Creek Watershed.

Agricultural BMPs

Agricultural activities are among the largest sources of nutrients in Maryland. The Harford Soil Conservation District (SCD) works to control these inputs through S*oil Conservation and Water Quality Plans* which are based on the design and implementation of agricultural BMPs. SCD has set a goal of 80 percent participation among farms in each of the Deer Creek subwatersheds. SCD uses many types of BMPs; however the strategies of specific importance to the WRAS, which are included as management strategies, include riparian buffer planting, stream protection using livestock exclusion fencing, and cover crops.

Riparian Buffer Planting

Protection and restoration of stream corridors using riparian buffers is a cost effective measure for both agricultural and non-agricultural areas of the Watershed. Riparian buffer restoration improves streambank stability, instream/riparian habitat and provides shading and nutrient loading reductions. Buffer plantings are included as strategies for both agricultural and non-agricultural areas in addition to being targeted to enhance cold water fisheries. Between five and six miles per year of riparian buffer planting is planned in the WRAS. To attain this goal, an increase in the capability and capacity of several stakeholder groups will need to be pursued.

Land Preservation

Land preservation is of key importance in the Deer Creek Watershed. Currently 32 percent of land area in the Deer Creek is under conservation easement, primarily agricultural, or in public ownership. Management strategies include expansion of the Deer Creek Rural Legacy Area, targeting easements in high priority protection subwatersheds, and using collaborative

partnerships for land preservation. Additional preservation strategies seek to increase the use of riparian buffers on streams and wetlands in new and existing conservation easements.

Outreach

Outreach is a critical component of the WRAS. The success of each strategy and the success of the WRAS implementation as a whole are dependent on the public being aware, engaged and involved. While each strategy includes efforts for education and outreach, specific strategies are included to promote a broad base of stewardship and an understanding of Watershed values and issues. These strategies involve the Deer Creek Watershed Association, watershed education programs and recreational uses.

Project Prioritization and Recommended Projects

The management strategies set goals of a total of five stormwater BMP projects, stream restoration in agricultural areas, and riparian stream buffer plantings close to 6 miles per year combined between agricultural and non-agricultural lands. The SCA data and Candidate site field visits and analysis helped to define a pool of potential projects from which the final sites required to meet the goals can be selected. Selected projects will seek to improve habitat and water quality for streams on Maryland's 303(d) list of impaired waters.

Fifty-two potential projects were identified from the Candidate site analysis: nine projects for stream buffer plantings, 12 stream restoration sites, and 31 stormwater management projects. Because of limited resources all of the identified projects cannot be implemented and managers need to know which projects should be implemented with higher priority. A qualitative benefit analysis was completed to aid in prioritizing the projects. Each project was rated based on how effectively it met each of 11 benefit criteria and four constraint criteria. Total scores for each project were tallied and each was placed in a Tier category. Tier 1 projects are the highest priority and Tier 5 projects are the lowest priority. Refer to Appendix A: Project Prioritization for the complete procedures, project matrix and results.

The results of the prioritization categorized 19 projects as Tier 1. There are 14 different project types that are placed into four broad categories as shown in the table below.

Table 25: Project Types and Tier Results

	Project Type	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5	Total
Buffer Plantings	Buffer Planting	3	5	1			9
	Buffer Planting/ filter strip/ trash removal					1	1
Stream Restoration/ Infrastructure Repair	Stream Restoration	2	1				3
	Bank Stabilization/buffer	2				1	3
	Fish Barrier Removal	1		1			2
	Pipe Outfall Repair				2		2
SWM Ponds	Pond Retrofit	4	3	2		1	10

	Project Type	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5	Total
	New Pond	2	1	1	2	1	7
	New Pond/Wetland	1					1
	Wetland Creation		1				1
SWM Filters	Bioretention	3		1		1	5
	Sand Filter	1					1
	Dry Swale					1	1
	Inlet Treatment				3	3	6
	Total	19	11	6	7	9	52

7.3 Pollutant Loading Reduction Estimates

The goals and objectives of the WRAS stress improvement to water quality and instream habitat. Reducing pollutant loads to receiving waters is an important step in meeting these goals. The WRAS presents many strategies and potential projects that benefit the Watershed by reducing pollutants from agricultural and urban runoff.

Pollutant loading reduction efficiency estimates for total nitrogen (TN), total phosphorus (TP) and total suspended solids (TSS) are given below in Table 26. Data are included from the Chesapeake Bay Program Watershed Model, The National Pollutant Removal Performance Database (Winer, 2000) and the Harford Soil Conservation District.

Table 26: Pollutant Loading Reduction Efficiencies

Management Strategy	TN	TP	Sediment
Agricultural BMPs			
Riparian Forest Buffer[1]	31-41%	50-60%	50-60%
Cover Crops (early season) on conventional till[1]	45%	15%	20%
Cover Crops (early season) [2]	9.48 lbs/ac/yr	0.13 lbs/ac/yr	na
Stream fencing with off-stream watering[1]	60%	60%	75%
Stream protection with fencing[2]	6.70 lbs/ac/yr	0.91 lbs/ac/yr	na
Riparian forest buffers[2]	27.28 lbs/ac/yr	2.15 lbs/ac/yr	na
Soil Conservation and Water Quality Plans[2]	0.93 lbs/ac/yr	0.14 lbs/ac/yr	na
Nutrient Management[2]	3.11 lbs/ac/yr	0.30 lbs/ac/yr	na
Stream restoration[1,3]	0.026 lbs/ft	0.0046 lbs/ft	3.32 lbs/ft
Stormwater Management			
Wet ponds and wetlands[1]	30%	50%	80%
Wet ponds[4]	33%	51%	80%
Wetlands[4]	30%	49%	76%
Dry detention ponds[1]	5%	10%	80%
Dry extended detention ponds[1]	30%	20%	60%
Dry ponds[4]	25%	19%	47%
Infiltration practices[1] (such as swales)	50%	70%	90%

Management Strategy	TN	TP	Sediment
Infiltration practices[4]	51%	70%	95%
Filtering practices[1] (such as bioretention, sand filter)	40%	60%	85%
Filtering practices[4]	38%	59%	86%
Water quality swales	84%	34%	81%
Non-Ag Treatments			
Riparian forest buffers[1]	25%	50%	50%
Stream restoration[1,3]	0.02 lbs/ft	0.0035 lbs/ft	2.55 lbs/ft
Behavioral Changes			
Lawn Care education	By testing soils and applying less fertilizer there will be reductions in nitrogen and phosphorus loading		
Education/Outreach	Effective education and outreach builds stewardship and sense of personal responsibility necessary to affect behavioral changes		
Septic System education/maintenance	Well maintained or upgraded septic systems are less likely to fail and will reduce nitrogen loading		
Broad Strategies			
Agricultural preservation	Reduces the potential for urban runoff loading such as metals, oils, grease		
Forest wetland preservation/restoration	Preservation can reduce loading associated with the conversion to developed land, restoration of forest and wetlands can attenuate pollutants		
Builders for the Bay	Better site design and reduced level of impervious surface will reduce pollutant loading from new development		

Notes: 1 – from Phase 5.0 of the Chesapeake Bay Program (CBP) Watershed Model; 2 – from Harford Soil Conservation District; 3 – estimates from CBP requiring final approval; 4 – median values from National Pollutant Removal Performance Database (2nd ed.)

Available reduction estimates that are quantifiable with a load per unit and year can be applied to several management strategies that have specific quantity goals. These provide a planning level estimate of the pollutant reduction for several BMPs. Values shown for reductions include the lbs/yr removal rate at year 10 of implementation and the cumulative load in lbs over the course of the 10 year period. Values for sediment removal were not readily available. All reduction rates are from Harford Soil Conservation District.

Table 27: Quantifiable Pollutant Load Reduction Estimates

Management Strategy	Deer Creek Application	TN	TP	Sediment Reduction
Cover crops (early season on conventional till)	3,300 acres per year, each year for the next 10 years	31,284 lbs/yr	429 lbs/yr	na
		312,840 lb	4290 lbs	na
Riparian forest buffer, only agricultural reductions shown	45 acres, approx 4 miles per year for ten years, total of 450 acres or 40 miles over ten years	12,276 lbs/yr	967 lbs/yr	na
		67518 lbs	5321 lbs	na
Stream protection with fencing	5,000 feet, assumed treated area of 200 feet wide translates to 23 acres per year, total of 230 acres over ten years	1,538 lbs/yr	209 lbs/yr	na
		8,460 lbs	1,149 lbs	
Soil Conservation and Water Quality Plans	Eighty percent participation applied to Harford County agricultural land, reported as yearly rate once 80 percent is met	34,551 lbs/yr	5201 lbs/yr	na
Stream Restoration	For purposes of computing a reduction assumed 100 feet per year for 1,000 feet 10 year total	26 lbs/yr	5 lbs/yr	3,320 lbs/ac
		143 lbs	25 lbs	18,260 lbs

7.4 Constraints to Implementation

Constraints to implementation include both broad constraints such as funding, staff, and public commitment, and more specific constraints such as property ownership and site design.

Funding and Staff

The cost of implementing the management strategies has been estimated at a planning level when possible. Some of the strategies are costly, require additional staff time and are presently beyond the existing capacity of the responsible party. To meet the goals of the WRAS several parties may need to seek additional program funds or additional staff. The County should consider seeking grant funding to hire a watershed coordinator to foster implementation of the WRAS. To supplement current resources, Federal, State and private grant, cost share and loans programs are available. These opportunities are discussed further in section 7.5, Funding.

Public Commitment

The WRAS strategies cannot be implemented without general public awareness and a willingness to play a role in maintaining the high quality of life and natural resources found in the Deer Creek Watershed. Commitment is also required at the state and local levels to keep natural resource protection a priority. Most strategies have a public outreach and education component that will be carried out to ensure the public is aware of the issue and the solution.

In many cases the strategy is focusing on providing education in an effort to make behavioral changes such as proper maintenance of lawns, woodlands, and septic systems.

Other strategies may require some use or conversion of private lands, either for easements, agricultural BMPs, or riparian stream buffers. Projects on private land are purely voluntary and if private land is necessary for a project, landowner coordination must occur prior to the project. The SCA field work and the Candidate Site visits were all conducted following a positive response to property owner notification.

Site Design

Management strategies such as a new pond, a pond retrofit, stream restoration or bioretention require that specific design criteria be met to ensure that the project can be constructed and that public safety is maintained. Furthermore, the project must be functional and provide the intended benefit. Constraints include property ownership, access, size of the site, utilities and steep slopes. The Candidate Site field visits were conducted with these constraints in mind, and sites with too many constraints were eliminated from further study. No detailed concept planning or preliminary design was completed, which may eliminate additional sites.

7.5 Monitoring Program, Success Tracking

Stakeholder Committee Role

Harford County Government and the Harford Soil Conservation District will take the lead role in the implementation phase of the plan and tracking success with major support from the Deer Creek WRAS Implementation Committee, which will be comprised of current Stakeholder Committee members and other interested parties. It is recommended that the Implementation Committee meet on a regular basis to report on status including implementation, monitoring, funding and outreach.

The Deer Creek website is currently supported and maintained by Harford County Planning and Zoning. The website can keep the Implementation Committee and general public up to date on implementation progress. The implementation may also be tracked using a database of the strategies and projects with information updated regularly.

The WRAS should not be considered a static document, nor should the recommendations and management strategies be considered finite. Watershed conditions are dynamic and the challenges faced by managers will continue to change. The implementation of the WRAS will need to adapt to those changes. Over the next 10 years new opportunities, management techniques, partnerships and funding sources will present themselves.

Monitoring

Each strategy in section 6 lists the success / performance measure that is appropriate for the individual strategy. These range from specific water quality sampling and analysis to tracking the public involvement and contacts made with property owners.

While each strategy will be tracked for completion and monitored for success individually, broader scientifically based monitoring and analysis is required to demonstrate a quantifiable effect. To draw conclusions with confidence the monitoring needs to be long term, regular, and be wide enough in its coverage that conclusions can be drawn at the subwatershed and even watershed level. The following monitoring strategies could be used to track effectiveness at the site level and for the overall condition of the Deer Creek and its subwatersheds.

- Maryland Biological Stream Survey (MBSS) data should be supplemented with additional sampling based on a similar sampling design using indicators of stream health such as water quality, macroinvertebrates, fish and physical habitat. Adoption of a county-wide monitoring program could be researched to monitor the long-term success of the County's watershed management plans (Deer Creek and Bush River).
- Continued monitoring and data share with the Susquehanna River Basin Commission (SRBC). The SRBC monitors stations along the Maryland/Pennsylvania line in Deer Creek, Ebaugh's Creek, Big Branch and Falling Branch for macroinvertebrates, habitat, and water chemistry conditions with funding provided by SRBC and the EPA.
- Continued monitoring and data share with volunteer efforts such as the MDNR's Stream Waders program.
- Additional water chemistry monitoring should be conducted. The synoptic survey sampling sites and protocols can be repeated to detect overall trends in pollutant loading from baseflow. Additionally, storm flow sampling should occur to quantify loads carried by stormwater runoff. Storm flow sampling is particularly telling in subwatersheds with new or retrofitted stormwater BMPs.
- Riparian buffer plantings at the project site level should be monitored for survivability rates and to ensure that sites are properly protected and maintained. Assessment of invasive species should be included.
- Riparian buffer planting and reforestation efforts should be tracked at the subwatershed and watershed levels. Data from various buffer planting programs such as Stream Releaf and the Buffer Incentive Program should be compiled to track the full extent of buffer plantings (see Items Requiring Additional Study).

- Monitoring will continue to be conducted by MDE on an unnamed tributary to Deer Creek east of Rt. 136. A series of agricultural BMPs were installed after the Synoptic Survey Monitoring. Continued monitoring will assess the effectiveness of these practices and changes in water quality.
- Stream restoration sites should be monitored to ensure the goals of the project have been met and that the design and construction are stable. Monitoring includes physical channel measurements and assessment of the design features and bank stabilization techniques. Additionally the site should be monitored to detect habitat enhancement and pollutant loading reductions.

7.6 Funding

Each management strategy listed in section 6 identifies a preliminary funding source. Those listed are by no means complete and additional sources can be investigated. If the strategy is limited enough in its scope and monetary/staffing requirement, existing staff and program resources of the responsible party may be adequate. Several strategies such as stormwater BMPs may require inclusion in Harford County's Capital Improvement Program (CIP).

Some of the strategies are costly, require additional staff time and are presently beyond the existing capacity of the responsible party. To meet the goals of the WRAS, responsible parties may need to seek additional program funds or additional staff. To supplement current resources, Federal, State and private grant, cost share and loans programs are available.

Funding opportunities are continually changing and new programs are being developed. The implementation of the WRAS should include regular review of programs and funding sources that Deer Creek strategies would qualify for. Several funding sources are listed below.

- Buffer Incentive Program, MDNR, Forest Service
- Chesapeake Bay Small Watersheds Grants Program, National Fish and Wildlife Program
- Chesapeake Bay Trust
- Clean Water Action Plan Nonpoint Source Program (319 Grant)
- Conservation Reserve Enhancement Program (CREP)
- East Coast Greenways
- Environmental Quality Incentives Program (EQIP)
- FishAmerica Foundation (American Sportfishing Association) and NOAA Fisheries Community Based Restoration Partnership
- Five Star Restoration Challenge Grants, National Fish and Wildlife Foundation
- Lower Susquehanna Heritage Greenway
- Maryland Agricultural Water Quality Cost Share Program (MACS)
- Maryland Environmental Trust

- Maryland Heritage Area Authority
- Maryland Nontidal Wetlands Mitigation Program
- National Scenic Byways Program
- North American Wetlands Conservation Act, Standard and Small Grants Programs, USFWS
- Partners for Fish and Wildlife, USFWS
- Reforestation Income Tax Modification Program
- Rural Legacy
- Small Creeks and Estuary Water Quality Restoration Program
- State Water Quality Revolving Loan Fund
- Stormwater Pollution Control Cost Share Program
- Stream ReLeaf
- Tree-Mendous Maryland
- Watershed Assistance Grants
- Wetlands Reserve Program (WRP)
- Wildlife Habitat Incentive Program (WHIP)
- Woodland Incentive Program (WIP)

7.7 Items Requiring Additional Study

Through the course of WRAS development there were several items where existing data or information could be improved upon to allow planners to make better watershed management decisions. In some cases the information gap is due to current constraints on budget resources or staff time.

Two management strategies were listed under Objective 4 of the Natural Resources strategies. They are listed here again:

- Continue Stream Corridor Assessments in subwatersheds not yet assessed and listed in the 2006 303(d) list of Impaired Waters as category 5 – Waterbodies that may require a TMDL (100 miles currently in Deer Creek).
- Develop two detailed management plans for the highest priority restoration and protection subwatersheds.

Other items include the following:

- The recommended potential projects represent the results of the current data review that was possible within the scope of the project and due to limited property access. There are many more candidate sites and potential projects throughout the watershed.

- Potential projects should have concept planning and preliminary design completed to develop costs to further prioritize projects.
- Because riparian buffers play such a vital role in Watersheds such as the Deer Creek, research to better understand the riparian buffer status in Deer Creek is crucial. Study should include analysis of how much stream mileage has historically and currently been impacted using aerial photography. Data from various buffer planting programs such as Stream Releaf and the Buffer Incentive Program should be compiled to track the full extent of buffer plantings and how green infrastructure hubs and corridors have been impacted.
- The impact of septic systems on receiving waters should be researched, both literature searches and field investigation specific to Deer Creek with possible coordination with Maryland's Source Water Assessment Program.
- County GIS information should be updated, including but not limited to land use and stormwater BMPs.
- Harford County should investigate the means of building capacity to address watershed management.

8 Conclusion

The Deer Creek WRAS has identified management strategies and potential projects to meet the water quality and habitat goals and objectives for agriculture, natural resources, development, education and outreach and interjurisdictional coordination.

The recommendations are based on the results of previous studies, current field work, watershed analysis and input from stakeholders. These studies indicate the Deer Creek requires both restorative actions and strategies to protect its high levels of biodiversity and sensitive natural resources. The Deer Creek Watershed will face many challenges including potential rapid growth in the headwaters and loss of agriculture and forest resources.

Restoration and protection of the Deer Creek Watershed will require a committed and coordinated effort from community groups, the public, and resource managers at all levels of government in Harford, Baltimore and York Counties with support and technical assistance from State and federal agencies.

9 References

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APPENDIX A: PROJECT PRIORITIZATION

Benefit Analysis

During the Candidate site analysis 52 potential projects were identified including nine stream buffer planting projects, 12 stream restoration projects and 31 SWM projects. To prioritize the projects a benefit analysis was completed. For several of the potential SWM projects, the major components of the project, such as a sand filter and pond retrofit at the same general site, were dealt with independently so that they could be prioritized at a finer scale. The benefit analysis therefore was conducted on a total of 61 potential projects. The benefit analysis compares the projects to qualitatively select those projects that should receive highest implementation priority. The first step was to determine a qualitative total *benefit*, and the second was to sum the potential project *constraints*, or measures of constructability. Lastly an overall benefit/constraint score is applied to each project to rank them against each other.

Qualitative project benefit estimates were derived based on how effectively each type of proposed project performs at making improvements in multiple watershed/stream quality parameters. The 11 benefit parameters used are listed below. The 'combination' parameter scores projects that are located close to each other that if pursued together, will provide a greater combined benefit.

Table A-28: Benefit Parameters

Restoration Priority	Riparian Habitat
Quantity Control	Public Safety
Nutrient Loading	Public Education/Outreach
Water Temperature	Fish Passage
Channel Erosion	Combination
Instream Habitat	

A matrix was developed where each project was rated for its effectiveness in meeting the listed parameters. Projects were rated as:

- 1 = Primary Benefit
- 2 = Secondary Benefit
- 3 = No Significant Benefit

The scores for each project were summed for a total score. The range of possible total scores went from 11 = Most Benefit, to 33 = Least Benefit. A percentile rank calculation was used to place the projects into five tiers from most benefit in Tier 1 to least benefit in Tier 5.

- 0-20% = Tier 1
- 21-40% = Tier 2
- 41-60% = Tier 3
- 61-80% = Tier 4

- 81-100% = Tier 5

An estimate of overall project constraints and constructability was developed using a matrix of each project rated against potential constraints. If any permitting will be necessary the project is considered to have some constraint however if the potential exists for more extensive permitting the project was considered to have significant constraint. Property ownership was developed using Harford County supplied property owner information. Public property presents less constraint than privately owned lands, however Candidate sites located on private lands where property owners gave permission for both the SCA field work and the Candidate site field work were assumed to be only some constraint. The four parameters used are listed below:

Table A-29: Constraint Parameters

Permitting
Property Ownership
Facility Access
Design / Construction

Projects were rated as:

- 1 = No Constraint
- 2 = Some Constraint
- 3 = Significant Constraint

The scores for each project were summed for a total constraint score. The range of possible total scores went from 4 = Least Constraint, to 12 = Most Constraint. A percentile rank calculation was used to place the projects into five tiers following the procedure described above for the benefit.

The scores for both the benefit and constraints were totaled for each project to give an overall prioritization. Higher priority recommendations should be investigated for full design and construction ahead of lower priority recommendations. The results are shown sorted by overall score and Tier in the following table. The benefit and constraint results are also shown.

Table A-30: Project Prioritization Results

Project No.	Project Type	Restoration Priority	Quantity Control	Nutrient Loading	Water Temperature	Channel Erosion	Instream Habitat	Riparian Habitat	Public Safety	Public Education/Outreach	Fish Passage	Combined	Benefit Total	Benefit Rank Tier		Permitting	Property Ownership	Facility Access	Design/Construction	Constraint Total	Constraint Rank		Overall Total	**Overall Rank**
12F	New Pond	1	1	1	1	2	2	1	3	2	3	1	18	Tier 1		3	1	1	1	6	Tier 3		24	**Tier 1**
10	Pond Retrofit	1	1	1	1	1	2	2	2	1	3	3	18	Tier 1		2	2	1	2	7	Tier 4		25	**Tier 1**
1D	Pond Retrofit	1	1	1	1	2	2	2	3	2	3	2	20	Tier 1		1	2	1	2	6	Tier 3		26	**Tier 1**
2C	Pond Retrofit	1	1	1	1	2	2	3	3	2	3	2	21	Tier 1		1	1	1	2	5	Tier 2		26	**Tier 1**
12A	Bioretention	1	3	1	1	3	2	3	3	1	3	1	22	Tier 2		1	1	1	1	4	Tier 1		26	**Tier 1**
12B	Bioretention	1	3	1	1	3	2	3	3	1	3	1	22	Tier 2		1	1	1	1	4	Tier 1		26	**Tier 1**
12C	Bioretention	1	3	1	1	3	2	3	3	1	3	1	22	Tier 2		1	1	1	1	4	Tier 1		26	**Tier 1**
28C	New Pond	3	1	1	1	2	2	2	3	1	3	1	20	Tier 1		2	1	2	1	6	Tier 3		26	**Tier 1**
073101	Stream Restoration	1	3	2	1	1	1	1	3	3	2	1	19	Tier 1		2	2	1	2	7	Tier 4		26	**Tier 1**
406101	Bank Stabil/Buffer	1	3	3	2	1	1	1	2	3	2	1	20	Tier 1		2	1	1	2	6	Tier 3		26	**Tier 1**
1A	Bioretention	1	3	1	1	3	2	3	3	1	3	2	23	Tier 3		1	1	1	1	4	Tier 1		27	**Tier 1**
2A	Bioretention	1	3	1	1	3	2	3	3	1	3	2	23	Tier 3		1	1	1	1	4	Tier 1		27	**Tier 1**
2B	Bioretention	1	3	1	1	3	2	3	3	1	3	2	23	Tier 3		1	1	1	1	4	Tier 1		27	**Tier 1**
9B	New Pond/Wetland	1	1	1	1	2	2	1	3	3	3	1	19	Tier 1		2	3	2	1	8	Tier 5		27	**Tier 1**
12E	Sand Filter	1	3	1	1	3	2	3	3	2	3	1	23	Tier 3		1	1	1	1	4	Tier 1		27	**Tier 1**
12G	Sand Filter	1	3	1	1	3	2	3	3	2	3	1	23	Tier 3		1	1	1	1	4	Tier 1		27	**Tier 1**
14C	Pond Retrofit	1	1	1	1	2	2	3	3	2	3	1	20	Tier 1		1	3	2	1	7	Tier 4		27	**Tier 1**
121102a	Bank Stabil/Buffer	1	3	2	1	1	1	1	3	3	2	1	19	Tier 1		2	2	2	2	8	Tier 5		27	**Tier 1**
122101	Stream Restoration	1	3	2	1	1	1	1	3	3	2	1	19	Tier 1		2	2	2	2	8	Tier 5		27	**Tier 1**
406103	Fish Barrier	1	3	3	3	1	1	3	2	3	1	1	22	Tier 2		2	1	1	1	5	Tier 2		27	**Tier 1**
067201	Buffer Planting	1	3	2	1	2	2	1	3	3	3	1	22	Tier 2		1	2	1	1	5	Tier 2		27	**Tier 1**
106102	Buffer Planting	1	3	2	1	2	2	1	3	3	3	1	22	Tier 2		1	2	1	1	5	Tier 2		27	**Tier 1**
115202	Buffer Planting	1	3	2	1	2	2	1	3	3	3	1	22	Tier 2		1	2	1	1	5	Tier 2		27	**Tier 1**
1B	Pond Retrofit	1	1	1	1	2	2	3	3	3	3	1	21	Tier 1		1	2	2	2	7	Tier 4		28	**Tier 2**
1C	Pond Retrofit	1	1	1	1	2	2	3	3	3	3	1	21	Tier 1		1	2	2	2	7	Tier 4		28	**Tier 2**

Project No.	Project Type	Restoration Priority	Quantity Control	Nutrient Loading	Water Temperature	Channel Erosion	Instream Habitat	Riparian Habitat	Public Safety	Public Education/Outreach	Fish Passage	Combined	Benefit Total	Benefit Rank Tier		Permitting	Property Ownership	Facility Access	Design/Construction	Constraint Total	Constraint Rank		Overall Total	**Overall Rank**
12D	New Pond	1	2	1	1	2	2	3	3	3	3	1	22	Tier 2		1	2	1	2	6	Tier 3		28	**Tier 2**
15A	Pond Retrofit	1	2	1	2	3	3	3	2	1	3	1	22	Tier 2		1	2	1	2	6	Tier 3		28	**Tier 2**
28B	Sand Filter	3	3	1	1	3	2	3	3	1	3	1	24	Tier 4		1	1	1	1	4	Tier 1		28	**Tier 2**
28E	Sand Filter	3	3	1	1	3	2	3	3	1	3	1	24	Tier 4		1	1	1	1	4	Tier 1		28	**Tier 2**
115201	Stream Restoration	1	3	2	1	1	1	1	3	3	2	3	21	Tier 1		2	2	1	2	7	Tier 4		28	**Tier 2**
121102b	Wetland Creation	1	2	1	1	2	2	3	3	3	3	1	22	Tier 2		2	2	1	1	6	Tier 3		28	**Tier 2**
386104	Buffer Planting	1	3	2	1	2	2	1	3	3	3	2	23	Tier 3		1	2	1	1	5	Tier 2		28	**Tier 2**
041301	Buffer Planting	5	3	2	1	2	2	1	3	1	3	1	24	Tier 4		1	1	1	1	4	Tier 1		28	**Tier 2**
071301	Buffer Planting	1	3	2	1	2	2	1	3	3	3	2	23	Tier 3		1	2	1	1	5	Tier 2		28	**Tier 2**
077102	Buffer Planting	1	3	2	1	2	2	1	3	3	3	2	23	Tier 3		1	2	1	1	5	Tier 2		28	**Tier 2**
112103	Buffer Planting	1	3	2	1	2	2	1	3	3	3	2	23	Tier 3		1	2	1	1	5	Tier 2		28	**Tier 2**
8B	New Pond	1	1	1	1	2	2	1	3	3	3	2	20	Tier 1		3	3	2	1	9	Tier 5		29	**Tier 3**
14B	Bioretention	1	3	1	1	3	2	3	3	1	3	1	22	Tier 2		1	3	1	2	7	Tier 4		29	**Tier 3**
27A	Pond Retrofit	3	1	1	1	2	2	3	3	2	3	2	23	Tier 3		1	2	1	2	6	Tier 3		29	**Tier 3**
28D	Pond Retrofit	3	1	1	1	2	3	3	3	3	3	1	24	Tier 4		1	1	1	2	5	Tier 2		29	**Tier 3**
367103	Fish Barrier	1	3	3	3	2	1	3	1	2	1	3	23	Tier 3		2	2	1	1	6	Tier 3		29	**Tier 3**
387106	Buffer Planting	1	3	2	1	2	2	1	3	3	3	3	24	Tier 4		1	2	1	1	5	Tier 2		29	**Tier 3**
14A	Bioretention	1	3	1	1	3	2	3	3	1	3	1	22	Tier 2		1	3	2	2	8	Tier 5		30	**Tier 4**
28A	New Pond	3	1	1	1	2	2	3	3	2	3	1	22	Tier 2		3	1	1	3	8	Tier 5		30	**Tier 4**
406102	Pipe Outfall	1	3	3	3	1	2	3	2	3	3	1	25	Tier 4		1	1	1	2	5	Tier 2		30	**Tier 4**
406104	Pipe Outfall	1	3	3	3	1	2	3	2	3	3	1	25	Tier 4		1	1	1	2	5	Tier 2		30	**Tier 4**
8A	New Pond	1	1	1	1	2	2	3	3	3	3	3	23	Tier 3		2	3	1	2	8	Tier 5		31	**Tier 4**
9A	Inlet Treatment	1	3	1	3	3	3	3	3	3	3	1	27	Tier 5		1	1	1	1	4	Tier 1		31	**Tier 4**
13	Inlet Treatment	1	3	1	3	3	3	3	3	3	3	1	27	Tier 5		1	1	1	1	4	Tier 1		31	**Tier 4**
15B	Inlet Treatment	1	3	1	3	3	3	3	3	3	3	1	27	Tier 5		1	1	1	1	4	Tier 1		31	**Tier 4**
27B	Bioretention	3	3	1	1	3	2	3	3	1	3	2	25	Tier 4		1	3	1	1	6	Tier 3		31	**Tier 4**

Project No.	Project Type	Restoration Priority	Quantity Control	Nutrient Loading	Water Temperature	Channel Erosion	Instream Habitat	Riparian Habitat	Public Safety	Public Education/Outreach	Fish Passage	Combined	Benefit Total	Benefit Rank Tier		Permitting	Property Ownership	Facility Access	Design/Construction	Constraint Total	Constraint Rank		Overall Total	**Overall Rank**
18	Pond Retrofit	1	2	1	1	3	2	3	3	2	3	3	24	Tier 4		1	3	2	2	8	Tier 5		32	**Tier 5**
33	Bioretention	5	3	1	1	3	2	3	3	1	3	3	28	Tier 5		1	1	1	1	4	Tier 1		32	**Tier 5**
20	Inlet Treatment	3	3	1	3	3	3	3	3	3	3	2	30	Tier 5		1	1	1	1	4	Tier 1		34	**Tier 5**
23	Inlet Treatment	3	3	1	3	3	3	3	3	3	3	2	30	Tier 5		1	1	1	1	4	Tier 1		34	**Tier 5**
26	Inlet Treatment	3	3	1	3	3	3	3	3	3	3	2	30	Tier 5		1	1	1	1	4	Tier 1		34	**Tier 5**
359103	Bank Stabil/Buffer	3	3	3	2	1	1	1	3	3	3	3	26	Tier 5		2	2	2	2	8	Tier 5		34	**Tier 5**
24B	New Pond	2	1	1	1	2	3	3	3	3	3	2	24	Tier 4		3	3	3	2	11	Tier 5		35	**Tier 5**
358208	Buffer Planting/filter strip/trash removal	3	3	2	3	2	2	2	3	3	3	3	29	Tier 5		1	2	3	1	7	Tier 4		36	**Tier 5**
3	Dry Swale	1	3	2	2	3	3	3	2	3	3	3	28	Tier 5		1	3	3	2	9	Tier 5		37	**Tier 5**
24A	Micropool	3	3	2	2	3	3	3	3	3	3	2	30	Tier 5		2	2	1	2	7	Tier 4		37	**Tier 5**

APPENDIX B: PUBLIC INVOLVEMENT MATERIALS

Public Involvement played a critical and decisive role in the formation of the Deer Creek WRAS. Appendix B provides examples of public information materials and vehicles for public input. Included are the website, public survey results, draft WRAS public comments and responses, and informational brochures, articles, fliers and handouts that were distributed at various stages of the study.

Deer Creek Website

A website was created on the Harford County Department of Planning and Zoning website to keep the public informed. The watershed background, goals and objectives and brochures were linked to the site. During public review of the Draft WRAS the document was available online with an online comment form. The website will continue to be updated during the implementation of the WRAS.

The website link: http://www.harfordcountymd.gov/PlanningZoning/WRAS/

An email address was also created that the public could use for transfer of thoughts, ideas and concerns. The email address will also be maintained throughout the implementation phase.

Email address: deercreekwras@harfordcountymd.gov

Figure B-3: Deer Creek Website

WRAS Survey

A survey was distributed at the first WRAS public meeting to solicit input from the public and from stakeholders on the issues they felt were most critical to the Deer Creek. The survey responses are provided below in summary.

Table B-31: Survey Response Summary

No. Responses	What do you value most about the Deer Creek Watershed and the place you live?
19	Quality of Life / Aesthetics
14	Agricultural / Rural Character
10	Water Quality
9	Recreation
7	Wildlife / Habitat
	What are the top 3 issues in the Watershed?
31	Development
10	Erosion
9	Agriculturally related activities
9	Water quantity
9	Water quality
7	Wildlife / Habitat loss
4	Stream buffers
2	Residential related activities
2	Other
	Ideas for improving water quality and habitat in the Deer Creek Watershed
9	Buffer improvements
9	Agricultural BMPs
8	Limit development
5	Increase regulations / enforcement
3	Education
16	Other

Draft WRAS Comments

Table B-32 provides the comments received from the general public following the Draft WRAS public meeting. The page number of the comment and the response or action taken are provided.

Table B-32: Draft WRAS Public Comments and Response

Comment	Page	Response/Action
1. Revise Executive Summary to be more engaging to reader: who, what, when, where.	Exec. Summary	Executive Summary has been revised.
2. Add LSHG as watershed asset	p. 6, Table 1	Language added
3. Add water & land trails under "recreation"	p. 6, Table 1	Will leave "recreation" as a general term; if one type of recreation is listed, then all types would need to be listed.
4. Add "interpret history, culture & natural environment"	p. 7, Table 2	Language added.
5. Add LSHG as responsible partner for Strategy 1 and 2	p. 73	Language added.
6. Amend management strategy 7 to read: "Install interpretive signage at County road stream crossings and along the water trail"; LSHG as responsible party; benefit: interpretation & education	p. 73	Included this recommendation in Strategy 3 on page 73.
7. Add a strategy to "Develop a National Scenic Byways Corridor Management Plan that includes the Deer Creek watershed"	p. 74	Strategy added, along with suggested language on benefits, responsible party, timeline and costs.
8. Add to funding list: LSHG, MD Heritage Area Authority, National Scenic Byways Program, East Coast Greenways	p. 84	Language added
9. Select a different type of facility for HCC retrofit projects other than sand filters; suggest advanced treatment or bioretention	p. 52, projects 12 E & F	Bioretention added as option in Table 24; sites will be further analyzed at time of capital project; language included in WRAS on p. 50.

Comment	Page	Response/Action
10. Appear to be a lot of calls for new SWM pond systems and not just retrofits; emphasize the need to analyze sites again to see if there is not a better alternative treatment type	pp. 50-53	Sites will be further analyzed at time of capital project; language included in WRAS on p. 50.
11. Put signage on major roads: Entering/leaving D.C. watershed	p. 74	Added to Strategy 7 on p. 74
12. Examine DPW road design and maintenance guidelines to eliminate trenches that take water immediately into streams		Stormwater management regulations now address runoff from new roads. Maintenance of existing road trenches will be explored with DPW.
13. Harford County lead by example: survey County properties for stream buffers & other BMPs; same for State properties	p. 76	Language has been added on p. 76 – Implementation Chapter 7
14. Extremely concerned about destruction caused by ATVs; need to deal directly with this issue (ex. Prince Georges Co. has ATV licensing law)	p. 73	Addressed as a strategy on p. 73, Strategy 4.
15. EPA Element Guide should be placed in the Table of Contents	pp. 7-8	The EPA Plan elements are listed on p. 7-8; pages identifying where these elements are located in the WRAS will be added
16. Maps need a scale bar		Maps provide scale text.
17. Provide a link to the DNR website for the technical documents	p. 5 and 10	Link has been added
18. Was any bacteria source tracking done? Would be helpful to know if it was animal or people-related	p. 11	It is a recommendation in the "Source Water Assessment for Deer Creek at the Chapel Hill Water Treatment Plant" that bacterial source tracking to identify sources of fecal contamination be considered. This has not been previously done.
19. Reference the SCA manual	p. 18	Reference has been added
20. Would be helpful to show PA land use code conversion to MDP codes in the Appendix	p. 21, Appendix C	Codes and conversions have been added in Appendix C.

Comment	Page	Response/Action
21. Indicate what scores of 1, 2 or 3 mean	p. 47, Table 19	Additional explanation has been provided in the text.
22. How will we address future land use change/impervious surfaces in PA?		The Implementation chapter identifies the need to pursue additional coordination with PA and Baltimore County to protect the Deer Creek watershed.
23. Concern was verbally expressed at the public meeting regarding the impacts of the landfill on water quality of Deer Creek	p. 76	No water quality issues had been previously identified at the landfill, and the stream at this location was not identified on the State 303(d) list of impaired waters. Language has been added on p. 76 for the County to "lead by example" and pursue implementation opportunities (such as riparian buffer plantings and stormwater management) on public lands.
24. Include the concept of an "Agricultural Resource District" to the WRAS	p. 69	This concept is generally included in Strategy 3 on p. 69, "Explore the use of various zoning tools, such as Transfer of Development Rights (TDR), to minimize the impacts of new development."
25. Recognize and state the role of the Deer Creek Scenic River Advisory Board	pp. 1 and 57	Language has been included on pages 1 and 57.
26. Could regular mandatory pumpouts of septics systems be incorporated into the WRAS recommendations?	pp. 71 and 86	Septic systems in the WRAS have been addressed through education and outreach (p. 71) and items for additional study (p. 86)
27. Concern was expressed at the public meeting regarding the overuse of fertilizers by residential property owners.	p. 71	Fertilizer use has been addressed in the WRAS through an educational strategy (Strategy number 3 on p. 71)

Informational Brochures, Articles, Fliers and Handouts

Through the course of the study materials were developed and distributed to keep the public informed of the study and to announce specific events such as public meetings. Included here are:

- Announcement fliers for the two Deer Creek WRAS public meetings that were held in March of 2006 and May of 2007.
- A general informational brochure was developed to summarize the Deer Creek conditions and the ecological significance of the watershed. The WRAS process was explained and contact information provided with links to other information.
- A handout was prepared for the Draft WRAS Public Meeting in May 2007. The handout describes the findings of the WRAS, presents a summary of the conditions, the goals and objectives, the priority subwatersheds and a synopsis of the management strategies.
- The Deer Creek WRAS was highlighted several times in articles in the Harford County Enviro News publication. Examples from the Fall 2004 and Fall 2006 editions are included.
- The Deer Creek Watershed Association publishes a newsletter. The Deer Creek WRAS was included in several issues. The September 2005 and spring 2007 editions are included in the Appendix.

Deer Creek Watershed Plan Public Meeting

When: **March 29th from 3pm to 8 pm**
Where: **Harford Community College**
Chesapeake Center—Dining Hall

Harford County is creating a watershed plan for Deer Creek and we need your help!

We would like to invite you to participate in a poster session and presentation to help shape the future of water quality and natural resource conservation in the **Deer Creek Watershed**. Share with us your ideas on what you value in the watershed, and what issues are of concern to you.

Two presentations will be given: one at **3 pm** and the second at **7 pm.** You may attend either session that is convenient for you. Exhibits showcasing data collected on the Deer Creek watershed and exhibits from various local environmental groups will be on display.

For more information contact: Pat Pudelkewicz– Harford County Planning and Zoning (410) 638-3135 or by email at
deercreekwras@harfordcountymd.gov

We Look Forward to Seeing You on March 29th!

Deer Creek Watershed Plan Public Meeting

When: **May 16th, 2007 at 3pm and 7pm**
Where: **Harford Community College**
Chesapeake Center—Dining Hall

Harford County has created a watershed plan for Deer Creek and we would like your input!

A Draft of the strategy has been developed to protect water quality and conserve the natural resources of the Deer Creek watershed. The draft may be found on the web at ***www.harfordcountymd.gov/PlanningZoning/WRAS*** Copies are also available for review at the Dept. of Planning & Zoning in Bel Air.

Two presentations will be given: one at **3pm** and the second at **7pm.** You may attend either session that is convenient for you. Exhibits showcasing data collected on the Deer Creek watershed and exhibits from various local environmental groups will be on display.

For more information or disability related accommodations contact:
Pat Pudelkewicz– Harford County Planning and Zoning (410) 638-3135 or by email at *deercreekwras@harfordcountymd.gov*

We Look Forward to Seeing You on May 16th!

This document available in alternative format upon request.

Information / Comments

Harford County Dept.
of Planning and Zoning
220 S. Main Street
Bel Air, Maryland 21014

(410) 638-3103

Fax (410) 879-8239

deercreekwras@harfordcountymd.gov

In partnership with the following groups:

Maryland Department of the Environment
http://www.mde.state.md.us

Maryland Department of Natural Resources
http://www.dnr.state.md.us

U.S. Environmental Protection Agency
http://www.epa.gov

Chesapeake Bay Program Office
http://chesapeakebay.net

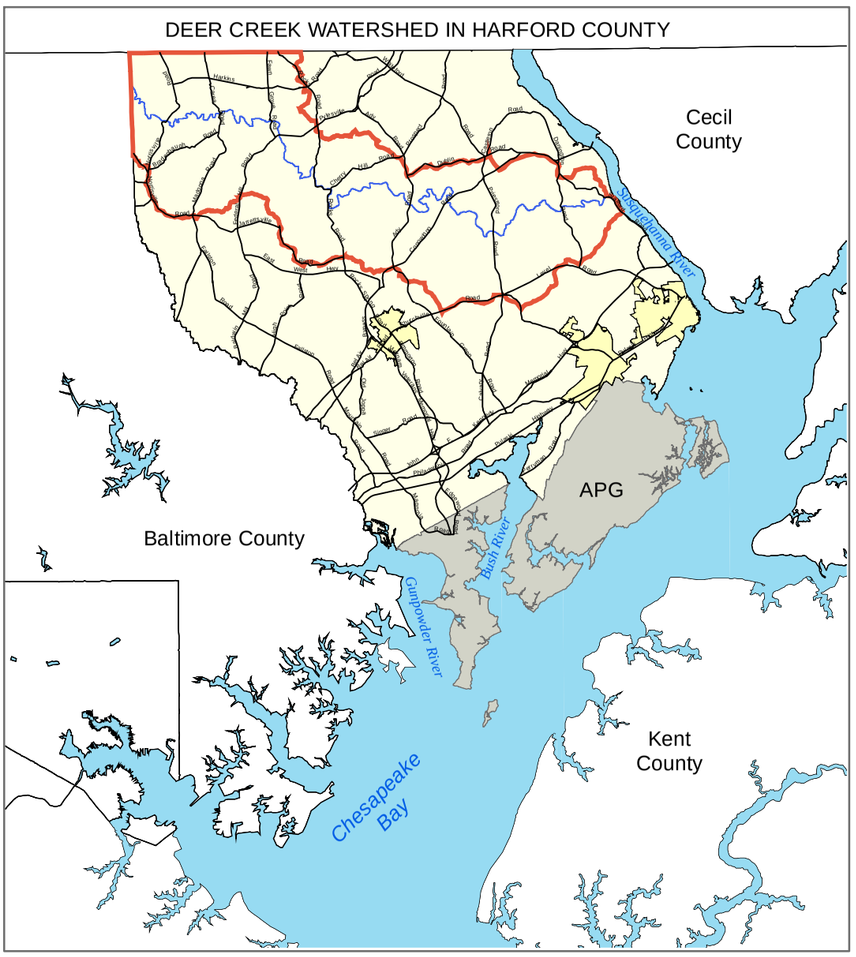
David R. Craig, Harford County Executive
Preserving Harford's past; promoting Harford's future

THIS DOCUMENT IS AVAILABLE IN ALTERNATIVE FORMAT UPON REQUEST

Deer Creek Watershed Study

HARFORD COUNTY, MARYLAND

DEER CREEK WATERSHED RESTORATION ACTION STRATEGY (WRAS)



The Deer Creek Watershed Restoration Action Strategy (WRAS) was initiated in 2005 to protect and restore habitat and water quality in the Deer Creek watershed. Harford County has collected all available natural resource data in the Deer Creek watershed to better understand the existing conditions and stressors that are impacting water quality and habitat. We will incorporate local knowledge and public input with the data. Restoration and protection strategies will be developed to protect and maintain the high quality areas, and restore areas that are found to be impaired.

There are several technical reports prepared by the State that provide the foundation for the development of the WRAS. These include:

--Characterization of the watershed - provides the background information such as demographics, land use / land cover, forest resources, easements and sensitive species.

--Synoptic Survey - provides a snapshot overview of the basic water chemistry of the streams in the watershed (104 sites sampled in April 2005) such as nitrate/nitrite, orthophosphate, temperature, dissolved oxygen, ph, and conductivity.

--Stream Corridor Assessment - 75 miles of stream were walked in the watershed; potential environmental problems such as erosion sites, inadequate stream buffers, fish barriers, pipe outfalls, channel alterations, and trash dumping areas were identified and mapped.

--Maryland Biological Stream Survey - sampled aquatic life in the sub-watersheds of Deer Creek to identify and prioritize areas most critical to maintain aquatic biodiversity through either restoration or preservation activities.

A Deer Creek Stakeholder Committee was formed early in the process to assist the County in formulating the plan. Members on the Committee include interests from the agricultural, governmental, environmental, educational, and business communities. The Committee, along with public input, will guide future implementation strategies in the plan.

The consultant firm KCI Technologies, Inc. has been hired to assist the County in assimilating all data gathered and developing priorities for restoration and protection strategies in the watershed.

A DRAFT WRAS will be available for public review and comment in November 2006. A FINAL plan will be completed by January 2007. All technical reports and information on the WRAS will be available through the County's webpage http//www.harfordcountymd.gov.

DEER CREEK WATERSHED STUDY

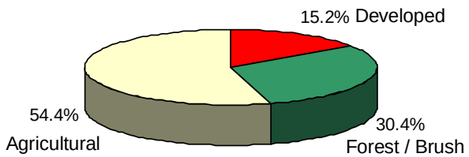
A watershed is a region or area of land that drains to a body of water. The boundary of a watershed is determined by the hills and valleys of the landscape. Every piece of land is part of a watershed.

BACKGROUND / GENERAL INFORMATION

Deer Creek is the largest watershed in Harford County, covering 38 percent of the County's land area. The entire watershed is approximately 109,350 acres, of which, 85,938 acres are within Harford County. The remainder of the watershed is in York County, PA (16,250 acres) and Baltimore County (7,150 acres).

Land Use in Deer Creek Watershed

(MD & PA)

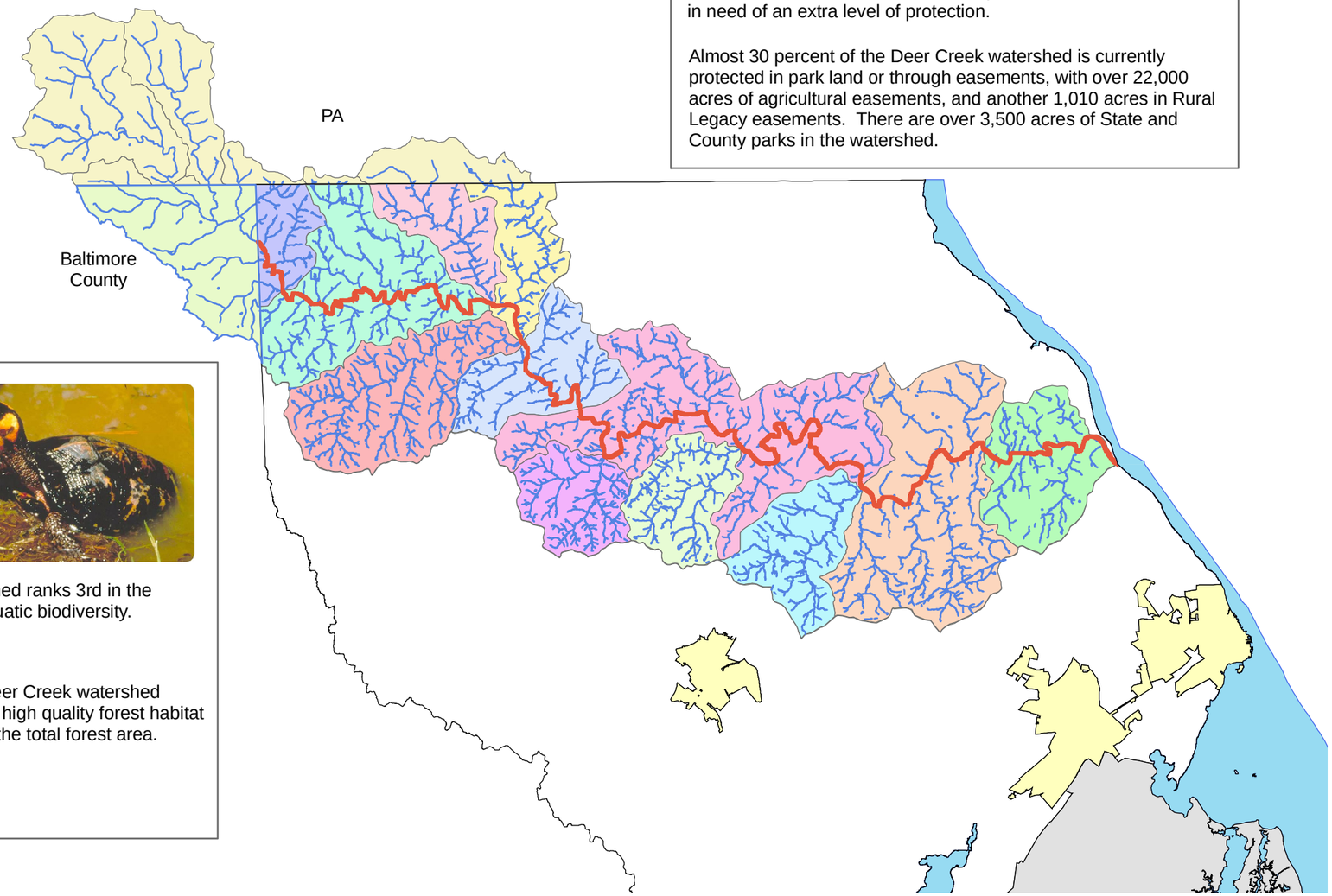


There are currently 8,810 households and 24,750 persons residing in the Deer Creek Watershed in Harford County; this represents 10.5 percent of the County's population.

PRESERVATION

Deer Creek Watershed is identified in Maryland's Clean Water Action Plan (1998) as a Category 1 watershed indicating that it is in need of restoration. It is also a Category 3 watershed indicating that it is a pristine or sensitive watershed in need of protection. These watersheds show signs of stress or degradation but still contain pristine or sensitive natural resources. Deer Creek has the added distinction of being designated a "Select" Category 3 watershed, which indicates a more pristine or sensitive watershed in need of an extra level of protection.

Almost 30 percent of the Deer Creek watershed is currently protected in park land or through easements, with over 22,000 acres of agricultural easements, and another 1,010 acres in Rural Legacy easements. There are over 3,500 acres of State and County parks in the watershed.



ECOLOGICAL SIGNIFICANCE

The Deer Creek watershed is a recognized local and State resource worthy of protection. Its many significant attributes resulted in its designation as a State Scenic River in 1973. Numerous sensitive species inhabit this watershed, including the endangered Maryland Darter, the bog turtle, and brook trout. Many of the streams are designated trout waters.

The Deer Creek Watershed ranks 3rd in the State of Maryland for aquatic biodiversity.

Maryland's part of the Deer Creek watershed contains 12,099 acres of high quality forest habitat which makes up 41% of the total forest area.

Deer Creek
Watershed Restoration Action Strategy
Harford County, Maryland

The Deer Creek Watershed covers 171 square miles in Harford and Baltimore Counties in Maryland and York County Pennsylvania. The Deer Creek flows to a confluence with the Susquehanna River. Close to 80 percent of the Watershed is located in Harford County. The Watershed retains a rural and agricultural heritage with land use that is primarily agricultural (54 percent) and forest (30 percent). Less than one percent of the Watershed area lies within Harford County's development envelope and it has an overall existing imperviousness of only 4.3 percent.

The Deer Creek is a State Scenic River and Stream Use classifications include both natural and recreational trout waters. The Watershed is home to many rare, threatened and endangered species and maintains a high level of biodiversity. Sensitive terrestrial habitats include Critical Areas, non-tidal Wetlands of Special State Concern and Habitats of Local Significance.

Deer Creek Stakeholder Committee collaboratively identified the Watershed's current assets and set a vision of the desired future watershed conditions. The Committee set goals and objectives in the areas of Agriculture, Natural Resources, Development, Outreach and Education and Interjurisdictional Coordination. The Deer Creek WRAS Management Strategies include both specific projects and broad strategies applicable to the entire Deer Creek.

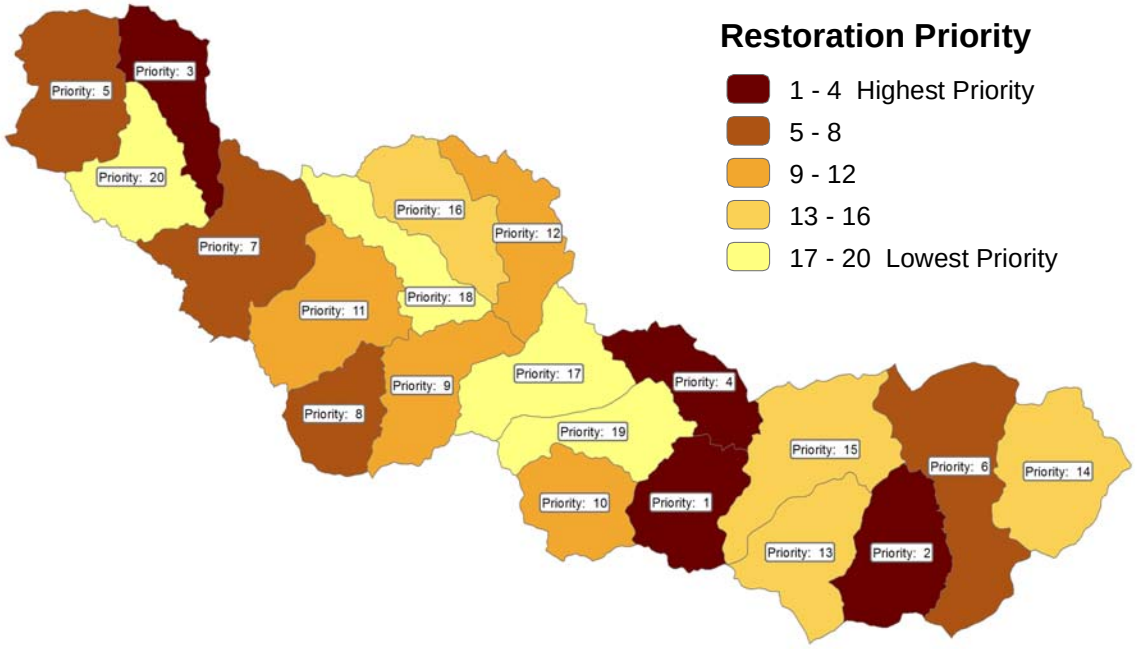
Development of the Deer Creek WRAS relies heavily on technical studies that are a part of the WRAS process including the Watershed Characterization, Synoptic Survey, Stream Corridor Assessment and Maryland Biological Stream Survey. Using data from these studies as well as additional analysis of land use, impervious cover and pollutant loading as indicators, the Deer Creek's subwatersheds were prioritized to identify those areas that are degraded and most in need of *restoration*, and those areas that are of high quality or vulnerable, and most in need of *protection*. The overriding theme is that the management strategies will be *targeted* for implementation when possible in the highest priority restoration and protection subwatersheds.

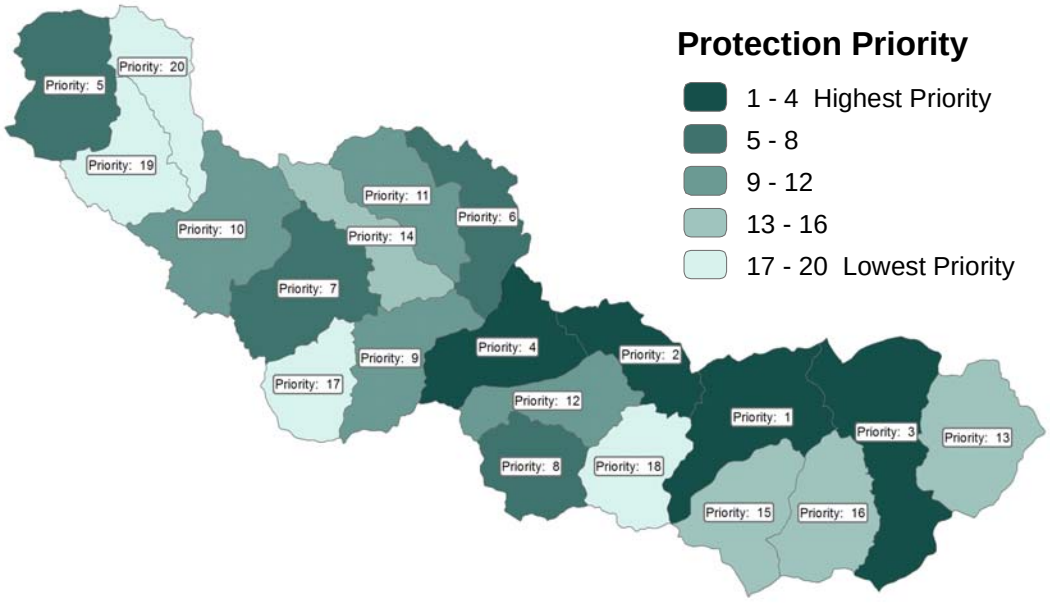
Based on the Deer Creek's conditions the *highest priority* strategies are focused on agricultural BMPs, riparian buffer planting, land preservation, and outreach. Harford County Government and the Harford Soil Conservation District will take the lead role in the implementation phase of the plan and success tracking with major support from the Deer Creek WRAS Stakeholder Committee.

Deer Creek WRAS
Goals and Objectives

AGRICULTURE	
Goal	Promote the recognition of the value of farming, awareness of best management practices, preservation of farmland and financial resources necessary for their implementation.
Objective 1	Promote the awareness of and implement best management practices in agricultural areas in order to protect water quality.
Objective 2	Preserve agricultural land to maintain the rural character of the watershed and preserve habitats.
NATURAL RESOURCES	
Goal	Manage natural resources on a sustainable basis, including forests, wetlands, stream corridors, sensitive species and wildlife.
Objective 1	Protect and restore stream corridors.
Objective 2	Protect and restore forest and wetland resources.
Objective 3	Protect sensitive species habitat in order to maintain a high level biodiversity.
Objective 4	Undertake additional research in order to protect and improve water quality and natural resources.
DEVELOPMENT	
Goal	Utilize sustainable development and implementation approaches to manage impervious surfaces and protect water quality.
Objective 1	Minimize the impacts of new development.
Objective 2	Reduce the impact of existing development on water quality and natural resources.
EDUCATION AND OUTREACH	
Goal	Develop and promote watershed awareness and stewardship.
Objective 1	Promote a stewardship ethic among residents in the watershed through an understanding of watershed values and issues.
Objective 2	Promote projects that encourage public access and public environmentally-oriented education and recreation.
INTERJURISDICTIONAL COORDINATION	
Goal	Network with regional jurisdictions to address common goals of water quality protection and environmental stewardship.

Deer Creek WRAS
Restoration and Protection Priority Subwatersheds





Deer Creek WRAS
Management Strategy Summary

AGRICULTURE

Deer Creek Planner in Soil Conservation District

Implement Agricultural Best Management Practices including riparian buffer plantings, cover crops and stream protection using livestock exclusion fencing

Preserve agricultural land, designate a portion of the Deer Creek Watershed as Agriculture Preservation Priority

Expand the Deer Creek Rural Legacy Area

NATURAL RESOURCES

Restore riparian buffers, 7,000 to 10,000 feet planted per year

Protect large contiguous forest tracts through easement programs

Outreach to forest land owners on forest management

Wetlands restoration projects through Harford Soil Conservation District and MDNR

Promote existing forest conservation programs

DEVELOPMENT

Zoning Code Update – incorporate Builders for the Bay; explore other zoning tools, such as TDR, to minimize impacts of new development

Educate residents on septic system maintenance and fertilizer use

Stormwater management projects in existing neighborhoods or public properties

EDUCATION AND OUTREACH

Build capacity of the Deer Creek Watershed Association

Watershed Education Programs through the Eden Milll Nature Committee

Link public lands along Deer Creek, canoe launch sites, strategy to address ATV use

Water trail maps provided by the Lower Susquehanna Heritage Greenway

Find out more by visiting the Deer Creek website

www.harfordcountymd.gov/PlanningZoning/WRAS

Contact us with comments and ideas!

email: deercreekwras@harfordcountymd.gov
phone: 410-638-3135, Pat Pudelkewicz, Department of Planning and Zoning

Fall 2004

Enviro News

A newsletter for environmental programs in Harford County

Welcome

Understanding our surroundings and the impact we have on our natural resources is the first step in restoring and protecting those areas. This issue of Enviro News includes articles that discuss the importance of characterizing our community.

Read the Deer Creek Watershed Plan to gain a better understanding of the magnificence of this special watershed and the County's effort to protect and restore this resource. Additionally, learn more about Bakerfield Elementary School's efforts in using computer mapping to engage their students in describing their community surroundings.

Enviro News is distributed quarterly (March, June, September, December) and is available in all Harford County Library branches, in display racks at various locations throughout the County, and on the Internet at www.co.ha.md.us under "Newsletters".

Oyster Dredging On the Skipjack Martha Lewis

Experience hands-on oyster dredging as you work along side the crew of the skipjack.

Various dates in November, 2004

More information (410) 939-4078

James M. Harkins
Harford County Executive

"Preserving our Values, Protecting our Future"

Deer Creek Watershed Plan

by Pat Pudelkewicz
Harford County Planning & Zoning

Recently, Harford County was awarded a grant from the Maryland Department of Natural Resources to develop a watershed management plan for the Deer Creek watershed. This plan, known as a watershed restoration action strategy (WRAS), will be developed over the next two years. The goal of the WRAS is to protect water quality, conserve fish and wildlife habitats, and restore those areas found to be impaired.

Deer Creek is the largest watershed in Harford County, covering 38 percent of the County's land area. The entire watershed is 109,500 acres, of which 91,900 acres are within Harford County. The remainder of the watershed is in York County, Pennsylvania (16,000 acres) and Baltimore County (1,600 acres).

Deer Creek lies within the Piedmont Province, and extends across the entire County, from the Susquehanna River to the Baltimore County/Pennsylvania line. The mouth of Deer Creek lies just three miles below the Conowingo Dam.

Agriculture is the main land use in the watershed, followed by forested lands. With farming being a predominant land use in this watershed, the Soil Conservation District will be an important partner in the development of the plan.

(Continued page 2)

This document available in alternative format upon request

Schedule of Events

Hurricane Isabel Forum – November 15th – 17th; Learn how the effects of a hurricane impact the resources within the Chesapeake Bay ecosystem; Linthicum; Fee, pre-registration; (800) Your-Bay.

Maryland Water Monitoring Council Annual Conference – November 18th, 9:00 a.m. – 4:30 p.m.; Explore the various types of water monitoring taking place across Maryland including water monitoring for public health and monitoring across the hydrologic cycle; Linthicum; Fee, pre-registration (410) 554-5559.

Holiday Open House – December 4th, 12:00 – 4:00 p.m. Enjoy the sights, sounds and smells of the holiday season while touring the historic buildings of Stepping Stone Museum; Susquehanna State Park, Havre de Grace; (410) 557-7994.

Night Walkers – December 4th, 4:30 – 6:00 p.m.; Join naturalists for an evening hike geared towards families with school-aged children, fee, pre-registration; Eden Mill, Pylesville (410) 836-3050.

For More Info

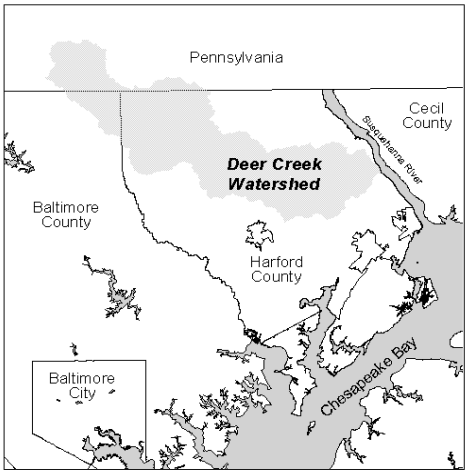
- Chesapeake Bay Program (800) Your-Bay
  www.chesapeakebay.net
- Eden Mill (410) 836-3050
  www.edenmill.org
- Harford County Government (410) 879-2000
  www.co.ha.md.us
- Harford Glen (410) 638-3903
  hcps.org/harfordglen/
- MD Dept. of Natural Resources (877) 620-8367
  www.dnr.state.md.us
- Skipjack Martha Lewis (410) 939-4078
  www.skipjackmarthalewis.org

Recommended Readings

Where Did All the Water Go
by Carolyn Stearns, David Aiken
This beautifully illustrated short story is written for middle school-aged children and explores natural phenomenon caused by the wind, weather and tides within the Chesapeake Bay region.

Deer Creek Watershed Plan (Continued from page 1)

Almost 30 percent of the Deer Creek watershed is currently protected in park land or through easements. Easements allow the land to remain in private ownership and use; however, further development is restricted. Over 22,000 acres are in agricultural easements, with another 1,010 acres in Rural Legacy easements.



There are 3,544 acres of State and County parks in the watershed. The three State Parks that lie within this watershed are Susquehanna, Rocks, and Palmer State Parks. All of these parks provide public access along Deer Creek.

The Lower Susquehanna Heritage Greenway, a certified Maryland Heritage Area, lies along the lower section of Deer Creek as it empties into the Susquehanna River. The Heritage Greenway promotes the protection of our cultural heritage as well as greenway and trail corridors.

The Deer Creek watershed is a recognized local and State resource worthy of protection. Its many significant attributes resulted in its designation as a State Scenic River in 1973. Numerous sensitive species inhabit this watershed, including the endangered Maryland Darter, the bog turtle, and brook trout. Many of the streams are designated trout waters. In 1998 a fish lift was constructed at Wilson Mill dam on Deer Creek to allow anadromous fish to spawn in the lower Deer Creek for the first time in 200 years.

Many conservation efforts are currently being undertaken in the watershed. The development of the Deer Creek WRAS will help coordinate and guide our efforts in the future. Throughout the development of the WRAS, meetings will be held to inform the public about the study and seek the public's input on key issues in the watershed. If you would like to be notified of these meetings, or for additional information, please contact Pat Pudelkewicz at (410) 638-3103 or pjpudelkewicz@co.ha.md.us.

Guest Author

The Bald Eagle: At Home in Harford County

by Heidi Ilg Paulus
Anita C. Leight Estuary Center

Many visitors to Leight Park have probably noticed that the number of bald eagles in the area is on the rebound. The Naturalists that lead canoe trips at the park have become accustomed to pointing out this majestic bird as it fishes the waters of Otter Point Creek.

The scientific name of the bald eagle, *Haliaeetus leucocephalus,* literally means a sea (*halo*) eagle (*aeetos*) with a white (*leakos*) head (*cephalus*). The adult bald eagle weighs 9 to 12 pounds and has a wing span of approximately seven feet. The female is slightly larger then the male. Juvenile eagles are a mottled brown and white and do not obtain the distinctive white head and tail until they are between 4 and 6 years old. The juveniles also have dark bills and feet, which become yellow as they mature.

Bald eagles eat primarily fish but will sometimes supplement their diet with small mammals, water fowl and carrion. Eagles can fly at speeds up to 30 m.p.h. and dive as fast as 100 m.p.h. Eagles are also known for their keen eyesight and can see fish up to one mile away! An eagle will swoop down to catch a fish with its talons, but can only lift prey half its own weight. Eagles have been known to use their strong wings as paddles and swim to shore with a particularly heavy fish.

Bald eagles mate for life and can live for 40 years in the wild. Courting behavior begins in April. This behavior involves aerial displays by both males and females, locking talons and spectacular dives. The female lays 1 to 3 eggs and, after a 35-day incubation period, the eggs hatch in late May to early June. The baby eagles are able to fly by the end of summer. At this point, the eagles migrate to warmer climates where they can fish and roost for the winter.

The bald eagle may have numbered half a million before Europeans settled the lands. With the increase of the human population, however, a significant amount of the eagle's natural habitat was destroyed and the population declined sharply in the late 1800's. From 1917 to 1953, 100,000 bald eagles were killed in Alaska by salmon fisherman who feared that the eagle was a threat to the salmon population. Due to increased use of the use of pesticides, including DDT, the population continued to decline and, on July 4, 1976, the US Fish and Wildlife Service officially listed the bald eagle as a national endangered species.

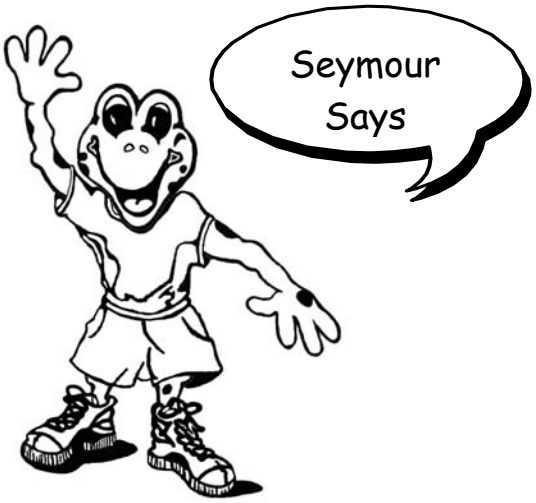
Historically in Maryland, as many as 3,000 pairs of bald eagles may have lived in the Chesapeake basin. In 1972, only 72 active nests could be found in the Maryland and Virginia regions of the watershed with no active nests in Pennsylvania. With the change in management strategies and increased awareness, the population has increased to include 760 nests in the Maryland, Pennsylvania, Virginia and D.C. portion of the Chesapeake Bay watershed. Due to the increase in population, the status of the bald eagle has recently been changed from endangered to threatened. For the eagle to be taken off the list entirely, permanent habitat protection will need to be completed. Once the eagle is removed from the list of threatened species, the federal government is required to monitor the population for five years.

In Harford County, the number of eagles at Aberdeen Proving Ground (APG) was reported to be 15 in 1983. 16 years later, the number of eagles on APG has risen to 160. Regulations at APG require a 1-kilometer buffer radius around each nest site to prevent any human interference. During the eagles breeding period, testing and training are held in other locations to ensure that the eagles are not disturbed. Eagles are attracted to the Proving Ground because it is mostly undeveloped with large trees and it is located near a large body of water. Unfortunately, even with the successful management plan there have been an increased number of eagle fatalities on APG in the recent past. Working with the US Fish and Wildlife service, the Army feels this may be due to the eagles landing on or hitting the power lines on APG. Until further information is known, APG has begun to modify the power lines located on the post and has begun to add spheres in eagle nesting areas to increase the visibly of the lines.

Visit Leight Park for a hike or a guided canoe trip this year to observe the majestic bald eagle as it continues to thrive in Harford County.

County	Occupied Nests	Active Nests	Nests Surveyed
Baltimore	3	3	6
Cecil	19	18	25
Harford	33	28	43

MD DNR 2003 Nesting Survey



The following are some suggestions on how to make your fall and winter activities more environmentally friendly:

- ✓ **Fall is the time to fertilize your lawn**
  Get a soil test first to find out how much fertilizer your lawn needs. Over fertilization not only wastes money, but the excess nutrients will run off into streams and cause water quality problems. Call the Extension Office for more information (410) 638-3255.

- ✓ **Christmas wrapping paper is recyclable**
  You may also want to consider wrapping gifts in brown paper grocery bags and have the kids decorate them. It's fun for the kids, it reuses an existing product and the paper can later be recycled.

- ✓ **Use ice melt products responsibly**
  If you need to use ice melt products, use those that contain calcium chloride, rather than fertilizer or sodium chloride (rock salt) which can harm vegetation and have a detrimental effect on stream water quality. Plain clay kitty litter is very good option when all you need is traction.

Enviro News
212 South Bond Street, 3rd Floor
Bel Air, Maryland 21014

Telephone: (410) 638-3545
E-mail: environews@co.ha.md.us

Next Issue available
December 2004

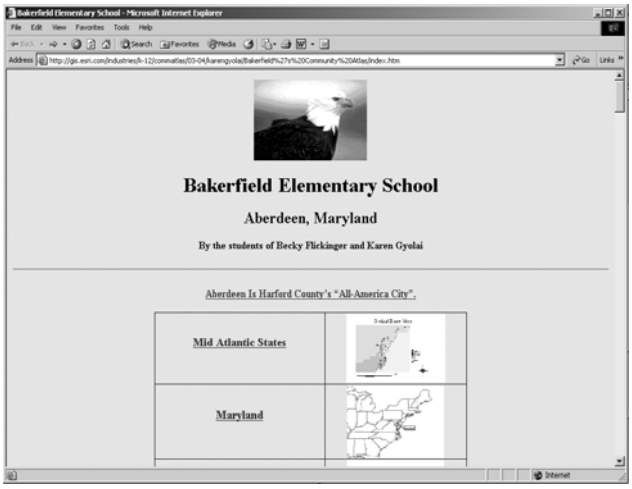
Schools

Community Atlas Project

by Eric Cromwell
Harford Glen

This past school year, Bakerfield Elementary School became the first elementary school in Maryland to complete a Community Atlas Project.

The Community Atlas program was created by Earth Systems Research Institute (ESRI) as a way for students to define their community through computerized maps or Geographic Information Systems (GIS). The output of the project is a website that describes their community.



As a reward for their work, Bakerfield Elementary received a school-wide site license of ArcView from ESRI. ArcView is an industry-standard GIS software that will allow students to ask "What if?" questions when looking at maps and other spatially related data.

Teachers Becky Flickinger and Karen Gyolai worked with their students over several days to complete the webpage that describes the town of Aberdeen.

To view the website, please visit the ESRI website: http://www.esri.com/industries/k-12/atlas/. Upon logging in, browse the 2003-2004 data for Bakerfield Elementary.

Teachers interested in creating their own Community Atlas should contact Eric Cromwell at Harford Glen. Phone 410-638-3903 or Eric.Cromwell@hcps.org

Fall 2006

Enviro News

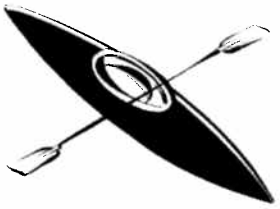
A newsletter for environmental programs in Harford County

Welcome

Monitoring and research allows us to develop an understanding of our environment and to develop programs and regulations to protect our natural resources.

In this issue of *Enviro News*, read about the data that has been collected and will be used to develop strategies to protect the Deer Creek watershed. Also, learn about the Waterkeeper Alliance, an organization dedicated to preserving and protecting our waters, and read about the impact of the June 2006 heavy rains on Maryland rivers and estuaries.

Enviro News is distributed quarterly (March, June, September and December) and is available in all Harford County Library branches, in display racks at various locations throughout the County, and on-line at www.harfordcountymd.gov under Documents & Publications - Public Works - Enviro News.



Autumn Color Kayak Trip

October 21, 2006

8:30 – 11am

Enjoy the beautiful fall colors as you discover Otter Point Creek.
Fee. Registration required.

For more information call (410) 612-1688
www.otterpointcreek.org

Deer Creek Watershed Plan

by Pat Pudelkewicz
Harford County Department of Planning and Zoning

In the fall 2004 issue of Enviro News, we reported that Harford County had received a grant to prepare a watershed plan for the beautiful Deer Creek watershed in the northern rural area of the County. The goal of the watershed plan, known as a Watershed Restoration Action Strategy (WRAS), is to protect water quality, conserve fish and wildlife habitat, and restore those areas found to be impaired. The plan is due to be completed in early 2007. Much data has been gathered and work is progressing on identifying strategies to protect the resources of the watershed.

A stakeholder workgroup, made up of a variety of interests throughout the watershed, has been formed and meets on a regular basis to provide input and guidance in the development of the WRAS.

Most of the Deer Creek watershed lies in Harford County, with smaller portions in Baltimore County and Pennsylvania. It will be important for all three jurisdictions to coordinate efforts since all have a role in protecting water quality and habitat in the watershed. Major land uses are agricultural (54%) and forested (31%), with developed land making up a smaller percentage (15%). Since the watershed is mostly rural, many of the water quality impacts are related to runoff from farms and developed lands.

In 2005, over 100 sites throughout the watershed were sampled for nutrients (nitrogen and phosphorus), temperature, acidity, and dissolved oxygen.

(continued page 2)

David R. Craig
Harford County Executive
"Preserving Harford's Past, Protecting Harford's Future"

This document available in alternative format upon request

Schedule of Events

Back to the Future – Living History at the Lock House - Oct 7 & Nov 4, 1-5pm. Re-enactors & craft demos. Lock House Museum, Conesteo St, Havre de Grace. Free. (410) 939-5780 www.lockhouse.org

Swanfest – Oct 15, 11am-4pm. Arts & crafts, entertainment, pumpkins, food, children's activities, house tours & more. Swan Harbor Farm, 401 Oakington Rd, Havre de Grace. Admission. (410) 939-6767 www.aberdeenpr.com

Harford Astronomical Society Open House – Oct 28, Nov 25 & Dec 30, 7:30pm, Harford Technical High School parking lot next to observatory. View the moon, stars & planets. (410) 836-7285 www.harfordastro.org

Honeybee Hive Maintenance –Oct 17, 4:30-5:30pm. Learn about the importance of honeybees, crop management, honeybee pests & diseases; hive maintenance demonstration. Eden Mill Nature Center, 1617 Eden Mill Rd, Pylesville. Free. (410) 836-3050 www.edenmill.org

Christmas at an English Country House – Dec 8-12, 11am-4pm. Ladew Topiary Gardens. 3535 Jarrettsville Rd, Monkton. Tour uniquely decorated rooms in the Ladew Manor House, buy fresh greens, gift shop, Santa. Admission. (410) 557-9466 www.ladewgardens.com

For More Info

- Waterkeeper Alliance (914) 674-0622
  www.waterkeeper.org
- U of MD Home & Garden Center (800) 342-2507
  www.hgic.umd.edu
- Harford County Government (410) 879-2000
  www.harfordcountymd.gov
- Eyes on the Bay (410) 260-8630
  www.eyesonthebay.net

Recommended Readings

Harford County: Then & Now
by Bill Bates, James Kropp (photographer)

Photographs and postcards of familiar scenes, people and life in Harford County over the past 100 years.

Deer Creek Watershed Plan (Continued from page 1)

Nutrients are of special interest since excess nutrients are identified as a primary cause of the degradation of the Chesapeake Bay. High nitrate loading was identified as one of the primary water quality issues that must be addressed in the watershed plan. High nitrate levels come from runoff from agricultural areas, fertilized lawns, and septic systems on residential lots. Dissolved oxygen was found to be good throughout the watershed, and the temperature of streams was also found to be generally good.

Cool stream temperature is very important to providing good trout habitat. The streams in Deer Creek watershed are home to a number of species of trout. Of particular note is the brook trout, the only native trout species that spawn in Maryland waters. Streamside forested buffers play an important role in keeping the temperature of streams cool, as well as serving as a filter for pollutants running off the land and providing habitat for wildlife.

Presence of streamside forest buffers was one of the parameters surveyed in a stream corridor assessment that occurred along 75 miles of streams in the Deer Creek watershed. Other issues that were documented along the surveyed streams were erosion areas, fish migration barriers, pipe outfalls, and trash dumping. The survey identified erosion as the most common problem, followed by inadequate streamside buffers.

Aquatic species and habitat have also been investigated by the Maryland Biological Stream Survey (MBSS) at 75 sites in the Deer Creek watershed between 1994 and 2005. MBSS ranks the Deer Creek watershed third highest in the entire State for aquatic biodiversity! Four of the twelve subwatersheds in Deer Creek are known to have rare, threatened, or endangered species present. The remaining subwatersheds either have a "watch list" aquatic species and/or have good biological richness and diversity. We will be working hard to develop strategies to protect these important resources.

In the near future, information will be available on the Harford County Department of Planning & Zoning website at www.harfordcountymd.gov/PlanningZoning. Information will include progress of the Deer Creek WRAS, links to technical documents, and future public meetings.

If you have any questions, or would like to be placed on a mailing list to be notified of future public meetings, contact us at (410) 638-3103 or via email at deercreekwras@harfordcountymd.gov

Volunteers

Waterkeeper Alliance

by Joanne Bowen
Harford County Water Resources

Waterkeeper Alliance is a grassroots organization dedicated to preserving and protecting our waters from pollution. The organization connects and supports a network of over 142 independently operated, privately funded, local Waterkeeper programs on 4 continents. The Alliance and individual Waterkeeper programs meet yearly to exchange information and strategies.

Each local Waterkeeper program employs a full-time person who serves as the Waterkeeper and advocate for that waterbody. All Waterkeepers have a boat to patrol their waterbody.

Local Waterkeepers respond to citizen complaints, encourage compliance with environmental laws, and develop methods to address and solve problems in their waterbody. They accomplish this by monitoring water quality, conducting restoration projects, educating and motivating the public on water quality issues, attending municipal board meetings, fighting for tougher local regulations, litigation, and various other methods, often with the help of volunteers.

In Maryland there are 8 active Waterkeeper programs. They include the Severn Riverkeeper, Chester Riverkeeper, South Riverkeeper, Choptank Riverkeeper, West/Rhode Riverkeeper, Patuxent Riverkeeper, Baltimore Harbor Waterkeeper, and the Assateague Coastkeeper.

Waterkeeper programs in the neighboring jurisdictions of Virginia, Pennsylvania, and the District of Columbia, as well as the Maryland programs, all fall under the Chesapeake Regional Coordinator of the Waterkeeper Alliance located in Annapolis, Maryland.

The Chester River Association (CRA) was founded in 1986 and hired it's first Riverkeeper in 2002. Since 1993 the CRA, in partnership with the LaMotte Company, has been conducting long-range water quality testing of the Chester River using trained teams of volunteers to conduct bimonthly sampling. CRA volunteers also help with habitat restoration, outreach and education, fund-raising, and advocacy.

Waterkeeper program names, such as Riverkeeper, Lakekeeper and Baykeeper, are protected under federal trademark law. Local Waterkeeper programs are required to pay an annual fee of $250 and obtain a trademark license from the Waterkeeper Alliance which wants to keep these names synonymous with effective citizen action. The Waterkeeper Alliance sets standards for the use of these names that reflect the purposes, goals and principles that make the Waterkeeper programs successful.

Local programs must secure their own funding and non-profit status. For more information on the Waterkeeper Alliance or about starting a local Waterkeeper program, refer to www.waterkeeper.org or call the Waterkeeper Alliance at 914-674-0622.

Guest Author

Monitoring Reveals Impacts of June Rains

by Mark Trice
MD DNR Tidewater Ecosystem Assessment Division

For the past four years, the Maryland Department of Natural Resources (DNR) has partnered with Harford County and NOAA's National Estuarine Research Reserve System (NERRS) to provide continuous water quality monitoring at two sites on the Bush River.

These sites, located on Otter Point and Lauderick Creeks have automated monitors that collect dissolved oxygen, turbidity (water clarity), chlorophyll (algae blooms), water temperature, salinity, pH, and water depth data every 15 minutes.

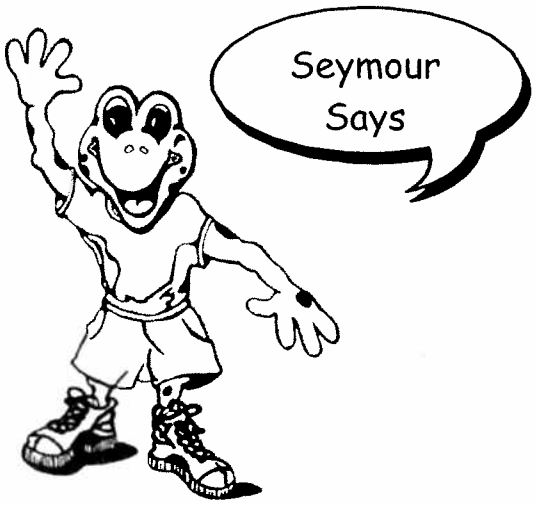
The data help DNR to assess: water quality for regulatory and watershed management purposes, habitat quality for animals and underwater vegetation, potential underwater vegetation restoration sites, and impacts from extreme meteorological events.

One such extreme meteorological event occurred this past June when some parts of the Bush River watershed received over 18 inches of rain over several days. There was concern that this event might have impacts similar to the rains caused by Hurricane Agnes in June 1972 which devastated clam populations and underwater grass habitat in the northern Chesapeake Bay and tributaries.

Fortunately, the June 2006 event had a lesser impact because river flows from the Susquehanna were only ½ of that during Agnes, in part due to the very dry conditions that preceded the 2006 deluge.

A variety of DNR-conducted monitoring programs detected the impacts of the June 2006 deluge to the northern Bay and Harford County tributaries. Satellite

(continued page 4)



The following are some suggestions on how to make your fall activities more environmentally friendly:

Instead of using the garbage disposal, start a compost pile. Compost added to soil recycles nutrients, enriches and improves the soil, and increases soil water holding capacity.

Use a fertilizer that contains at least 40% of its nitrogen in a slow release form. Look for the terms water insoluble nitrogen (WIN), ureaformaldehyde, IBDU, or sulfur, resin, or polymer coated urea on the label.

Conserve water by turning off the faucet while you lather-up in the shower, when washing your hands, or when brushing your teeth.

For a free and effective fertilizer, use the water you drain when you clean your fish tank to water your plants. Water in fish tanks is rich in the nutrients nitrogen and phosphorus.

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Next Issue available December 2006

June Rains (continued from page 3)

imagery available through DNR's Eyes in the Sky website pictures the sediment and nutrient runoff plume extending past the Bay Bridge and persisting for several weeks.

Continuous monitoring at Otter Point Creek reveals that turbidity values increased eight times over the preceding, already murky levels. Twice monthly sampling at DNR's long-term northern Chesapeake Bay monitoring stations shows that dissolved oxygen levels were average to above average during the summer due to mixing of the water column and perhaps reduced light for algae to grow and then decay creating hypoxic (low dissolved oxygen) conditions.

An August 16th DNR sponsored over-flight of upper Eastern Shore and upper Bay tributaries revealed that for the most part underwater grasses were not greatly affected by this storm, but most upper portions of rivers and creeks remained highly turbid almost two months after the rains.

For complete access to real- and near-time monitoring data and graphics from Maryland's bays and tributaries, satellite imagery, water quality health advisories and monitoring stories on this event and other news of note, visit DNR's water quality website, "Eyes on the Bay" (www.eyesonthebay.net).

❖Deer Creek Notes❖

The Newsletter of The Deer Creek Watershed Association, Inc, September 2005

Watershed Management For Deer Creek

Grant from DNR Supports Plan Development
County Government Seeking Advice From Stakeholders

Deer Creek Watershed Plan

In September 2004 Harford County was awarded a grant from the Maryland Department of Natural Resources (DNR)* to develop a watershed management plan for the Deer Creek watershed. Since 2000 DNR has awarded 5 grants per year to local jurisdictions throughout the State to develop locally-supported watershed management plans. Harford County received one of these grants in 2001 for the Bush River watershed. The Bush River Watershed Management Plan was completed in 2003 and is currently being implemented.

The main goals of the Deer Creek planning effort are to protect water quality, conserve fish and wildlife habitats, and develop protection and restoration strategies for the watershed. This plan, known as a watershed restoration action strategy (WRAS), will be developed in partnership with local stakeholders and State/federal agencies over the next two years. Once developed, it is expected that this plan will help prioritize and guide restoration and protection initiatives, and better position the County for future State/federal funding for agricultural best management practices and other restoration/ protection efforts.

Technical assistance totaling over $200,000 is provided to the County as part of the WRAS process. In addition, a $40,000 grant will be available in the second year of the project to assist the County with preparation of the plan. As part of the technical assistance, the State will prepare a characterization of the watershed describing current knowledge regarding water quality, habitat, natural resource issues, land use, population, and other information. Water quality sampling is being conducted throughout the watershed. This will provide information on nutrient loads, stream temperatures, dissolved oxygen, and pH. Sampling is also being done for fish and macroinvertebrates.

A "stream corridor assessment" on 100 miles of stream is another benefit afforded the County. Two subwatersheds within Deer Creek were chosen to do a more detailed on-the-ground assessment of the condition of the stream corridor. Property owners were contacted to obtain access to the streams. Stream corridor conditions were recorded, including areas of streambank erosion, fish blockages, status of riparian buffers, and other identifiable issues. Once all of the technical data is collected and analyzed, the County will then use this information to develop the watershed plan.

As another technical service offered by the grant, the National Park Service is assisting the County with public outreach and stakeholder involvement. The involvement of key stakeholders in the watershed is a critical element in the development of a watershed plan. Prior to applying for the grant, Harford County staff met with the Board of Supervisors of the Harford Soil Conservation District (SCD) and obtained their support for the initiative. Since the Deer Creek watershed is a prime agricultural area of the County, the support of the SCD is critical.

Subsequent to being awarded the grant, the County established a Deer Creek Watershed Stakeholder Workgroup to advise the County on the development of the plan. This workgroup includes representatives of the Deer Creek Watershed Association, Soil Conservation District, Farm Bureau, Harford Land Trust, Scenic River Board, Forestry Board, Lower Susquehanna Heritage Greenway, Deer Creek Rural Legacy Committee, State Parks, Izaac Walton League and other groups. Since a portion of the Deer Creek watershed lies in Baltimore County and Pennsylvania, representatives of these jurisdictions are also *(continued on p. 3)*

WRAS Stakeholders

Elsewhere in this newsletter we have an article about the Watershed Restoration Action Strategy (WRAS) that has been undertaken by the county for the Deer Creek watershed. In that article is reference to the many "stakeholders" involved in the process. What is a stakeholder? A stakeholder can be an organization whose interests are so likely to be affected by decisions resulting from the WRAS process that their participation is needed to help assure the success of the effort. A stakeholder may also be an organization whose knowledge, skills or influence can help the WRAS process be more thorough and complete. That the Deer Creek Watershed Association should be a stakeholder in a WRAS that examines the Deer Creek watershed is easily understood. The connection for other stakeholders, however, may seem less direct or obvious.

When watershed protection is advanced as a subject, it usually emphasizes water quality. It is easy to think of water quality in streams as a major item of concern. The suitability of that water for fish and other wildlife, for human recreation and for visual beauty correctly suggests that organizations with obvious ties to conservation, preservation and environmental interests should be stakeholders. However, a watershed is not just the streams. It is the land area from which all subsurface and surface waters drain to the principal stream in that watershed. It includes all of the waters in that land area including the underground water resources. Any plan to address the protection of the waters in a watershed has consequences not just for the environment but also for the residents and the industries operating in the watershed. Water is needed for almost everything, and the amount of water to be protected is every bit as important as the quality of the water. Thus, for long-range success, the WRAS process must involve considerations not just of surface water quality, but also for all water in the watershed, its quality, its use, and its replenishment. Finally, the implications of all of this on the environment, the economics, and future water demand have to be addressed in long range planning for the watershed.

Tackling these issues in the WRAS process definitely creates stakeholders, as defined above. Consider the Forest Conservancy District Board for Harford County. The "forestry board" is one of the stakeholders. At first blush, they might be viewed as one of the strictly environmental interest groups (...are they tree huggers?). A closer look, however, reveals the broad value of this group as a WRAS stakeholder for the Deer Creek watershed. The forestry board's purpose is to advocate stewardship and sound uses of forest, woodlot and tree resources, and the Deer Creek watershed contains a large amount of the county's forest resources. The board would obviously have a strong interest in any strategy or long range plan that could have an impact on those forest resources. Such impacts could include watershed protection recommendations like the best management practices employed in timber management, or the regulation of the timing, frequency or acreage limits for timber harvests or plantings. The economic value of these timber assets is important, and the WRAS process needs to consider this when preparing recommendations for watershed protection. The forestry board also has knowledge of the balance of nature represented by the ecological links among the living systems, the soils and the water in a watershed, and the impacts of human use. If the WRAS process predicts that four species of fish should be present in a stream and actual sampling shows that the one species missing is a fish that needs cool water, the forestry board readily expects that part of the problem is related to trees. They know how to have the affected part of the watershed evaluated to determine whether tree cover is part of the problem and, if so, how to fix the problem for the future. Where water samples show high nutrient or sediment loads, the board can access expertise to evaluate the related streamside buffers in terms of their widths, and the usefulness of the density and diversity of the plants in the buffer. Where data show that land use is contributing to excessive runoff from storm events, the planting of additional trees can be an approach to managing the problem appropriately. Again the board can help with recommendations and access to resources.

We see that the forestry board has a strong interest in a major resource and part of the economic impact of a WRAS for Deer Creek's watershed. We also see that they serve as a source of knowledge, tools and skills useful in developing plans and actions that may arise from the WRAS. The Deer Creek Watershed Association is proud to be an active stakeholder in the WRAS for the Deer Creek watershed. We appreciate the participation of the many stakeholders in this effort and encourage their active involvement in this effort to make this effort as useful for the future of the Deer Creek watershed as possible.

LSHG PROGRESSING WITH TRAILS

The Lower Susquehanna Heritage Greenway (LSHG) continues to make progress with its development of trails. Surveys, designs and cost estimates have been completed for uncompleted segments of the trail on the Harford County side from the Conowingo Dam to I-95 and on the Cecil County side from the Dam to Perryville Park. The route of the trail segment around the Arundel Quarry is in process of being resolved.

The LSHG is sponsored guided educational trail walks along the various trail segments throughout the spring and summer. Thus far there has been a Mother's Day Hike and a Father's Day Hike. Colleen Webster, a teacher at Harford Community College, is the trail guide. A schedule for future guided trail walks can be obtain by calling the LSHG office at (410) 457-2482.

LSHG's **Gala and Benefit Auction** will be held on Friday, October 7, 2005 from 7:00pm to 10:00pm at Ripkin Stadium. Auction items are needed. For more information call the LSHG office (410-457-2482).

President's Message

DCWA Moving Forward

The Deer Creek Watershed Association has completed another successful year that included the equine trail ride last November in which profits were shared with the Harford Land Trust and the Manor Conservancy. We have also continued our challenge to the City of Aberdeen's attempt to use Deer Creek as a municipal water source. The Association is continuing to work with Harford County to develop a WRAS (Watershed Restoration Action Strategy) for the entire watershed. However, our organization is now thirty-six years old, and many of our founding directors and members are retired, have moved away or have passed. With this in mind, the Board has dedicated itself to increase our membership and member participation in the coming year. Clearly Harford County and the demographics of the watershed have changed since 1969, and in order for us to move forward, we plan to reach out to those "new" residents that are interested in preserving the good qualities of the area that most likely attracted them to this area in the first place. There will also be a trail ride this fall, with the Harford Land Trust taking the lead. We will continue to fight against predatory practices against the watershed (such as the Aberdeen water request) that reduces the carrying capacity for plants, animals and people that live within the Deer Creek valley. Our organization has accomplished many things over its thirty-six year history and, with your help, we will continue to accomplish more. If you have any suggestions for the Board or want to help with a new project, please call me at 410-836 2452. We are ready to move the Association forward.

(continued from p. 1)

Watershed Plan

participating on the Stakeholder Workgroup. The workgroup will meet periodically throughout the two-year planning period to advise and assist the County with the development of the plan.

In addition to the Stakeholder Workgroup, the County will be seeking the involvement of other stakeholders in the watershed and the general public at various points throughout the process. If you would like to be notified of future outreach efforts, or if you have any questions or would like additional information regarding the development of the Deer Creek WRAS, please contact Pat Pudelkewicz of the Harford County Department of Planning and Zoning at (410) 638-3135, or ppudelkewicz@co.ha.md.us.

*In December 2004 the §319 Program, which funds the WRAS, was transferred from the DNR to the Maryland Department of Environment.

Are Your Dues Overdue?

Please look at your address label. If it contains five asterisks (*****), your annual membership dues are overdue, and this is your last newsletter until we receive your renewal. For your convenience, an envelope has been enclosed for mailing your dues. Simply make out your check to the Deer Creek Watershed Association for your annual dues of $10 and mail it to us.

Membership

We are delighted to have new members. Send your $10 annual dues to the address on the mailing envelope. Dues are needed to support this newsletter and to fund other activities associated with our preservation and conservation efforts.

Dues, Donations and Assistance

Besides paying $10 annual dues, many members have been helpful on special projects such as research, petition drives, etc. Volunteers for such work are welcome. Whereas regular dues are needed for recurring expenses such as printing and mailing this newsletter and reimbursing the owners of the facility where our Directors hold their monthly meeting, we also need extra donations to defray special expenses. This is especially true at this time because of our commitment to oppose use of water from Deer Creek to support additional development in the county.

Aberdeen's Water Request

There has not yet been a decision in the City of Aberdeen's request to use Deer Creek as a municipal water supply. The appropriate permits have yet to be issued. The Susquehanna River Basin Commission is requiring that a study be done to show the impacts of a new withdraw on the watershed, and now has a Request for Proposal on its website. The Deer Creek Watershed Association will continue to show that this request for water is not scientifically, economically and legally viable. The permit should be denied by the appropriate agencies

Upcoming Events

Lower Susquehanna Heritage Greenway Gala and Benefit Auction

The LSHG's **Gala and Benefit Auction** will be held on Friday, October 7, 2005 from 7:00pm to 10:00pm at Ripkin Stadium. Auction item are needed. For more information call the LSHG office at 410-457-2482.

Harford Soil Conservation District Banquet

The Harford Soil Conservation District Banquet will be held on October 13, 6 PM at the Level Fire Hall.

Deer Creek Trail Ride

The Deer Creek Trail Ride, this year with the Harford Land Trust as the lead organizer, is scheduled for Sunday, November 6 at the Crouse farm where it was held last fall. The event will also include food, drink, music, and art displays, with a thematic approach aimed at the Deer Creek area.

Deer Creek Notes **September 2005**

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Inside This Issue

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Dept of P&Z
220 South Main Street
Bel Air, MD 21014

❖Deer Creek Notes❖

The Newsletter of The Deer Creek Watershed Association, Inc, Spring 2007

Deer Creek Watershed Restoration Action Strategy Report Nears Completion

Public Meetings on Outcomes and Recommendations at Harford Community College May 16

Past issues of Deer Creek Notes have outlined the overall goals, participants, and methods of development of a plan for management of the Deer Creek Watershed. The main goals of the planning effort are to protect water quality, conserve fish and wildlife habitats, and develop protection and restoration strategies for the watershed. Different types of research efforts were conducted, including stream walks to visually document stream conditions, synoptic surveys involving physical and chemical measurements of water samples, and identification of fish and invertebrates that inhabit the creek.

For two and a half years, this study has been ongoing under the supervision of the Harford County Department of Planning and Zoning through a grant from the U.S. Environmental Protection Agency. They have been assisted by the Maryland Department of the Environment, the Maryland Department of Natural Resources, the US Department Interior, a large number of stakeholder organizations in the county and in the Deer Creek watershed in Pennsylvania and Baltimore County, and by KCI which is a company hired to assist with the statistical analysis of all of the data and the development of the strategy.

The public will have a chance to learn about the outcomes and recommendations of the Deer Creek Water Restoration Action Strategy (WRAS) on Wednesday, 16 May 2007 at the Harford Community College's Chesapeake Center. Public reaction and input will be sought to help complete the final report. This is the second public meeting that has been held concerning the study undertaken by Harford County to evaluate the water quality conditions of Deer Creek and its watershed. A final report of the study with recommendations is expected to be published this summer.

Information gathered at the first public meeting on the WRAS last year helped shape the directions in which recommendations were developed and have led to a two-pronged approach to the WRAS. One of these directions will be to take actions to correct problems identified in sections of some of the smaller streams of Deer Creek. The second direction will focus on actions to maintain the quality of water in some areas where the conditions of the streams proved to be very good. Actions in either case include considerations of land use in the supporting subwatersheds, because many aspects of water quality in streams are directly affected by activities on the lands that drain to those streams. The drainage process includes surface runoff and subsurface flow to the streams. Nutrient loads such as nitrogen and phosphorus from septic fields and agricultural applications, and sedimentation from runoff and erosion are examples of impacts on the water quality in the streams as a result of land uses.

To help organize and focus the Deer Creek WRAS, the strategy recommendations of the study are being grouped under various goals that were identified and developed by the stakeholders. The goals have various objectives assigned to them and the strategy recommendations are placed with the objectives that they support. There are goals for Agriculture, Development, Natural Resources, Education/Outreach and Interjurisdictional Coordination. Some of the recommendations represent actions with an obvious endpoint. The expansion of the Rural Legacy area of Deer Creek to include the entire watershed is an example of such a recommendation. Many recommendations are intended to be ongoing processes carried out indefinitely. Educating residential property owners about the impacts of fertilizer and pesticide/herbicide use in the watershed is an example of a recommendation that would be carried out indefinitely.

(continued on page 3)

More Emphasis on Agricultural Education in Harford County High Schools

Broad Magnet Program Under Development for North Harford High

Preservation of agricultural land for farming does not necessarily assure its continued use for farming. Farming as a way of life is changing in Harford County, with fewer dairy farms but also with opportunities for activities that differ from age old practices. The success of farming in the county depends on several factors, including planning, legislation, community support, and especially education. It is critical that the next generation not only appreciate the values of agriculture but also learn the means to pursue it successfully. Two high schools in Harford County, Harford Technical School and North Harford High School, offer programs in agriculture that attempt to meet this basic need.

Harford Technical School offers courses dealing with agribusiness/ animal science and horticulture. The Agribusiness/Animal Science program, taught by Mrs. Naomi Knight, prepares students to become competent Veterinary Assistants, with skills appropriate for work with a veterinarian, a dog groomer, or in retail sales in agriculture. The program includes an extensive background in large and small animal handling, restraint, laboratory and diagnostic testing, anatomy and physiology. Students become well versed in veterinary medical terminology, with many seniors getting experience under local veterinarians. Upon successful completion of the program, students have the opportunity to achieve a certificate of completion in Veterinary and Laboratory Assistance given by the Harford Veterinary Medical Association. Students also can earn the Level I Pet Care Technician presented by the American Boarding Kennels Association. The program has an articulation with one community college (CCBC of Essex) and is developing another with Delaware Valley College. The majority of graduates go on to complete a four year degree in a vast array of majors ranging from large animal studies, zoology, animal behavior, animal nutrition, and animal genetics. The horticulture program at Harford Technical School, taught by Fred Gradishar, focuses on growing potted plants and their use in landscaping.

At North Harford High School, located in primarily agricultural northern Harford County, a substantial proportion of the students have a farming background. Over several years the North Harford Agricultural Advisory Committee, composed of local farmers, agribusiness owners and parents, has provided assistance in support of a broad program with a strong hands-on component. Under the guidance of Dene Bruce, Aimee Densmore, and Holly Woodward, the current program endeavors to expand the student's knowledge of various aspects of farming, from efficient production practices to more profitable ways of marketing. The program strives to provide a basic understanding of not only traditional farming, plant and animal production, and basic mechanics, but also horticulture. It uses a hands-on approach to raising different breeds of livestock, with detailed information on nutrition, reproduction, disease prevention, as well as showing and judging. The program has grown and flourished due in part to agricultural community involvement and a dynamic staff. With the renovation of North Harford High School the program now has more facilities, including a new greenhouse, to support the program.

Over the past five years Harford County Public Schools has worked to refine the ten Career Clusters, as defined by the Maryland State Department of Education, into four clusters to streamline existing course and program offerings. A Local Program Advisory Committee (PAC), composed of existing North Harford Agricultural Advisory Committee members, additional school system officials, and supportive members of the agricultural community, has been evaluating the need and feasibility of growing the program into a magnet program. The resulting proposal for a Natural Resources and Agricultural Sciences Magnet Program for North Harford High School was formally approved by the Board of Education on February 12, 2007. The Superintendent advised the Board of the importance of having a coordinator for the program at North Harford High School and of the critical role of continued support of the community. The PAC continues to meet to develop details of the magnet program. Members are familiarizing themselves with the current curriculum and practices provided to students in order to identify commonalities among the current offerings and how they relate to four possible strands in the magnet program. These strands currently include:

- **Natural Resources**—comprised of courses such as Global Positioning System, Geographical Information System, aquaculture, forestry, wetlands management
- **Plant Sciences**—comprised of field crops, vegetable production, ornamental planting, soils, Best Management Practices, Integrated Pest Management, pesticides, etc.
- **Animal Production**—comprised of breeding, genetics, nutrition, medicinal developments for livestock, etc.
- **Equine Science**—comprised of courses such as nutrition, safety, veterinary science, conformation, business, husbandry, etc.

The PAC continues to study the current and projected labor market demands in these areas. The program could provide career choices for students in Harford County, meet the needs of the county and the community, and provide specialized training and advancement opportunities.

Upcoming Events and Activities

16 May 2007: Public Meeting of the Deer Creek WRAS (see article, this issue) at Harford Community College Chesapeake Center. Contact the Harford County Department of Planning and Zoning at 410-638-3135 for information.

18 May 2007: Canoe trip on Deer Creek from the Eden Mill Nature Center, 1617 Eden Mill Road, Pylesville, MD. Trip starts at 5:45pm and ends at 8pm. Cost is $10 per person with all funds going to the county Envirothon Committee. Call 410-836-3050 for information and reservations. Additional trip dates are 4, 6 and 18 June 2007.

25 May 2007: First Twilight Market at Rockfield Manor for the 2007 season. This farmers' market runs from 5pm to dusk on the last Friday of each month through September. It features Harford County agricultural producers selling beef, vegetables, fruits, honey, cheeses, ice creams and flowers in a social setting that includes music, food and beverages. The location is 501 Churchville Road, Bel Air.

9 June May 2007: Tenth Annual Wade-In at Anita C. Leight Estuary Center, 700 Otter Point Road, Abingdon, MD. Event takes place from 2pm to 5pm. Lots of educational activities for all ages, music, free ice cream and the wade-in event itself. No admission charge. Call 410-260-8725 for information.

WRAS Meeting May 16

Citizen awareness, education and involvement are crucial to keeping high quality water flowing throughout the Deer Creek watershed. The benefit extends to all folks who derive any kind of value from Deer Creek, regardless of whether that value is economic, recreational or aesthetic. Your input to the Deer Creek WRAS can help set the direction for future work to achieve and maintain the water quality of this stream system. The Deer Creek Watershed Association strongly encourages your attendance and participation in this upcoming public meeting. For your convenience, a formal presentation will be given at 3:00pm and again at 7:00pm. You are welcome to attend either session. Between the sessions there will be exhibits related to the activities of stakeholders who have participated in the WRAS process. You will have a good chance to learn more about their efforts on behalf of Deer Creek as well as their other interests and activities. Please, mark your calendar now and plan on attending the public meeting on 16 May. A draft copy of the WRAS will be available for review at www.harfordcountymd.gov/PlanningZoning/WRAS in early May. For additional information please contact Pat Pudelkewicz of the Harford County Department of Planning and Zoning via Email at deercreekwras@harfordcountymd.gov or by telephone at 410-638-3135.

Are Your Dues Overdue?

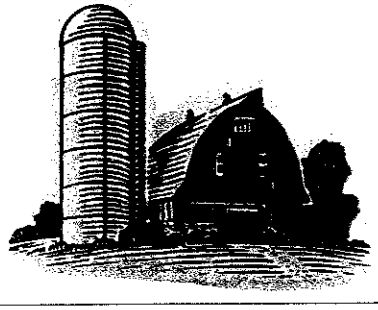
Please look at your address label. If it contains five asterisks (*****), your annual membership dues are overdue, and this is your last newsletter until we receive your renewal. For your convenience, an envelope has been enclosed for mailing your dues. Simply make out your check to the Deer Creek Watershed Association for your annual dues of $10 and mail it to us.

Membership

We are delighted to have new members. Send your $10 annual dues to the address on the mailing envelope. Dues are needed to support this newsletter and to fund other activities associated with our preservation and conservation efforts.

Dues, Donations and Assistance

Besides paying $10 annual dues, many members have been helpful on special projects such as research, petition drives, etc. Volunteers for such work are welcome. Whereas regular dues are needed for recurring expenses such as printing and mailing this newsletter and reimbursing the owners of the facility where our Directors hold their monthly meeting, we also need extra donations to defray special expenses. This is especially true at this time because of our commitment to oppose use of water from Deer Creek to support additional development in the county.



Upzoning Without Rezoning?

Why Not a Moratorium!

During the past year Harford County citizens have watched the usual dance that occurs when comprehensive rezoning is under consideration and many property holders request changes in zoning that allow for more development than is currently permitted. Following consideration of hundreds of applications the County Council approved a myriad of changes that left some people happy and some unhappy. Some difficult choices were made, at times unpopular, but apparently in keeping with the existing zoning codes. After much consideration and to the consternation of the Council, Executive David Craig vetoed the plan, citing too many upzoning changes outside the development envelope. It appears that both Mr. Craig and some current members of the County Council, especially President Billy Boniface, agree that the code needs very badly to be rewritten to properly consider requests from property owners. It also appears that at least a year may elapse before this process is completed, during which time zoning requests will be considered by examiners in the usual manner. The mere granting of upzoning requests can be construed as a gift, with no costs involved in securing development rights as would occur with a meaningful transfer program or with purchase of rights, as occurs in the agricultural preservation program. Would it not make good sense to declare a moratorium on changes in zoning of properties until the code is rewritten and a mandatory comprehensive zoning plan adopted. Action by the County Council would accomplish this if good sense and courage could prevail.

Deer Creek Notes **Spring 2007**

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Dept of P&Z
220 South Main Street
Bel Air, MD 21014

APPENDIX C: LAND USE

The land uses and impervious factors applied for all Maryland and Pennsylvania existing land use are shown in Table C-33. The 'RAS' land use codes are for those areas in the Pennsylvania portions of the Deer Creek Watershed. Table C-34 shows only the Pennsylvania land use codes and the Maryland Department of Planning code that it most closely matched. The impervious factors in these tables were applied to both existing and future land uses. Major highways are designated as "transportation" in the Pennsylvania portions of the Watershed. There is no corresponding MDP designation for transportation; therefore these areas were left as transportation with an imperviousness of 95 percent.

After intersecting the existing land use with the zoning layers, each land use was examined to determine what the future land use would most likely be. Tables C-35, C-36 and C-37 list the current land uses and the zoning codes for all polygons. In general, all residential land uses (11, 12, and 13) were assumed to be the same level of residential land use under future scenarios, regardless of zoning. Likewise, commercial areas remained in commercial use. Areas in agricultural and forested land uses were assumed to develop if the future zoning indicated a higher level of development. Exceptions to the above rules were only made in cases where there was only a single polygon that could easily be seen on the aerial photography. For example, there is an area in Baltimore County that is coded as commercial for the existing land use. This area was identified as a used car junkyard on the aerial photography. The areas is zoned for heavy manufacturing. Rather than leave the area as commercial under future land use, this area was coded as industrial.

Zoning in York County is decided by townships and boroughs. There are multiple zoning codes that are very similar between municipalities. Similar rules were followed to apply future land use values to the Pennsylvania portions of the watershed. That is, residential and commercial land uses retained the same future land use regardless of the zoning. All decisions made for the Pennsylvania portions of the Watershed are shown in Table C-37.

Table C-33 – All Land Use Codes and Impervious Factors

Land Use Code	Land Use Name	Impervious Factor
11	Low-density residential	14%
12	Medium-density residential	28%
13	High-density residential	41%
14	Commercial	72%
15	Industrial	53%
16	Institutional	34%
18	Open urban land	9%
21	Cropland	2%
22	Pasture	2%
23	Orchards/vineyards/horticulture	2%
25	Row and garden crops	2%
41	Deciduous forest	0%
42	Evergreen forest	0%
43	Mixed forest	0%
44	Brush	0%
50	Water	0%
60	Wetlands	0%
73	Bare ground	9%
241	Feeding operations	2%
242	Agricultural buildings	2%
RAS 1	Open Water	0%
RAS 10	Urban/Residential Deciduous Tree	14%
RAS 11	Urban/Residential Evergreen Tree	14%
RAS 12	Urban/Residential Mixed Trees	14%
RAS 15	Urban/Residential Recreational Grass	34%
RAS 17	Extractive	9%
RAS 18	Barren	9%
RAS 20	Deciduous Forest	0%
RAS 21	Evergreen Forest	0%
RAS 22	Mixed Forest	0%
RAS 25	Pasture/Hay	2%
RAS 26	Croplands	2%
RAS 3	Low Intensity Developed	14%
RAS 30	Natural Grass	0%
RAS 35	Deciduous Wooded Wetland	0%
RAS 36	Evergreen Wooded Wetland	0%
RAS 37	Emergent (sedge-herb) wetland	0%
RAS 38	Mixed Wetland	0%
RAS 4	Medium Intensity Developed	34%
RAS 5	High Intensity Developed	72%
RAS 8	Transportation	95%

Table C-34 - Pennsylvania Land Uses and Associated MDP Land Use Codes

Land Use Code	Land Use Description	MDP Land Use Code	Impervious Factor Applied
RAS1	Open Water	50	0%
RAS3	Low Intensity Developed	11	14%
RAS4	Medium Intensity Developed	16	34%
RAS5	High Intensity Developed	14	72%
RAS8	Transportation	N/A	95%
RAS10	Urban/Residential Deciduous Tree	11	14%
RAS11	Urban/Residential Evergreen Tree	11	14%
RAS12	Urban/Residential Mixed Trees	11	14%
RAS15	Urban/Residential Recreational Grass	16	34%
RAS17	Extractive	18	9%
RAS18	Barren	18	9%
RAS20	Deciduous Forest	41	0%
RAS21	Evergreen Forest	42	0%
RAS22	Mixed Forest	43	0%
RAS25	Pasture/Hay	22	2%
RAS26	Croplands	21	2%
RAS30	Natural Grass	44	0%
RAS35	Deciduous Wooded Wetland	60	0%
RAS36	Evergreen Wooded Wetland	60	0%
RAS37	Emergent (sedge-herb) wetland	60	0%
RAS38	Mixed Wetland	60	0%

Table C-35 - Conversion of Current Land Use and Zoning to Future Land Use – Baltimore County

Current Land Use (MDP Codes)	Zoned (Baltimore County Zoning Codes)	Future Land Use	Notes
11 - Low Density Residential	25 - Agricultural Resource Conservation	11 - Low Density Residential	
11 - Low Density Residential	28 - Rural Residential Resource Conservation	11 - Low Density Residential	
11 - Low Density Residential	3 - Business, Major	11 - Low Density Residential	only 1 polygon
11 - Low Density Residential	30 - Resource Preservation Zone	11 - Low Density Residential	
11 - Low Density Residential	1 - Business, Local	11 - Low Density Residential	only 1 polygon
11 - Low Density Residential	34 - Resource Conservation Commercial	11 - Low Density Residential	
12 - Medium Density Residential	3 - Business, Major	12 - Medium Density Residential	
12 - Medium Density Residential	28 - Rural Residential Resource Conservation	12 - Medium Density Residential	only 1 polygon
14 - Commercial	1 - Business, Local	14 - Commercial	
14 - Commercial	15 - Manufacturing, Heavy	15 - Industrial	used car junkyard
14 - Commercial	25 - Agricultural Resource Conservation	14 - Commercial	
14 - Commercial	28 - Rural Residential Resource Conservation	14 - Commercial	
14 - Commercial	3 - Business, Major	14 - Commercial	
14 - Commercial	34 - Resource Conservation Commercial	14 - Commercial	
14 - Commercial	7 - Business, Roadside	14 - Commercial	
15 - Industrial	25 - Agricultural Resource Conservation	15 - Industrial	area surrounding school bus lot
15 - Industrial	16 - Manufacturing, Light	15 - Industrial	
16 - Institutional	25 - Agricultural Resource Conservation	16 - Institutional	
16 - Institutional	28 - Rural Residential Resource Conservation	16 - Institutional	
18 - Open Urban Land	25 - Agricultural Resource Conservation	18 - Open Urban Land	highway interchange
18 - Open Urban Land	28 - Rural Residential Resource Conservation	18 - Open Urban Land	highway interchange
21 - Cropland	1 - Business, Local	14 - Commercial	only 1 polygon
21 - Cropland	25 - Agricultural Resource Conservation	21 - Cropland	
21 - Cropland	28 - Rural Residential Resource Conservation	11 - Low Density Residential	
21 - Cropland	3 - Business, Major	14 - Commercial	
21 - Cropland	30 - Resource Preservation Zone	21 - Cropland	
21 - Cropland	34 - Resource Conservation Commercial	14 - Commercial	only 1 polygon
21 - Cropland	7 - Business, Roadside	14 - Commercial	
22 - Pasture	25 - Agricultural Resource Conservation	22 - Pasture	
22 - Pasture	30 - Resource Preservation Zone	22 - Pasture	

Current Land Use (MDP Codes)	Zoned (Baltimore County Zoning Codes)	Future Land Use	Notes
22 - Pasture	28 - Rural Residential Resource Conservation	11 - Low Density Residential	
22 - Pasture	34 - Resource Conservation Commercial	14 - Commercial	
41, 42, 44 - Forest and Brush	25 - Agricultural Resource Conservation	Left as original land use	
41, 42, 44 - Forest and Brush	28 - Rural Residential Resource Conservation	11 - Low Density Residential	
41, 42, 44 - Forest and Brush	3 - Business, Major	14 - Commercial	
41, 42, 44 - Forest and Brush	30 - Resource Preservation Zone	Left as original land use	
41, 42, 44 - Forest and Brush	34 - Resource Conservation Commercial	14 - Commercial	
50 - Water	25 - Agricultural Resource Conservation	50 - Water	
60 - Wetlands	30 - Resource Preservation Zone	60 - Wetlands	

Table C-36 - Conversion of Current Land Use and Zoning to Future Land Use – Harford County

Current Land Use (MDP Codes)	Zoned (Harford County Zoning Designations)	Future Land Use	Notes
11 - Low Density Residential	Agriculture	11 - Low Density Residential	
11 - Low Density Residential	Commercial Industrial District	11 - Low Density Residential	
11 - Low Density Residential	Community Business District	11 - Low Density Residential	
11 - Low Density Residential	General Business District	11 - Low Density Residential	
11 - Low Density Residential	Neighborhood Business District	11 - Low Density Residential	
11 - Low Density Residential	Right of Way	11 - Low Density Residential	
11 - Low Density Residential	Rural Residential	11 - Low Density Residential	
11 - Low Density Residential	Urban Residential District (R1)	11 - Low Density Residential	
11 - Low Density Residential	Urban Residential District (R2)	11 - Low Density Residential	
11 - Low Density Residential	Urban Residential District (R3)	11 - Low Density Residential	
11 - Low Density Residential	Village Business District	11 - Low Density Residential	
11 - Low Density Residential	Village Residential District	11 - Low Density Residential	
12 - Medium Density Residential	Agriculture	12 - Medium Density Residential	
12 - Medium Density Residential	Community Business District	12 - Medium Density Residential	
12 - Medium Density Residential	General Business District	12 - Medium Density Residential	
12 - Medium Density Residential	Right of Way	12 - Medium Density Residential	
12 - Medium Density Residential	Rural Residential	12 - Medium Density Residential	
12 - Medium Density Residential	Urban Residential District (R1)	12 - Medium Density Residential	
12 - Medium Density Residential	Urban Residential District (R2)	12 - Medium Density Residential	
12 - Medium Density Residential	Urban Residential District (R3)	12 - Medium Density Residential	
12 - Medium Density Residential	Village Business District	12 - Medium Density Residential	
12 - Medium Density Residential	Village Residential District	12 - Medium Density Residential	
13 - High Density Residential	Agriculture	13 - High Density Residential	
13 - High Density Residential	Rural Residential	13 - High Density Residential	
13 - High Density Residential	Urban Residential District (R3)	13 - High Density Residential	
14 - Commercial	Agriculture	14 - Commercial	
14 - Commercial	Commercial Industrial District	14 - Commercial	
14 - Commercial	Community Business District	14 - Commercial	

Current Land Use (MDP Codes)	Zoned (Harford County Zoning Designations)	Future Land Use	Notes
14 - Commercial	General Business District	14 - Commercial	
14 - Commercial	Neighborhood Business District	14 - Commercial	
14 - Commercial	Right of Way	14 - Commercial	
14 - Commercial	Rural Residential	14 - Commercial	
14 - Commercial	Urban Residential District (R2)	14 - Commercial	
14 - Commercial	Village Business District	14 - Commercial	
14 - Commercial	Village Residential District	14 - Commercial	
15 - Industrial	Agriculture	15 - Industrial	
15 - Industrial	General Industrial District	15 - Industrial	
15 - Industrial	Rural Residential	15 - Industrial	
16 - Institutional	Agriculture	16 - Institutional	
16 - Institutional	Commercial Industrial District	16 - Institutional	
16 - Institutional	General Business District	16 - Institutional	
16 - Institutional	Right of Way	16 - Institutional	
16 - Institutional	Rural Residential	16 - Institutional	
16 - Institutional	Village Business District	16 - Institutional	
16 - Institutional	Village Residential District	16 - Institutional	
18 - Open Urban Land	Rural Residential	18 - Open Urban Land	
18 - Open Urban Land	Right of Way	18 - Open Urban Land	
18 - Open Urban Land	Agriculture	18 - Open Urban Land	
21 - Cropland	Agriculture	21 - Cropland	
21 - Cropland	Commercial Industrial District	14 - Commercial	
21 - Cropland	Community Business District	14 - Commercial	
21 - Cropland	General Business District	14 - Commercial	
21 - Cropland	General Industrial District	15 - Industrial	
21 - Cropland	Neighborhood Business District	14 - Commercial	
21 - Cropland	Right of Way	21 - Cropland	
21 - Cropland	Rural Residential	11 - Low Density Residential	Rural Residential may be built to 1du per 2-acre lot per Harford County zoning guidance
21 - Cropland	Urban Residential District (R1)	11 - Low Density Residential	

Current Land Use (MDP Codes)	Zoned (Harford County Zoning Designations)	Future Land Use	Notes
21 - Cropland	Urban Residential District (R2)	12 - Medium Density Residential	
21 - Cropland	Urban Residential District (R3)	12 - Medium Density Residential	
21 - Cropland	Village Business District	14 - Commercial	
21 - Cropland	Village Residential District	12 - Medium Density Residential	
22 - Pasture	Agriculture	22 - Pasture	
22 - Pasture	Right of Way	22 - Pasture	
22 - Pasture	General Business District	14 - Commercial	
22 - Pasture	Neighborhood Business District	14 - Commercial	
22 - Pasture	Rural Residential	11 - Low Density Residential	
23 - Orchards/vineyards/horticulture	Agriculture	23 - Orchards/vineyards/horticulture	
23 - Orchards/vineyards/horticulture	Community Business District	14 - Commercial	
23 - Orchards/vineyards/horticulture	Neighborhood Business District	14 - Commercial	
23 - Orchards/vineyards/horticulture	Right of Way	23 - Orchards/vineyards/horticulture	
23 - Orchards/vineyards/horticulture	Rural Residential	11 - Low Density Residential	
23 - Orchards/vineyards/horticulture	Village Residential District	12 - Medium Density Residential	
241 - Feeding Operations	Agriculture	241 - Feeding Operations	
241 - Feeding Operations	General Industrial District	15 - Industrial	
241 - Feeding Operations	Right of Way	241 - Feeding Operations	
241 - Feeding Operations	Village Residential District	12 - Medium Density Residential	
242 - Agricultural Buildings	Agriculture	242 - Agricultural Buildings	
242 - Agricultural Buildings	Community Business District	14 - Commercial	
242 - Agricultural Buildings	General Industrial District	15 - Industrial	
242 - Agricultural Buildings	Right of Way	242 - Agricultural Buildings	
242 - Agricultural Buildings	Rural Residential	11 - Low Density Residential	
242 - Agricultural Buildings	Urban Residential District (R3)	12 - Medium Density Residential	
25 - Row and Garden Crops	Agriculture	25 - Crops	
41 - Deciduous Forest	Agriculture	41 - Deciduous Forest	
41 - Deciduous Forest	Commercial Industrial District	14 - Commercial	
41 - Deciduous Forest	Community Business District	14 - Commercial	
41 - Deciduous Forest	General Business District	14 - Commercial	
41 - Deciduous Forest	General Industrial District	15 - Industrial	
41 - Deciduous Forest	Neighborhood Business District	14 - Commercial	

Current Land Use (MDP Codes)	Zoned (Harford County Zoning Designations)	Future Land Use	Notes
41 - Deciduous Forest	Right of Way	41 - Deciduous Forest	
41 - Deciduous Forest	Rural Residential	11 - Low Density Residential	
41 - Deciduous Forest	Urban Residential District (R1)	11 - Low Density Residential	
41 - Deciduous Forest	Urban Residential District (R2)	12 - Medium Density Residential	
41 - Deciduous Forest	Village Business District	14 - Commercial	
41 - Deciduous Forest	Village Residential District	12 - Medium Density Residential	
42 - Evergreen Forest	Agriculture	42 - Evergreen Forest	
42 - Evergreen Forest	Right of Way	42 - Evergreen Forest	
42 - Evergreen Forest	Rural Residential	11 - Low Density Residential	
43 - Mixed Forest	Agriculture	43 - Mixed Forest	
43 - Mixed Forest	Right of Way	43 - Mixed Forest	
44 - Brush	Agriculture	44 - Brush	
44 - Brush	General Business District	14 - Commercial	
44 - Brush	Right of Way	44 - Brush	
44 - Brush	Rural Residential	11 - Low Density Residential	
50 - Water	Agriculture	50 - Water	
50 - Water	Rural Residential	11 - Low Density Residential	
73 - Bare Ground	Agriculture	73 - Bare Ground	

Table C-37 - Conversion of Current Land Use and Zoning to Future Land Use - York County, Pennsylvania

Current Land Use (Using Pennsylvania Codes)	Zoned (Zoning codes from multiple townships/boroughs)	Future Land Use (Using MDP codes)	Notes
1 - Water	Multiple	50 - water	water
3 - Low Intensity Developed	All Zoning Codes	11 - Low Density Residential	
4 - Medium Intensity Developed	All Zoning Codes	16 - Institutional	
5 - High Intensity Developed	All Zoning Codes	14 - Commercial	
8 - Transportation	All Zoning Codes	RAS8	Transportation (no MDP designation)
10 - Urban/Residential Deciduous Tree	All Zoning Codes	11 - Low Density Residential	
11 - Urban/Residential Evergreen Tree	All Zoning Codes	11 - Low Density Residential	
12 - Urban/Residential Mixed Trees	All Zoning Codes	11 - Low Density Residential	
15 - Urban/Residential Recreational Grass	All Zoning Codes	16 - Institutional	
17 - Extractive; 18 - Barren	VC - Village Center	73 - Bare Ground	
17 - Extractive; 18 - Barren	A - Agriculture	21 - Cropland	
17 - Extractive; 18 - Barren	C/I; CM - Commercial/Industrial	14 - Commercial	
17 - Extractive; 18 - Barren	SR; RO; - Suburban Residential; Single Family Residential	11 - Low Density Residential	
17 - Extractive; 18 - Barren	RA; R; RR - Residential Ag; Residential; Rural Residential	11 - Low Density Residential	
17 - Extractive; 18 - Barren	RII; RT - Residential; Residential Town	12 - Medium Density Residential	
20, 21, 22 - Deciduous, Evergreen, Mixed Forest	A - Agriculture	43 - Mixed Forest	
20, 21, 22 - Deciduous, Evergreen, Mixed Forest	C; C/I; Cm - Commercial	14 - Commercial	
20, 21, 22 - Deciduous, Evergreen, Mixed Forest	CV - Conservation	43 - Mixed Forest	
20, 21, 22 - Deciduous, Evergreen, Mixed Forest	I - Industrial	15 - Industrial	

Current Land Use (Using Pennsylvania Codes)	Zoned (Zoning codes from multiple townships/boroughs)	Future Land Use (Using MDP codes)	Notes
20, 21, 22 - Deciduous, Evergreen, Mixed Forest	RA; R; RR; RO; SF; SR - Residential Ag; Residential; Rural Residential; Single Family; Suburban Residential	11 - Low Density Residential	
20, 21, 22 - Deciduous, Evergreen, Mixed Forest	RII; RT - Residential; Residential Town	12 - Medium Density Residential	
20, 21, 22 - Deciduous, Evergreen, Mixed Forest	VC - Village Center	14 - Commercial	
25, 26 - farmland, crops	A - Agriculture	Kept as farm/crop (MDP 21 or 22)	
25, 26 - farmland, crops	RA; R; RR; RO; SF; SR - Residential Ag; Residential; Rural Resid.; Single Family; Suburban Residential	11 - Low Density Residential	
25, 26 - farmland, crops	C; C/I; Cm - Commercial	14 - Commercial	
25, 26 - farmland, crops	CV - Conservation	Kept as farm/crop (MDP 21 or 22)	
25, 26 - farmland, crops	I - Industrial	15 - Industrial	
25, 26 - farmland, crops	RII; RT - Residential; Residential Town	12 - Medium Density Residential	
25, 26 - farmland, crops	VC - Village Center	14 - Commercial	
30 - Grass	A - Agriculture	44 - Brush	
30 - Grass	C; C/I; Cm - Commercial	14 - Commercial	
30 - Grass	RA; R; RR; RO; SF; SR - Residential Ag; Residential; Rural Residential; Single Family; Suburban Residential	11 - Low Density Residential	
30 - Grass	CV - Conservation	44 - Brush	
30 - Grass	VC - Village Center	14 - Commercial	
35, 36, 37, 38 - Various Wetlands	All Zoning Codes	60 - Wetlands	