

# **Chesapeake Bay Tributary Strategy Dauphin County, Pennsylvania**



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Dauphin County Conservation District  
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## ***List of Acronyms***

2004 303(d) list - Commonwealth of Pennsylvania 2004 303(d) list of impaired waters

ALP - Agricultural Land Preservation

AMD - Abandoned Mine Drainage

AML - Abandoned Mine Lands

BMP - Best Management Practice

CREP - Conservation Reserve Enhancement Program

CWF - Cold Water Fishery

DCCD - Dauphin County Conservation District

DFTU - Doc Fritchey Chapter of Trout Unlimited

E&S - Erosion and Sediment Control

MS4 - Municipal Separate Storm Sewer Systems

NMA - Pennsylvania's Nutrient Management Act

NPDES - National Pollutant Discharge Elimination System

NRCS - Natural Resources Conservation Service

PA DCED - Department of Community and Economic Development

PA DCNR - Pennsylvania Department of Conservation and Natural Resources

PA DEP - Pennsylvania Department of Environmental Protection

PCWEA - Paxton Creek Watershed and Education Association

PDA - Pennsylvania Department of Agriculture

RUSLE - Revised Universal Soil Loss Equation

SAPS - Successive Alkalinity Producing System

SCCD - Schuylkill County Conservation District

SLD - Subdivision and Land Development

SRBC - Susquehanna River Basin Commission

SWM - Stormwater Management

TCCCA - Tri-County Conewago Creek Association

TMDL - Total Maximum Daily Load

TSF - Trout Stocked Fishery

TVWA - Tri-Valley Watershed Association

USDA - United States Department of Agriculture

USGS - United States Geological Survey

VFP - Vertical Flow Ponds

WWF - Warm Water Fishery

## METHODOLOGY

The basis and foundation for the *Dauphin County Chesapeake Bay Tributary Strategy* was initiated within the Dauphin County Conservation District (DCCD) as far back as 1992. At that time, DCCD's directors and staff recognized that the primary focus of their work was centered on water quality and water quantity issues. Gaining a working knowledge of all of the streams within the county was established as a goal. Initial research was very elementary, consisting of a collaborative effort between Penn State Harrisburg and a DCCD intern collecting weekly water samples at 40 sites throughout the county. The data collected and quantified in those early years indicated that we did not have the technical knowledge or monitoring protocol necessary to apply our efforts in a way that would benefit our streams.

A huge step forward came in 1998, when DCCD's directors created a full-time Aquatic Biologist position. In 2002, we were fortunate to be able to establish a second Aquatic Resource position. With employment in the initial position came the establishment of credible stream data. Working with aquatic biologists from the Pennsylvania Department of Environmental Protection (PA DEP), a stream monitoring protocol was developed that met standards recognized by the scientific community. From that point through today, we continue to monitor all of the major streams in Dauphin County using a combination of biological, chemical and physical assessments (*Appendix A*).

Sound data and a working knowledge of our streams form the basis and foundation of the *Dauphin County Chesapeake Tributary Strategy* (Strategy).

The format used in the presentation of this Strategy is to begin with the large overall picture and continue to focus in increasing detail on the specifics relating to our water quality issues and concerns. Initially, the Strategy reports on Dauphin County as a whole, with a description of its physical, socio-economic and land use characteristics (*Appendix B*). From the countywide picture, the focus narrows down to individual watersheds. The report identifies eleven primary watersheds. River drainage areas are numerous along the county's western border and have been assimilated into adjoining watersheds. River drainage shall be assumed to be of the same character and conditions of the adjoining watersheds, unless otherwise noted. Proceeding from the northern-most watershed in a southerly direction, the watersheds are: Mahantango Creek, Wiconisco Creek, Armstrong Creek, Powells Creek, Clark Creek, Stony Creek, Fishing Creek, Paxton Creek, Spring Creek West, Swatara Creek and Conewago Creek. Combined, these creeks provide Dauphin County with 886 miles of streams (*Appendix C*).

As will be noted when the Strategy is read, diversity may be the best way to capsule our watersheds into one term. The profiles provided for each watershed will show many similarities with some watersheds and stark differences with others (*Appendix D*). The county has good quality streams; it also has streams impaired by agriculture, development, abandoned mine drainage (AMD) and acid rain. Each watershed will be described to develop an understanding of its characteristics, its water quality, threats or impairments and what DCCD views as the trends or future of each stream. Some of these watersheds will be viewed as a whole; others will be broken down to identify tributary sub-watersheds where significant.

Following the understanding developed of each watershed, the format of the Strategy changes to address the four specific areas relating to stream impairment and stream mitigation. The

four areas identified are: Agriculture, Development, Abandoned Mine Land and Discharges and Acid Rain.

***Agriculture:*** Agriculture is addressed by dividing the County into five segments. Two segments, termed the Northern and Central regions, are areas of little or no agricultural activity. Therefore, these segments are excluded from the Agricultural section of the Strategy and fall under the Development chapter. The remaining three segments group watersheds with similar agricultural characteristics and are referred to in the Agricultural Profile and Strategic Plan as Agricultural Regions One, Two and Three.

- 1 *Agricultural Region One* encompasses all agricultural land north of Peters Mountain and includes the Mahantango, Wiconisco, Armstrong, Powells and River Drainage watersheds.
- 2 *Agricultural Region Two* is bordered on the north by Blue Mountain, on the east by the Dauphin County line, on the south by Swatara Creek and on the west by Beaver Creek. All drainage in this segment is part of the Swatara Creek watershed. Primary sub-watersheds within this segment are the eastern half of Beaver Creek, Bow Creek, Manada Creek and Kellock Run.
- 3 *Agricultural Region Three* is bordered on the north by Swatara Creek, to the east and south by the Dauphin County line, and to the west by the Susquehanna River. Sub-watersheds within this region are all tributaries to the southern side of the Swatara Creek, Conewago Creek and River Drainage streams.

***Development:*** Development within our Strategy plan is not defined by individual watersheds, although specific streams and stream segments identified as impaired or under threat of impairment exist in the majority of watersheds. Development is a concern countywide. Component parts of the Development section focus on mitigation of impaired streams, but perhaps more importantly, they focus on education as a tool for maintaining stream quality and preventing additional impairment. Act 167 Stormwater Management Plans, Municipal Separate Storm Sewers System (MS4s), floodplain education, stream monitoring and the education of public officials and the general public are key activities in this section.

***Abandoned Mine Land and Drainage (AML/AMD):*** The northeastern corner of Dauphin County falls on the southernmost limits of anthracite coal deposits. Sediment discharges from AMD primarily impact the upper portions of the Wiconisco Creek, portions of Stony Creek, and possibly Clarks Creek. Aggressive mitigation efforts are underway to address the county's most significant AMD discharges.

***Acid Rain:*** Although acid rain falls uniformly across the entire county, Rattling Run, a tributary of Wiconisco Creek, is especially threatened. Geologic formations unique to this sub-watershed do not possess adequate buffering capacity to mitigate the effects of acid rain. Monitoring and mitigation efforts are noted in the Strategy plan.

The last section of our *Chesapeake Bay Tributary Strategy Plan* provides insight as to who had input in this planning process, who had input into the contents of this plan, and how the District makes decisions and prioritizes our workload and projects. DCCD views the preparation of this plan as an extension of our current plan of operation, putting into writing

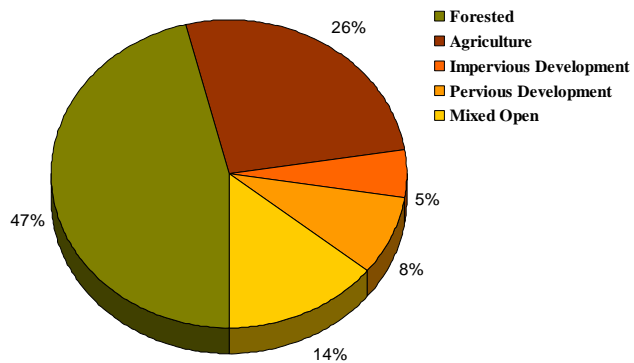
what we are already doing. It is an extension of our strategic planning process and how we are implementing the plan. As this Strategy is reviewed, we believe that it will show that DCCD is technically proficient, fiscally responsible, realistic in expectations, diverse, a good partner and administratively sound.

## **I. DAUPHIN COUNTY GENERAL DESCRIPTION**

# DAUPHIN COUNTY GENERAL DESCRIPTION

Located in southcentral Pennsylvania within the lower Susquehanna Valley, Dauphin County covers an area of approximately 525.3 square miles. The county ranks fifteenth in population size in Pennsylvania; according to Dauphin County Planning Commission figures, 251,798 people reside within the county's 40 municipalities. Dauphin County experienced a 5.9% growth rate between 1990 and 2000 - the highest growth rate in the past forty years. Dauphin County covers an area of approximately 550 square miles containing 40 municipalities with a population of 251,798 people (*Appendix E*). The county's western boundary is the west shore of the Susquehanna River; its northern boundary is the Mahantango Creek; its southern boundary is the Conewago Creek; and the eastern boundary is delineated by the borders of Schuylkill and Lebanon Counties. Dauphin County is located within PA DEP's South Central Region. Dauphin County has approximately 933 miles of streams, of which, 208.14 stream miles (21.0%) are listed on PA DEP's "Commonwealth of Pennsylvania 2004 303(d) list of impaired waters" (2004 303(d) list).

Dauphin County is essentially divided in half by a series of four ridges and valleys running through the approximate center of the county that separate the southern portion of the county from the northern portion. These areas are different in both topography and dominate the areas' land usage and economy. Land use in Dauphin County is diverse, and is composed of 260.4 square miles (47% of total county land) of forested area,



79.2 square miles (14%) of open areas, 147.7 square miles (26%) of agricultural areas, 47.1 square miles (8%) of pervious development areas, and 28.6 square miles (5%) of impervious development areas (*Figure 1*). The county's economy has remained primarily agriculture based throughout its recorded history; manufacturing, state and local government, wholesale trade and retail trade are also significant enterprises and have experienced moderate growth in the past decade (*Appendix F*).

## **NORTHERN REGION**

(Agricultural Region One; north of Peters Mountain)

Dauphin County's Northern Region includes all land bounded by county boundaries on its north, east and west, and Peters Mountain in the south (*Figure 2*). Roughly ten percent of the county's population lives in this region, predominantly in the urbanized areas in the boroughs of Williamstown, Gratz, Lykens, Pillow, Berrysburg, Elizabethville, Millersburg, and Halifax. Municipal townships in this region include Lykens, Williams, Wiconisco, Jackson, Washington, Mifflin, Upper Paxton, Jefferson, Wayne, Halifax and Reed. Watersheds in this region include: Mahantango Creek, Wiconisco Creek, Armstrong Creek, Powells Creek and river drainage systems. Land use is predominately agricultural land mixed with forested ridge slopes of the surrounding mountains.

Future development and its impact upon water quality in the northern portion of the county is difficult to predict due to the fact that zoning is non-existent in 14 of the 18 municipalities in northern Dauphin County. It is also unclear at the present time how much impact improved highway access to the northern portion of the county may have. It is possible, but unknown at present that a greatly increased rate of residential and commercial development may occur north of Peters Mountain. DCCD has implemented preservation of 8,000 acres of agricultural land through its Agricultural Land Easement Program (ALP). This, combined with a large Amish population in northern Dauphin County, may help to offset areas affected by increased development.

## **CENTRAL REGION**

(Rural; south of Peters Mountain, north of Blue Mountain)

The Central Region of Dauphin County is bordered on the north by the ridge of Peters mountain, on the south by the ridge of Blue Mountain, on the east by the county line and on the west by the Susquehanna river (*Figure 2*). Portions or all of the following municipalities are located in the central region: the Borough of Dauphin, and East Hanover, West Hanover, Middle Paxton, Rush, and Susquehanna townships. Included in this region are Fishing Creek, Stony Creek, Clark Creek and the headwaters of Manada Creek. Nearly the entire region consists of forested lands on State Game Lands 211, 210, and 246, lands owned by the City of Harrisburg, and Fort Indiantown Gap Military Reservation.

Some low density residential development is evident in Dauphin Borough and the lower reaches of Clark and Stony Creeks. The potential for future development in this region is significantly low, due to the high percentage of forested land owned by government agencies and the region's generally unfavorable topography.

*Continued on page 8.*

# Chesapeake Bay Tributary Strategy Regions

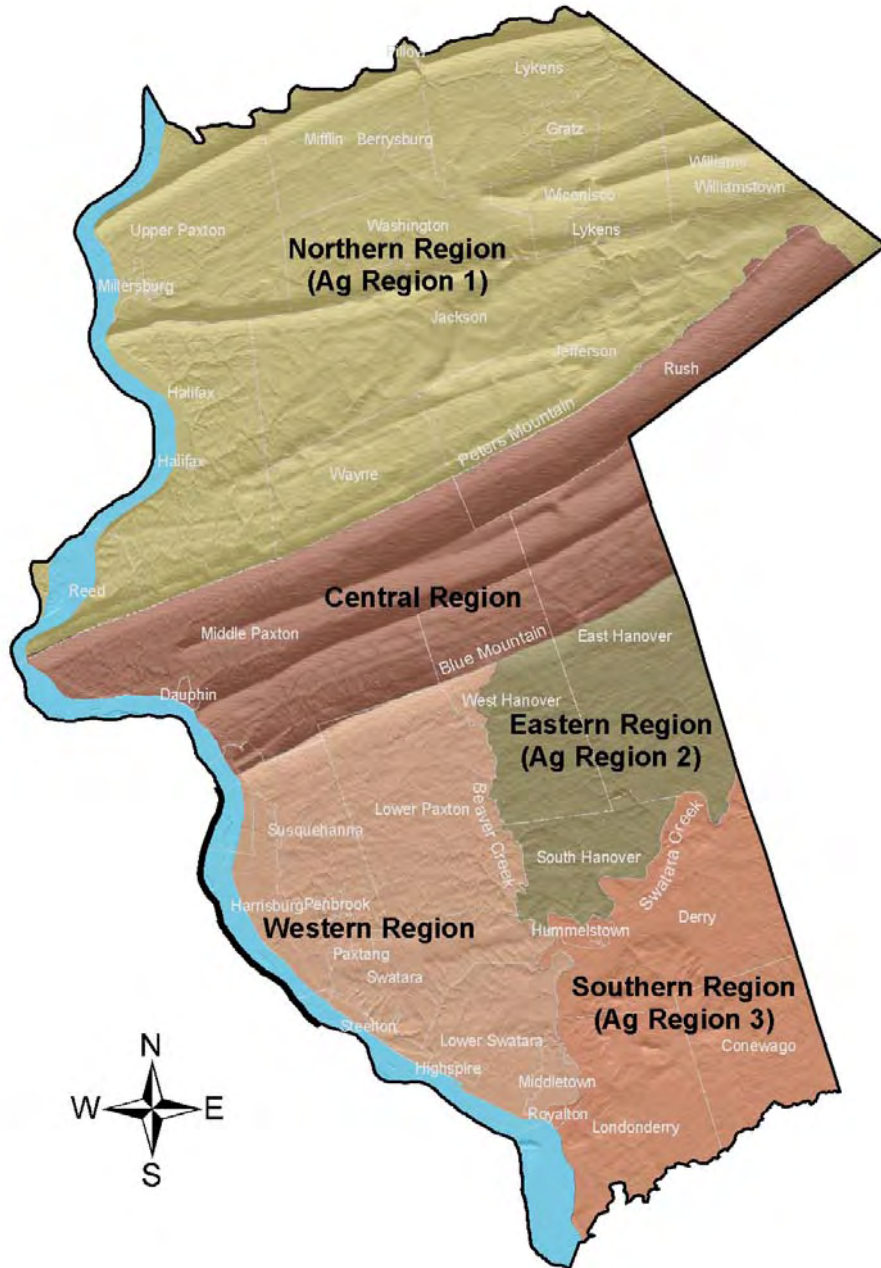


Figure 2. Dauphin County and local municipalities by Region

## **WESTERN REGION**

(Development; south of Blue Mountain, west of Beaver Creek)

The Western Region of Dauphin County is bordered by the south ridge of Blue Mountain in the north, Beaver Creek in the east, Swatara Creek in the south, and the west shore of the Susquehanna River in the west (*Figure 2*). Portions or all of the following 11 municipalities are located in the Western Region: the City of Harrisburg, the boroughs of Dauphin, Penbrook, Paxtang, Steelton, Highspire, and Middletown; and Susquehanna, Swatara, and Middle and Lower Paxton townships. Included in this region are the Paxton Creek and Spring Creek West watersheds, and portions of Swatara Creek watershed. The Western Region contains the majority (66%) of Dauphin County's population, and is subsequently the region with the majority of developed land within the county; nearly the entire region consists of high-density urban or suburban development.

The county's western region has exhibited the most dramatic growth over the past 25 years and continues to develop at a rapidly accelerated rate, despite low availability of land parcels.

## **EASTERN REGION**

(Agricultural Region Two; east of Beaver Creek, north of Swatara Creek)

Bordered on the north by the south slope of Blue Mountain, on the east by the Dauphin County line, on the south by Swatara Creek and on the west by Beaver Creek, all drainage in the Eastern Region is part of the Swatara Creek watershed. Primary sub-watersheds within this segment are the eastern half of Beaver Creek, Bow Creek, Manada Creek and Kellock Run. Only two municipalities, East Hanover and South Hanover townships, containing 4% of the county's population, are located within the Eastern Region (*Figure 2*).

The open land that dominates in the Eastern Region dramatically contrasts the heavy development of the Western Region in land use. However, land use in this portion of the county is changing rapidly from agricultural land to increasing development due to shifting economic trends and changes in zoning.

## **SOUTHERN REGION**

(Agricultural Region Three; south of Swatara Creek to Lebanon County line)

Dauphin County's Southern Region is bordered on the north by Swatara Creek, to the east and south by the county line, and to the west by the Susquehanna River. This region includes portions or all of the following municipalities: the boroughs of Hummelstown and Royalton; and Derry, Conewago, Lower Swatara, and Londonderry townships; the Southern Region contains approximately 17% of the total county population. Small sub-watersheds, and the larger Spring Creek East sub-watershed, in this region are tributaries of the southern side of Swatara Creek and Conewago Creek.

## **SOUTHERN REGION (cont.)**

Current land use is predominantly agriculture, with increasing levels of low-density residential development. Land use in the future tends to favor a decline in agricultural use, if urban development continues to increase at current levels.

## **II. DAUPHIN COUNTY WATERSHEDS**

# Chesapeake Bay Tributary Strategy Watersheds

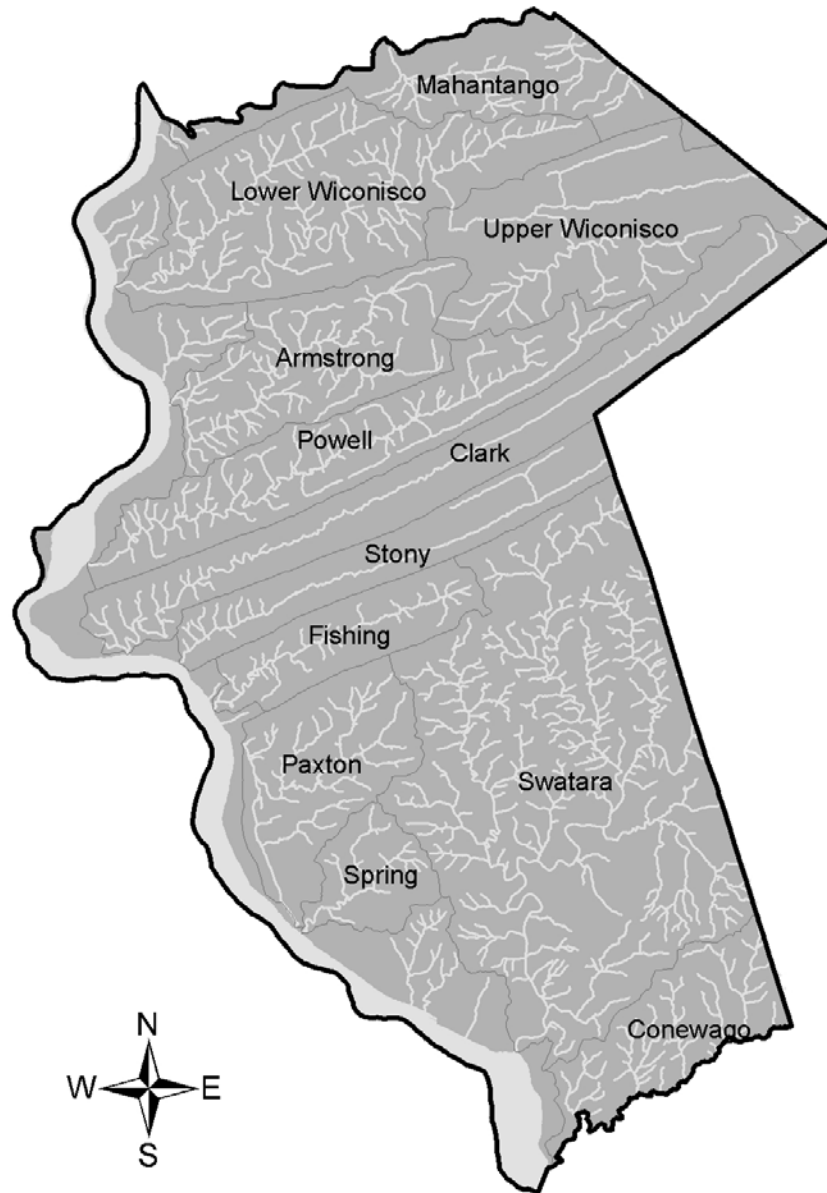


Figure 3. Dauphin County by watersheds.

# **MAHANTANGO CREEK WATERSHED**

## **GENERAL GEOGRAPHY, SIZE, AND LOCATION**

The Mahantango Creek watershed drains approximately 164.6 square miles, of which 28.5 square miles (17.0%) occur within the boundaries of Dauphin County and includes portions of or all of the municipalities of Lykens Township, Gratz Borough, Pillow Borough, Mifflin Township, and Upper Paxton Township (*Figure 4*). The remaining 83% of land in the watershed is located in Schuylkill and Northumberland counties to the north and east. In Dauphin County, the southern watershed boundary follows the ridge of Mahantango Mountain, except where its Deep Creek tributary breaks through the mountain and drains some land south of the mountain. Mahantango Creek is the northern boundary line of Dauphin County. The stream discharges to the Susquehanna River at the northwest corner of the county. The creek's southern border dips to include its two significant tributaries in Dauphin County, Deep Creek and Pine Creek. Deep Creek flows south of Mahantango Creek and merges with it east of the Borough of Pillow; Pine Creek flows south of Mahantango Creek through the northeast corner of Dauphin County and enters the Mahantango north of Klingerstown in Schuylkill County.

## **GENERAL LAND USE**

The Mahantango Creek watershed consists of forested mountain slopes and agricultural land on lesser slopes, which define the land use activities in the watershed. Logging operations are currently taking place on Mahantango Mountain with the remaining land in the watershed being used primarily for agriculture. Several permanently eased farms through DCCD's Agricultural Land Preservation program are located within this watershed, thereby assuring long-term agricultural land use. A minor amount of urbanized land exists in Gratz and Pillow boroughs, along with dispersed residential and commercial lots throughout the watershed.

While some development is likely to continue, the pace of development is generally slow. There are no discernable trends in land use management within the watershed.

## **WATER RESOURCES/QUALITY**

The Mahantango Creek watershed in Dauphin County is classified as a Warm Water Fishery (WWF) by PA DEP, except for Pine Creek and its tributaries, which are classified as Cold Water Fisheries (CWFs). Mahantango Creek is impacted by poor agricultural practices throughout the watershed and AMD from its Pine Creek tributary. However, 83% of the watershed, and nearly all impaired reaches, lie outside Dauphin County's borders, in Schuylkill and Northumberland counties. Monitoring has indicated elevated in-stream nutrient concentrations within the Dauphin County portion of the watershed. Stream buffers are generally inadequate, particularly in Deep Creek. The main stem of Mahantango Creek appears to have a greater forested buffer.

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# Mahantango Creek Watershed, Dauphin County

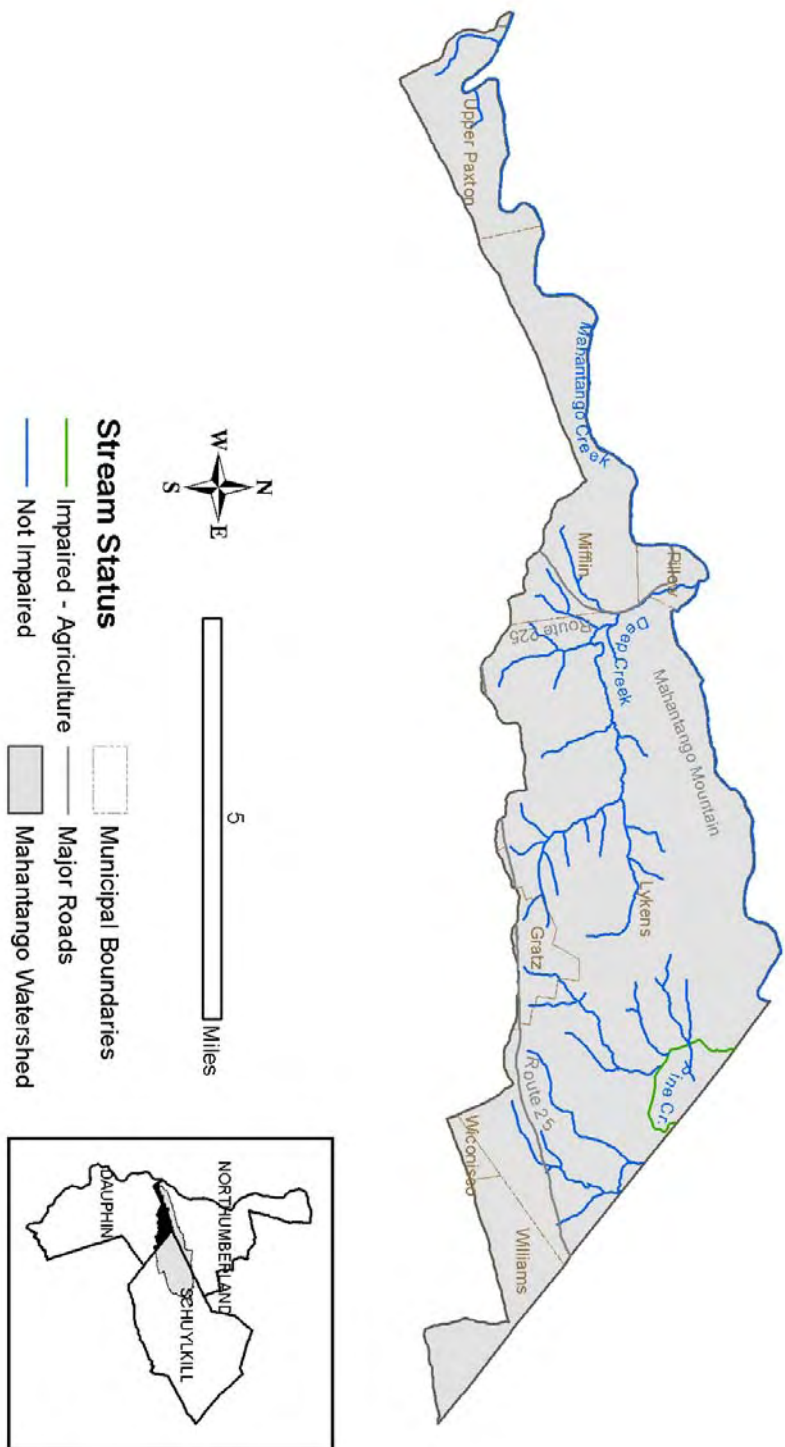


Figure 4.

## **MAHANTANGO CREEK WATERSHED**

### **WATER RESOURCES/QUALITY (cont.)**

*Pine Creek Tributary* - The lower reaches of Pine Creek, including the short section that runs through Dauphin County, are impaired due to siltation from agriculture. Since the impaired section extends upstream of Dauphin County and most of the Pine Creek watershed lies in Schuylkill County, it is not clear how much Dauphin County farmers might be contributing to this problem.

*Deep Creek Tributary* - Although this tributary is not listed on PA DEP's 2004 303(d) list of impaired streams, monitoring performed by DCCD indicates that nitrate concentrations in Deep Creek are consistently among the highest in the county and are cause for concern. Sediment yields are also likely to be high based on habitat evaluations and land use observations. These factors make land use in the Deep Creek watershed particularly relevant to the Chesapeake Bay.

## WICONISCO CREEK WATERSHED

### GENERAL GEOGRAPHY, SIZE AND LOCATION

The Wiconisco Creek watershed drains an area of approximately 116 square miles in northern Dauphin County and western Schuylkill County. The majority of the watershed, 102 square miles (98%), covers all or portions of the following municipalities of Dauphin County: the boroughs of Williamstown, Gratz, Lykens, Berrysburg, Elizabethville, Millersburg; and Lykens, Williams, Wiconisco, Jackson, Jefferson, Washington, Mifflin, and Upper Paxton townships (*Figure 5*). The diverse characteristics existing in the Wiconisco Creek watershed, and their related impacts on its water quality, can be better characterized by splitting the watershed geographically into its eastern and western halves.

#### *Upper Wiconisco Creek Basin – upstream of Loyalton*

The Upper Wiconisco is the eastern half of the watershed and encompasses the area from the creek's headwaters in Schuylkill County to Loyalton in Dauphin County. The creek originates in Schuylkill County east of Tower City on the slopes of the junction of Broad Mountain and Big Lick Mountain. From its headwaters to Tower City Borough, the creek drains the semi-broad Williams Valley and is joined by a tributary from the southeast just south of Tower City. From Tower City to the end of Short Mountain at Loyalton, the Wiconisco Creek continues its westward flow through a narrow, steep sided valley. Two significant tributaries, Bear Creek and Rattling Creek, meet the Wiconisco Creek at Lykens. Bear Creek enters the Wiconisco from the north, draining an elevated valley between Big Lick and Bear mountains. Rattling Creek enters Wiconisco Creek from the south, draining a broad, forested area between Berry Mountain to the north and Broad and Peter's Mountains to the south.

#### *Lower Wiconisco Creek Basin – Loyalton to Susquehanna River*

At Loyalton, the Wiconisco Creek meanders west to its junction with the Susquehanna River at Millersburg Borough. The northern boundary of the watershed leaves the ridge of Mahantango Mountain north of Berrysburg and follows a low ridge roughly southeast through Gratz to the ridge of Big Lick Mountain. Two large tributaries join Wiconisco Creek through this reach. An unnamed tributary (known locally as Gratz Creek or White Creek) drains the north slope of Short Mountain and land to the west of and including portions of Gratz Borough. This tributary enters Wiconisco Creek north of Loyalton. The largest sub-watershed of Wiconisco Creek, the Little Wiconisco Creek, drains a 17.5 square mile area including the southern flank of Mahantango Mountain and land between Berrysburg Borough and Millersburg Borough.

Many other smaller unnamed tributaries join Wiconisco Creek between Loyalton and Millersburg. Most drain small sub-watersheds dominated by agricultural land. Some drain predominately forested sub-basins on the north slope of Berry Mountain, the southern border of the watershed. From the Upper Paxton Township-Mifflin Township border, the creek generally hugs the base of Berry Mountain to its junction with the Susquehanna River.

*Continued on page 17.*

# Wiconisco Creek Watershed, Dauphin County

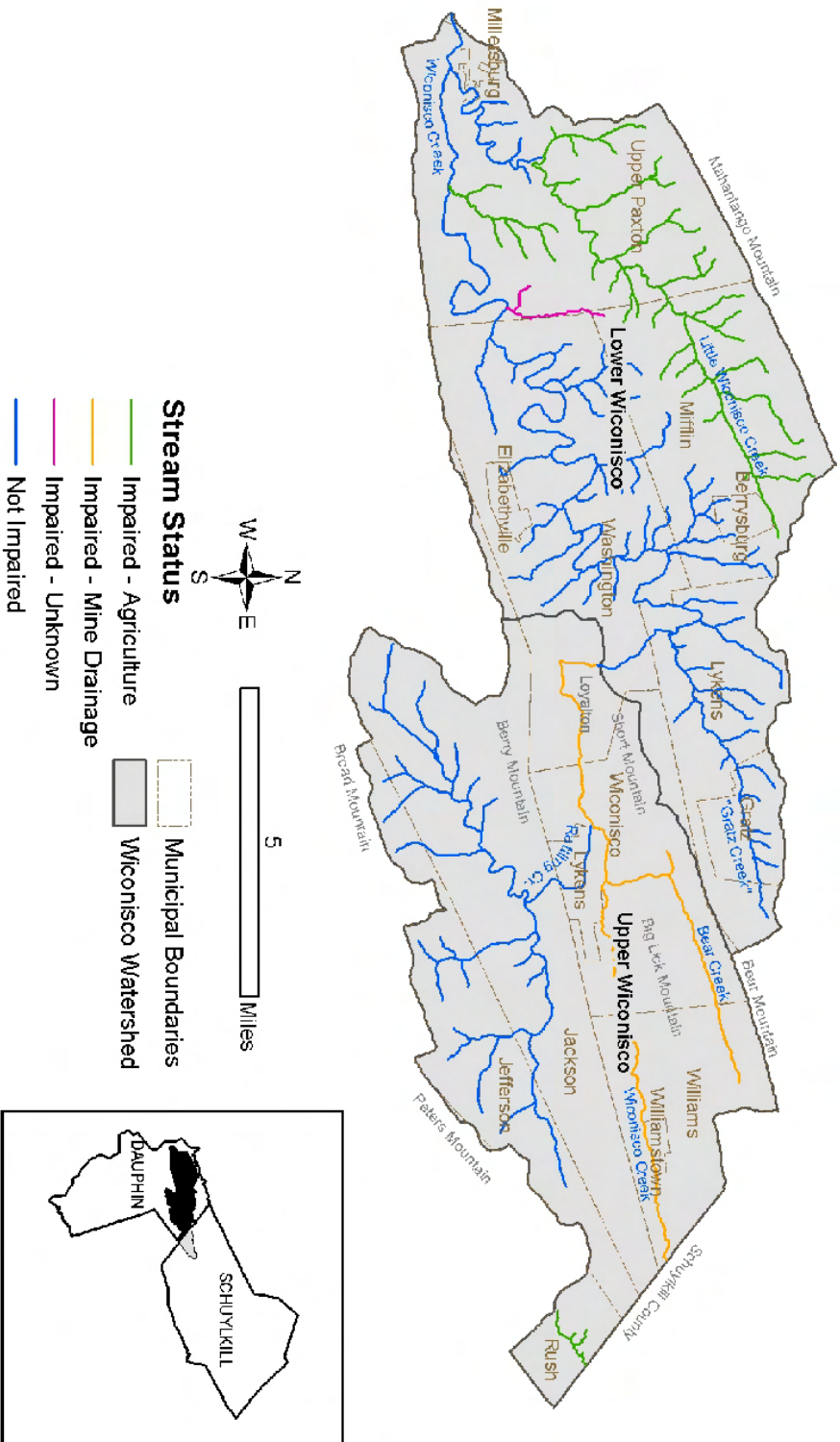


Figure 5.

# WICONISCO CREEK WATERSHED

## GENERAL LAND USE

The vast majority of the land in the entire Wiconisco Creek watershed is forested or used for agriculture. This watershed covers a predominantly rural area, in which population growth has remained low, and is not projected to increase significantly. There are, however, several boroughs across the watershed where residential use is dominant. In the few areas where residential development is proceeding at a more rapid pace, the trend favors small-scale projects, such as single-lot subdivisions in areas that have been zoned for agricultural use rather than residential use. Small-scale commercial and industrial uses exist on a limited scale, occurring in generally isolated spots throughout the watershed. Large-scale commercial and industrial projects, such as shopping centers, malls, large retailers or office buildings, are uncommon to this point but unpredictable.

A major retail store that is currently under development may be a one-time isolated development impact, or it may signal the coming of major land use changes with significant development. Six municipalities, four boroughs and two townships, currently have no zoning. Land use within the boroughs does not have the likelihood of much change. Combining the significant number of Amish farms within the Wiconisco watershed and the large blocks of farmland preserved through the Agricultural Land Preservation Program, it is envisioned that agriculture will remain the predominant land use.

### *Upper Wiconisco Creek Basin*

The eastern end of the watershed, the Upper Basin, is primarily forest, designated as State Game Lands or State Forest Land, with limited areas of agricultural use. Development in the Upper Basin is limited by the region's topography, and is predominantly residential, with concentrations in Tower City (Schuylkill County), Williamstown and Lykens. Mining activity has been historically significant; however, current mining activity is limited to designated actions specified under the watershed's only existing active mining permit for the Porter Tunnel above Reinerton in Schuylkill County. Large areas of coal waste on slopes near Tower City, Williamstown and Lykens. A large wetland is located at the junction of Wiconisco Creek and its Rattling Creek tributary east of Lykens.

### *Lower Wiconisco Creek Basin*

The western end of the watershed, the Lower Basin, is a wide valley bounded by Mahantango Mountain in the north and by Berry Mountain in the south. Agriculture is by far the dominant land use here. Forested areas are limited to the slopes of the bounding mountains and to a lesser extent, stream corridors. While residential use is concentrated in the boroughs of Berrysburg, Elizabethville and Millersburg, it is prevalent throughout this end of the watershed. Much of this is in the form of frontage development with some larger residential development, primarily in the vicinity of Millersburg and Elizabethville.

## WICONISCO CREEK WATERSHED

### WATER RESOURCES/QUALITY

As designated by PA DEP, all unnamed tributaries in the Upper Wiconisco area, including Bear and Rattling Creeks are classified as CWFs. The entire main stem of the Wiconisco Creek, the Little Wiconisco Creek, and all unnamed tributaries in the Lower Wiconisco area are classified WWF. The Wiconisco Creek watershed contains Dauphin County's only Exceptional Value watershed, Rattling Creek, which drains most of the forested area in the watershed's southwestern end. According to PA DEP's 2004 303(d) list, more than 58 miles of stream in this watershed are listed as impaired within Dauphin County. The entire Wiconisco Creek watershed is impacted by various nonpoint source pollutants ranging from acid and alkaline mine drainage, to coal fines, urban runoff, and nutrient and sediment loads from agricultural operations.

The Wiconisco Creek also has a number of point source discharges that could potentially influence water quality, particularly nutrient levels. Point sources are not addressed in this document since their compliance with discharge requirements are under the authority of Pennsylvania's NPDES program. For additional information about the impacts of nonpoint source pollution in the Wiconisco Creek watershed, see the publications by the Susquehanna River Basin Commission (SRBC) (1998, 1999). Additional relevant publications are Phase I and II of the Wiconisco Creek Watershed Study (Dauphin County Planning Commission, 1985, 1986) and the Final Draft Wiconisco Creek Watershed Conservation Plan (DCCD, 2004) currently under review by PA DCNR.

#### *Upper Wiconisco Creek Basin*

The Dauphin County portion of the Upper Wiconisco Creek watershed includes more than 19 miles of impaired stream. Although there is some agriculture in this region, the majority of nonpoint source impacts stem from past coal mining activities. Sedimentation from metal-contaminated AMD and the ensuing runoff from coal banks is visibly evident throughout the Upper Basin, from the creek's headwaters in Schuylkill County to the confluence of Bear and Rattling creeks near Lykens. Addressing AMD sedimentation in the basin will reduce the amount of metals-related sediments entering the Chesapeake Bay. Nonpoint source trends with respect to AMD in the Upper Wiconisco Creek Basin are not expected to change significantly over time.

*Bear Creek Tributary* - DCCD is currently under contract to PA DEP to craft a TMDL Implementation Plan for the Bear Creek watershed. This plan will outline specific BMPs to be placed in the Bear Creek watershed to reduce sedimentation caused by AMD. The Bear Creek TMDL Implementation Plan is slated to be completed in June 2005.

*Rattling Creek Tributary* - Rattling Creek is included in the state's Special Protection Program. Its headwaters, from the source to the confluence of the east and west branches, are designated as an exceptional value watershed; Rattling Creek from the confluence of the east and west branches to its mouth is designated a High Quality CWF.

## WICONISCO CREEK WATERSHED

### WATER RESOURCES/QUALITY (cont.)

Although its high quality rankings make it a valuable contributor to the Wiconisco Creek's recovery, Rattling Creek is affected by acid rain and portions of the creek are unable to support a balanced benthic community without the aid of limestone sand dosing. Historically, sulfur compounds have contributed heavily to acid rain in the eastern United States.

With the advent of federal emissions regulations, amounts of sulfur compounds have decreased but nitrogen compounds have not. It is possible that nitrogen emissions trends will increase in the future. Addressing acid rain from an emissions standpoint, at both state and national levels, will help reduce nitrogen input to the Chesapeake Bay.

#### *Lower Wiconisco Creek Basin*

The Lower Basin can be characterized as an area in biological recovery from the extensive impacts of mining activities in the Upper Basin. However, habitat and water quality in the Lower Basin are affected by agricultural activities. The Susquehanna River Basin Commission (1999) lists the Lower Basin as slightly impaired due to low taxonomic diversity. Further, PA DEP lists more than 39 miles of impaired stream in the Lower Wiconisco Creek Basin, most of which are in the Little Wiconisco Creek. Small named and unnamed tributaries of the Susquehanna River, such as Shippen Run, are located in the vicinity of Wiconisco Creek, and are included as part of the Lower Basin watershed. Several of these tributaries, although not impaired at this time, experience similar agricultural impacts and contribute additional sediment and nutrients to the Chesapeake Bay.

*Little Wiconisco Tributary* – Historically, nutrient levels in the main stem of the Wiconisco Creek are not exceedingly high, due to the influence of tributaries such as Gratz Creek and Rattling Creek, which serve to dilute the effects of agricultural nutrient input. However, the Little Wiconisco Creek is a prime contributor of agriculture-related sediment and nutrients to the Lower Basin watershed. Stream bank erosion and nutrient and sediment runoff from agricultural lands contribute heavily to the impaired condition in the Little Wiconisco Creek. According to historic and recent data, nutrient levels are notably high in the Little Wiconisco Creek and, judging from benthic fauna and habitat assessments, sediment loads are also high.

The Little Wiconisco Creek remains one of Dauphin County's largest contributors of sediment and nutrients (primarily nitrogen) to the Chesapeake Bay, and will likely remain so for the future. Addressing the sediment and nutrient loads in all of the tributaries of the Lower Wiconisco Creek basin will greatly reduce sediment and nutrients (primarily nitrogen) to the Chesapeake Bay.

## **ARMSTRONG CREEK WATERSHED**

### **GENERAL GEOGRAPHY, SIZE AND LOCATION**

The Armstrong Creek drains an area of approximately 32.5 square miles located entirely within Dauphin County, including portions or all of Halifax Borough and Jackson, Jefferson, Wayne and Halifax Townships (*Figure 6*). This basin has a much broader, gently sloping valley floor than the four basins to the south (Powell, Clark, Stony and Fishing creeks). Steeper slopes are found on the mountains and ridges that form the watershed's headwaters. The headwaters of Armstrong Creek begin between Broad Mountain and Berry Mountain in north central Jackson Township, above Haldeman State Forest. The creek flows southwest, and picks up a large unnamed tributary (known locally as Conley Run) north of the village of Enders, then continues southwest toward Halifax Borough. Prior to reaching Halifax, Armstrong Creek turns north, then picks up its second large tributary, New England Run, about a mile north of Halifax, before curving east to its mouth at the Susquehanna River.

### **GENERAL LAND USE**

Land in the Armstrong Creek watershed is predominantly used for agriculture. Forested land exists on the mountain slopes that form the watershed and along stream corridors. The largest concentrations of developed land are located around the small villages of Fisherville and Enders and the Borough of Halifax. Most new development is in the form of frontage residential construction, but there has recently been some commercial development south of Halifax Borough on Route 225, the largest transportation route in the watershed. Smaller township roads provide access to the rest of the watershed. This watershed, similar to Powell Creek, will probably see an increase in residential development and supporting commercial development with the completion of the Route 322 reconstruction from Dauphin to the Clarks Ferry Bridge. The future land use scenario is based on existing land use patterns. Municipalities in this basin do not have zoning ordinances; therefore, future land use patterns are uncertain.

### **WATER RESOURCES/QUALITY**

PA DEP has designated the upstream portion of the Armstrong Creek watershed and its major unnamed tributary (known locally as Conley Run) as CWF, whereas downstream portions of the watershed, including New England Run, are designated as Trout Stocked Fisheries (TSF). A section of the unnamed tributary (Conley Run) is listed in the state's Special Protection Waters program as High Quality.

Compared to other Dauphin County watersheds, Armstrong Creek watershed is of moderate concern as a source of nutrient and sediment pollution to the Chesapeake Bay. The Armstrong Creek watershed is impacted by poor agricultural practices, with 11.3 miles of stream (16% of the watershed) designated as impaired. Some areas with severely eroding stream banks are noted contributors of sediment, although extensive areas of crop fields are undoubtedly the major source of sediment pollution. The relative contribution from these two sources is unknown and requires study. Monitoring by DCCD has also documented moderately elevated nitrate concentrations in the watershed.

# Armstrong Creek Watershed, Dauphin County

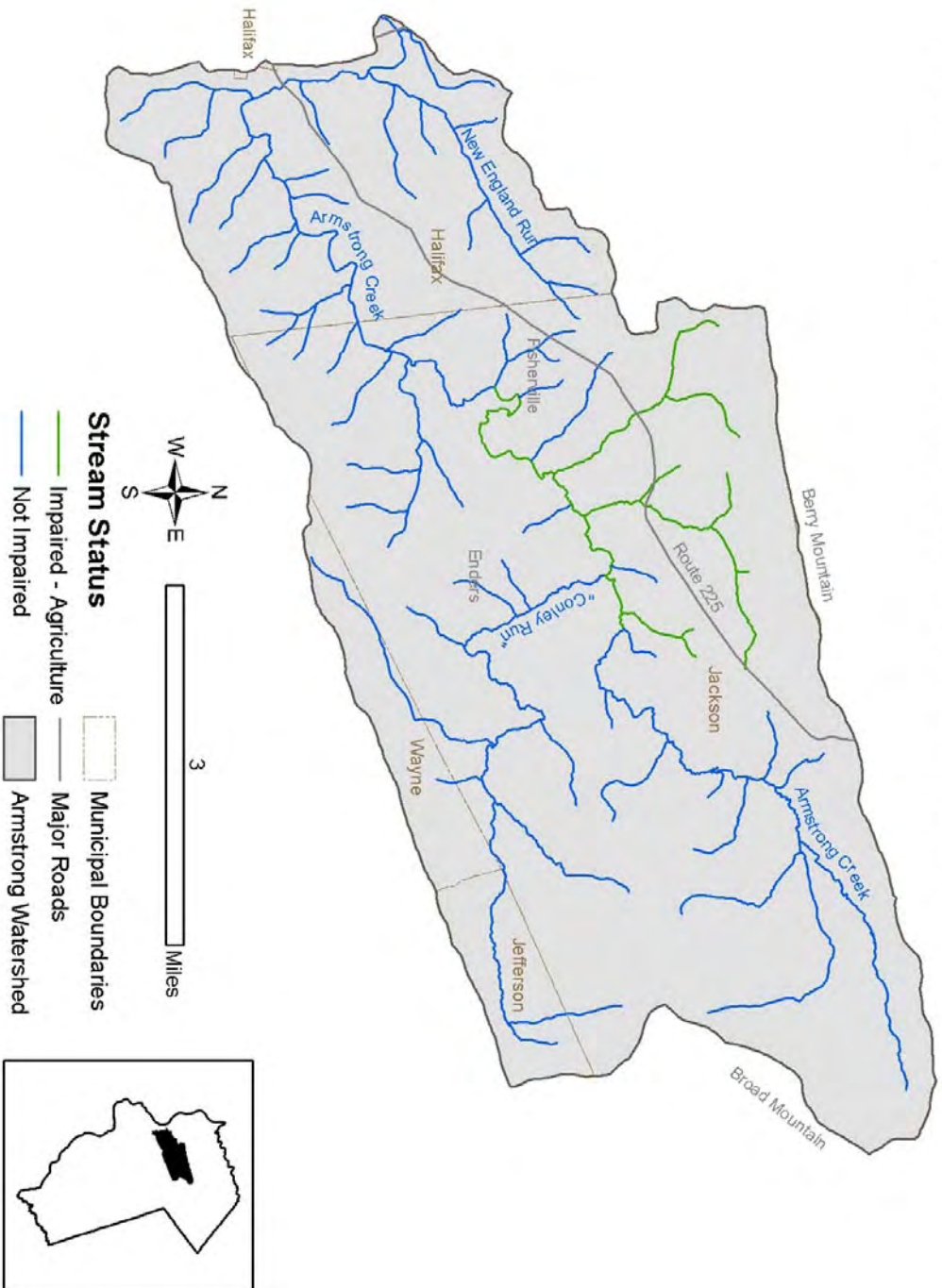


Figure 6.

# **POWELL CREEK WATERSHED**

## **GENERAL GEOGRAPHY, SIZE AND LOCATION**

The Powell Creek watershed drains approximately 39.6 square miles of land in Dauphin County. Municipalities included in this watershed include portions of or all of Jefferson, Wayne, Halifax and Reed Townships (*Figure 7*). Similar to other watersheds in the northern region of the county, the Powell Creek basin is nearly 20 miles long, and narrow, typically about two miles wide, with a broad valley floor. Steeper slopes are found on the mountains and ridges along the watershed's northern, eastern and southern boundaries. At its western end, the valley broadens slightly with the northern boundary dropping from a mountain ridge to high ground in the local topography. The creek headwaters originate as two streams, the North Fork and South Fork, on the forested slopes between Broad Mountain in the north and Peters Mountain in the south. North and South forks flow southwest and join approximately two miles west of Carsonville. Powell Creek continues west, flowing into the Susquehanna River about four miles southwest of Halifax Borough. The main stem of the creek collects several small, unnamed tributaries from the north and south.

## **GENERAL LAND USE**

The upper one-third of Powell Creek watershed is almost entirely forested with the lower two-thirds being comprised of significant amounts of agricultural land. Residential development is currently limited and exists primarily in the form of frontage lots. Slightly more dense residential use is found in the western end of the basin along Route 225, which cuts north through the basin around the village of Matamoras. Commercial and industrial uses are not significant in the watershed. The main transportation route is Powells Valley Road, which runs the length of the basin. A well-established network of side roads exists primarily to the south of Powells Valley Road.

This watershed has potential for development in the near future, with reconstruction of Route 322 in the area between Dauphin and the Clarks Ferry Bridge being complete. By alleviating the traffic congestion in this area, Route 322 will allow for easier access from Harrisburg to areas north of Peters Mountain. New development is likely to spring up in the western end of the watershed, and consist of residential development, followed by supporting commercial uses. The future land use scenario in this basin is based on existing land use patterns. Municipalities in this basin do not have zoning regulations; therefore, development may occur in random manner.

## **WATER RESOURCES/QUALITY**

The eastern headwaters of this watershed begin on predominantly forested mountain slopes, and are classified as CWF by PA DEP. The area is underlain by sandstone, which offers little buffering capacity to streams originating here. As a result, acid-neutralizing capacity is low and there is potential for the headwaters to be impacted by acid rain. The portion of the watershed downstream from the confluence of the north and south forks is classified as trout stocked fisheries.

Powell Creek watershed is of general concern as a contributor of nutrients and sediment to the Chesapeake Bay, as it has only 3.03 miles (3.7% of watershed) designated as impaired stream. Stream impairment is attributed to siltation from agriculture.

# Powell Creek Watershed, Dauphin County

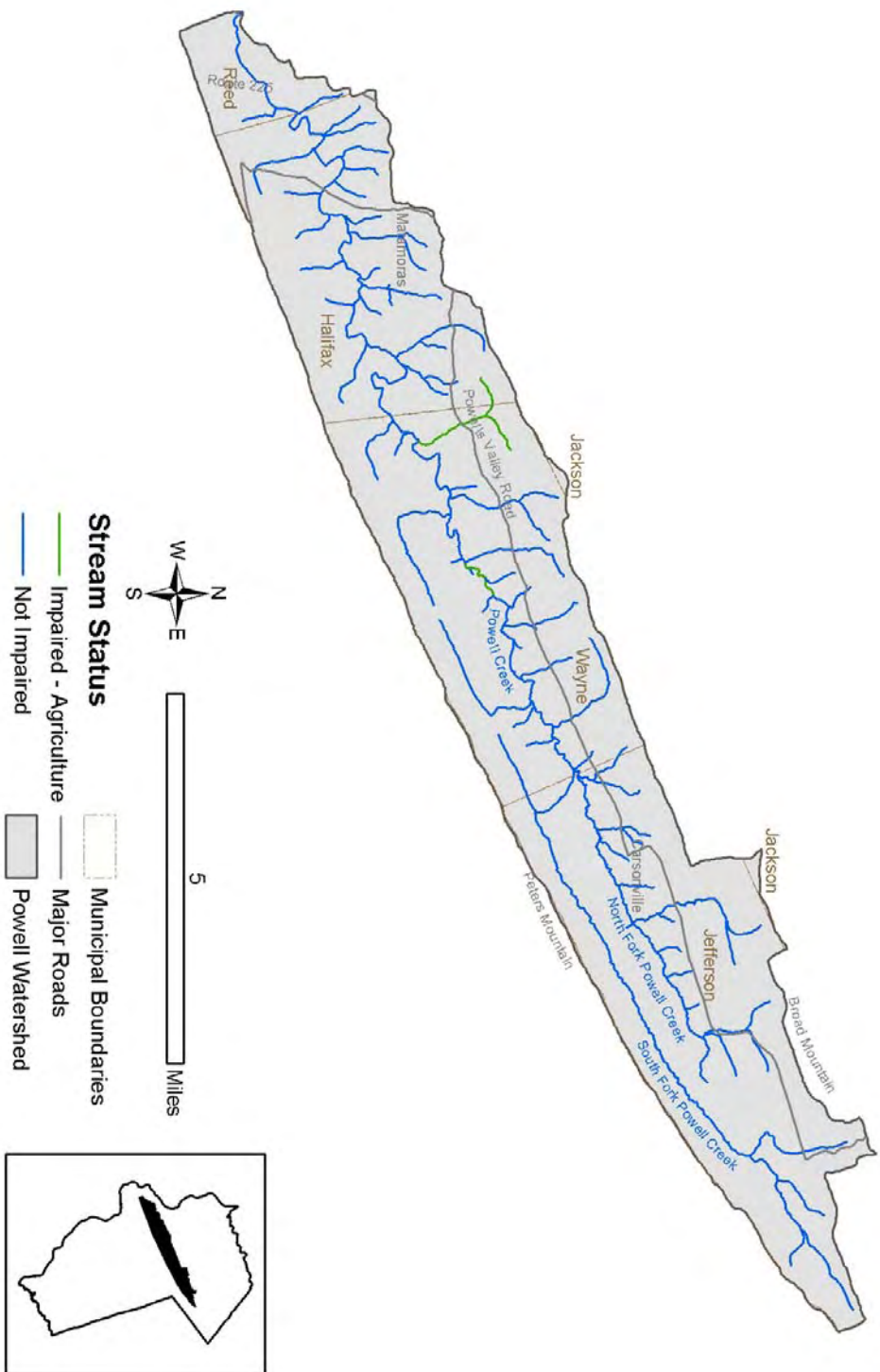


Figure 7.

# **CLARK CREEK WATERSHED**

## **GENERAL GEOGRAPHY, SIZE AND LOCATION**

The Clark Creek watershed covers 45.1 square miles located entirely within Dauphin County, in portions of Rush and Middle Paxton Townships (*Figure 8*). Basin topography is simple, consisting of a narrow, steep sided valley, approximately 25.0 miles long, with flat to gently sloping topography on the valley floor. Clark Creek begins in the easternmost portion of Dauphin County, south of Tower City. The stream flows west to the Susquehanna River northeast of Dauphin Borough. There are no significant tributaries only small streams draining the mountainsides; Third and Stony Mountain to the south and Peters Mountain to the north.

## **GENERAL LAND USE**

The majority of Clark Creek watershed is forested, including significant land areas designated as State Game Lands and land surrounding the DeHart Reservoir, which is owned by the City of Harrisburg and provides part of its water supply. Nearly half of the watershed is tributary to the reservoir. Route 325, the watershed's only major transportation route, follows Clark Creek the length of the basin. Current development activity consists primarily of limited residential units with frontage along Route 325. Large developments are limited to a single site, which recently began construction. Commercial and industrial uses do not exist; agriculture is on a minor scale.

Future development will most likely be restricted to frontage lots and possibly a few larger low-density residential developments due to the limited amount of available land and topography.

## **WATER RESOURCES/QUALITY**

The entire Clark Creek watershed is listed in DEP's Special Protection Program as a High Quality CWF. No sections are listed as impaired. With a significant amount of the watershed protected as a water supply area for DeHart Reservoir and much of the watershed consisting of steep mountainsides, future development is likely to be very limited.

Compared to other Dauphin County streams, the Clark Creek watershed contributes little sediment or nutrients to the Chesapeake Bay.

# Clark Creek Watershed, Dauphin County

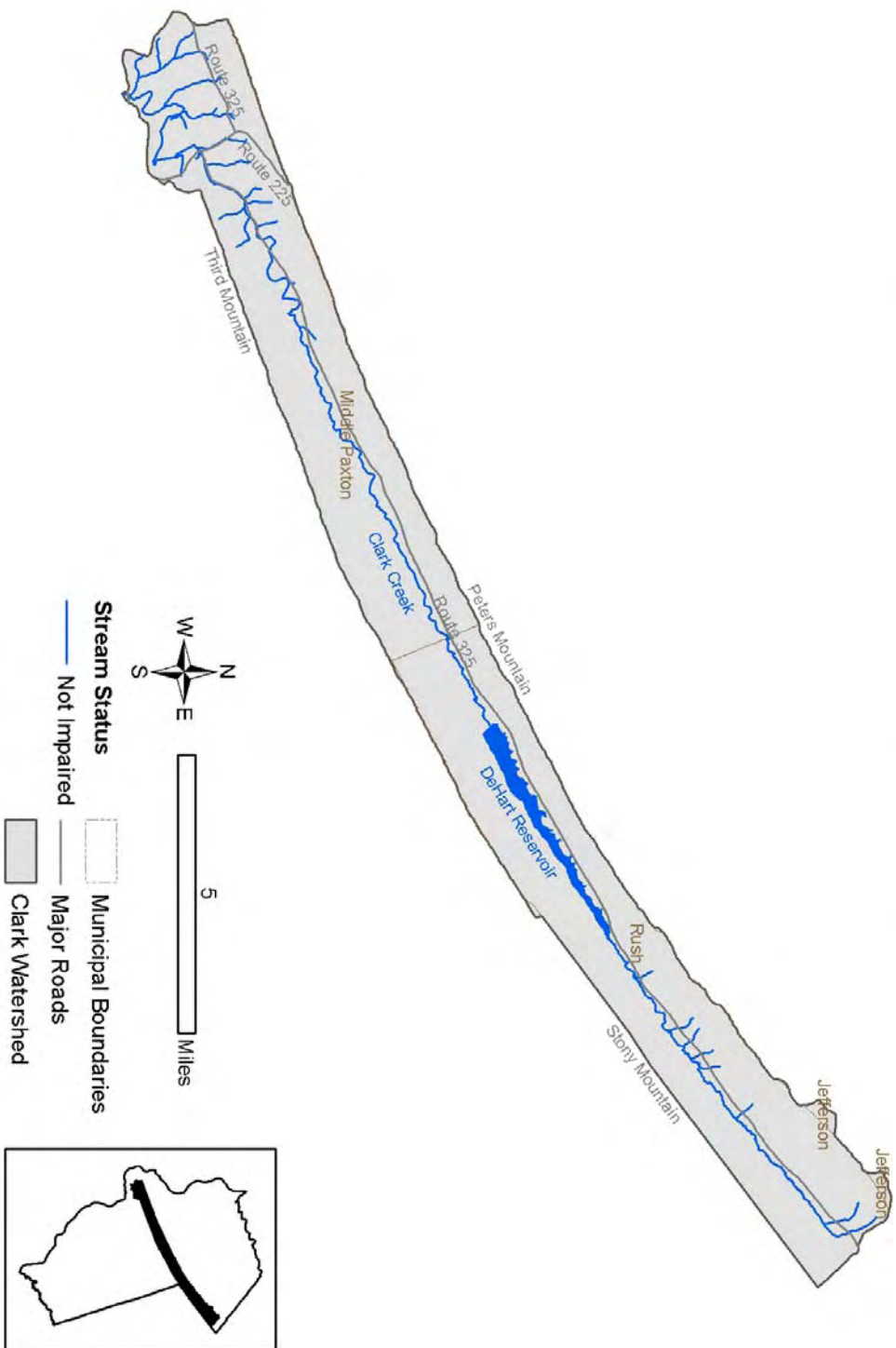


Figure 8.

## STONY CREEK WATERSHED

### GENERAL GEOGRAPHY, SIZE AND LOCATION

The Stony Creek watershed basin covers 35.5 square miles in Dauphin and Lebanon counties. Municipalities with portions completely or partially located in this watershed include the Borough of Dauphin, and Middle Paxton and East Hanover Townships (Figure 9). The creek's headwaters originate in northern Lebanon County and flow west to the Susquehanna River at Dauphin Borough. The 1.5 mile-wide watershed is a steep-sided valley, with a gently sloping valley floor, that stretches approximately 21.0 miles across Dauphin County between Second Mountain, its southern border, and Third Mountain, its northern border. North of Third Mountain are the ridges of Sharp and Stony mountains. Two significant tributaries, Rausch Creek and Rattling Run drain small upland valleys that run parallel to the Stony Creek valley and flow through gaps in Sharp Mountain to join the main stem of Stony Creek. Rattling Run drains a unique geologic area known as Devil's Race Course. This basin is similar to Clark Creek both physically and in terms of land use.

### GENERAL LAND USE

Most of the basin, over 80%, is State Game Lands and is entirely forested. Only a small amount of the basin at the west end is unforested. The Borough of Dauphin is located at the confluence of Stony Creek and the Susquehanna River. The largest road providing access to the basin is Middle Paxton Township's road, Stony Creek Road. This road follows Stony Creek from Dauphin east a distance of approximately five miles then joins an old railroad bed, which runs the length of the basin. The railroad bed is gated by the Game Commission approximately two miles from Stony Creek Road, and is used for recreational access only from the gate east. Between Stony Creek Road and the Game Commission gate, a mix of cabins and residences exist along the railroad bed. Nearly all development is residential in the form of frontage units along Stony Creek Road and various side streets and roads. Except in the Borough of Dauphin, commercial and industrial uses do not exist. Agriculture is very limited in the basin.

Future development in the basin will be limited to the westernmost area, as the Game Commission owns the eastern end. Residential development will be the prominent type of development, but may be limited due to topography, infrastructure and limited land availability.

### WATER RESOURCES/QUALITY

The entire Stony Creek is classified as a CWF by PA DEP. Above Ellendale, near the end of Stony Creek Road, the creek is classified as high quality in the state's Special Protection Program, and is the only section in Dauphin County to be included in the state's Scenic River Program. The Stony Creek watershed's only two significant tributaries are impaired due to acidic conditions resulting from abandoned mine drainage. The local chapter of Trout Unlimited actively maintains a limestone diversion well, which counteracts the acidity and most likely improves the headwater reaches of Stony Creek. This watershed does not yield enough nutrients or sediment to the Chesapeake Bay be of much concern .

# Stony Creek Watershed, Dauphin County

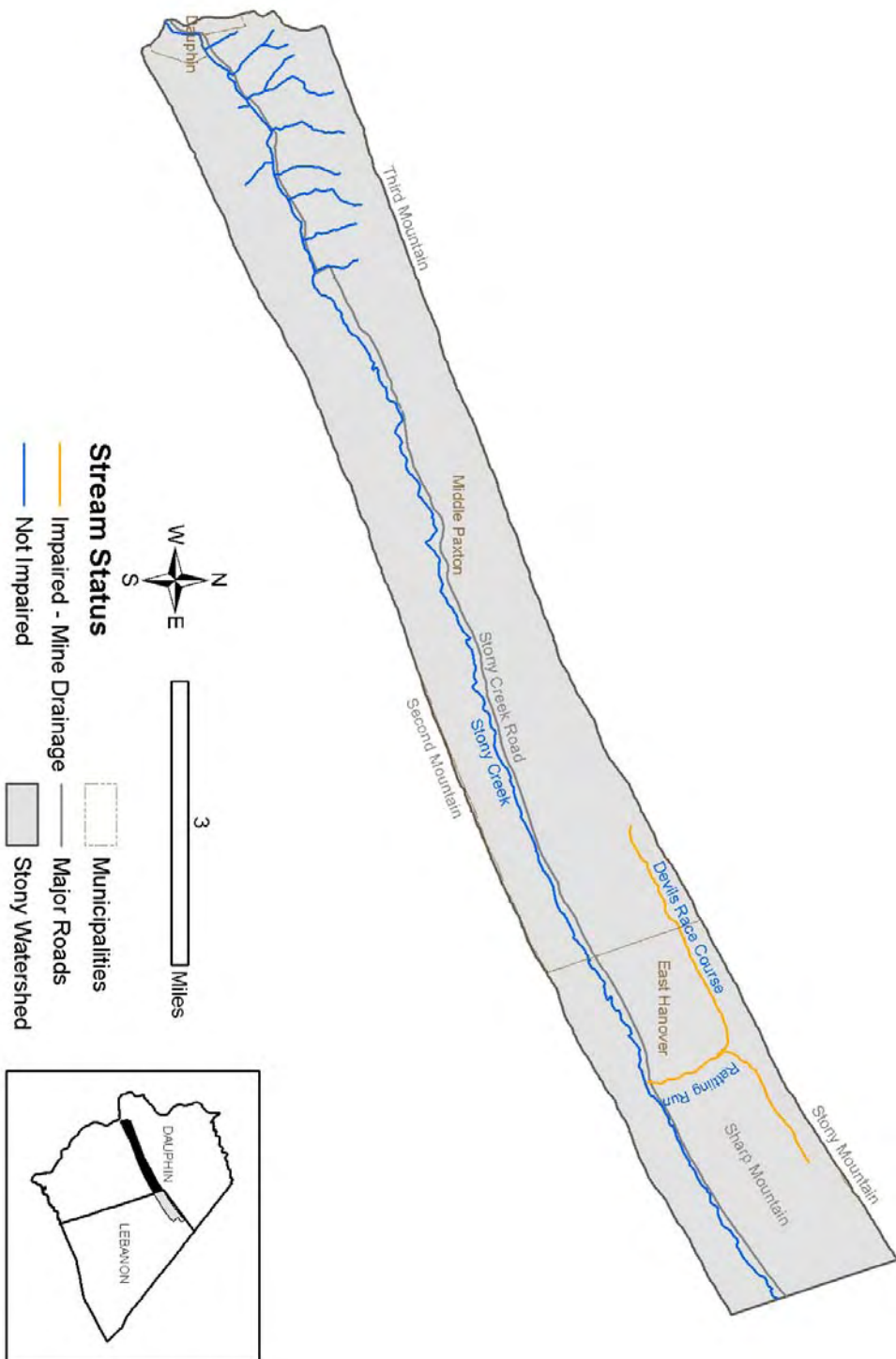


Figure 9.

## FISHING CREEK WATERSHED

### GENERAL GEOGRAPHY, SIZE AND LOCATION

Fishing Creek watershed drains 18.2 square miles, and is contained within the borders of Dauphin County. Its boundaries include all or portions of three townships: West Hanover, Middle Paxton and Susquehanna (Figure 10). The basin is a narrow, steep sided valley with flat to gentle slopes dominating the narrow valley floor. Headwaters begin in northern West Hanover Township and flow west through the valley between Blue and Second mountains until the creek reaches its mouth at the junction with the Susquehanna River at Fort Hunter. Many small tributaries join Fishing Creek from the surrounding mountainsides.

### GENERAL LAND USE

The vast majority of the basin remains forested. Pennsylvania Route 443 is the only major roadway in the basin and roughly parallels Fishing Creek the entire length of the basin. Existing development is predominantly frontage residential development along Route 443 and side streets. Large residential developments within the basin are few and are predominantly very low density. Most new development is in the form of low-density residential units. Commercial and industrial land uses are all but non-existent; largest commercial land use is for two golf courses. A limited amount of agriculture currently exists.

Given the basin's proximity to Harrisburg, pleasant aesthetic qualities and somewhat limited amount of development area, the development trend favors low-density residential units. Intense development will probably not occur in the foreseeable future.

### WATER RESOURCES/QUALITY

Fishing Creek and all tributaries are classified as WWFs by PA DEP. Although the narrow Fishing Creek valley contains more low-density residential development than Clark and Stony creek watersheds, none of the streams in the watershed are included on PA DEP's impaired list and monitoring efforts have indicated no problems. This watershed is not a significant source of sediment or nutrients to the Chesapeake Bay.

# Fishing Creek Watershed, Dauphin County

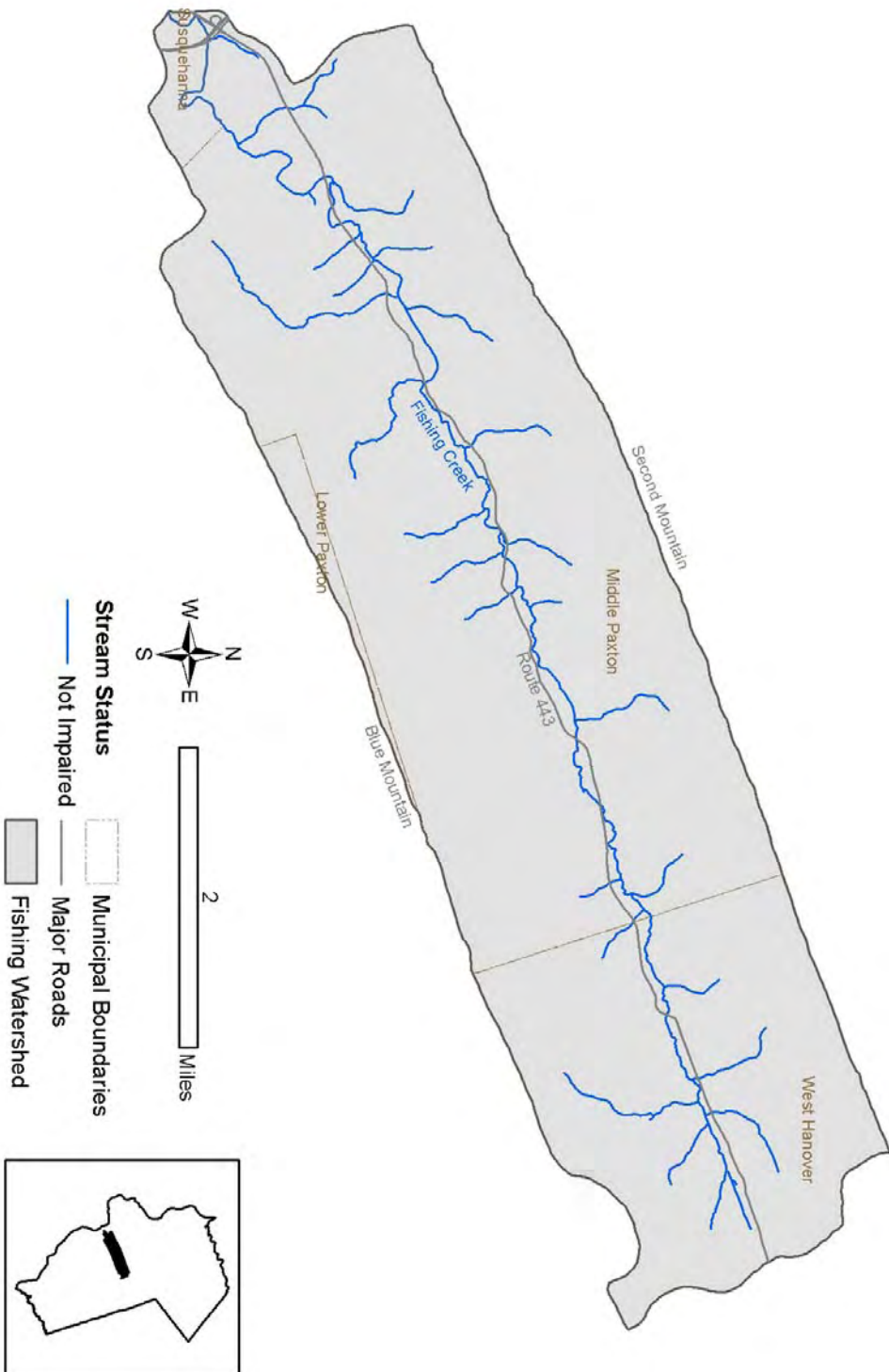


Figure 10.

## PAXTON CREEK WATERSHED

### GENERAL GEOGRAPHY, SIZE AND LOCATION

The 27.4 square-mile Paxton Creek watershed is located entirely within Dauphin County and includes the following four municipalities: City of Harrisburg, the Borough of Penbrook, Susquehanna Township and Lower Paxton Township (Figure 11). Watershed topography is generally flat to gently sloping overall, with steeper slopes near Blue Mountain, whose south slope marks the watershed's northern border. This 18 square-mile area drains into Wildwood Lake just north of Interstate 81. Many of Paxton Creek's tributary streams originate at the foot of Blue Mountain.

### GENERAL LAND USE

This watershed is marked by heavy development of all varieties. Forested land is limited to the south slope of Blue Mountain and several scattered patches. Land use in Harrisburg and Penbrook can be characterized as urban. High-density residential development, industrial and commercial uses are dominant. Upstream of Wildwood Lake can be characterized as developed suburban land. Low- to medium-density residential development dominates current land use; however, commercial development (primarily retail, professional and mixed uses) is also significant primarily along Route 39 (Linglestown Road) and Route 22 (Jonestown Road). Continuing development is primarily residential. A very small percentage of this area consists of open fields and farmland.

### WATER RESOURCES/QUALITY

All of the stream miles in Paxton Creek watershed are listed as WWFs. PA DEP lists more than 16 miles of impaired stream in the watershed on its 2004 303(d) list. The main reasons given for the listing are urban runoff, construction and storm sewers and combined sewer overflows that occur in the City of Harrisburg.

Paxton Creek has many of the typical impacts seen in urban streams. Stream bank erosion with subsequent sedimentation due to excessive flows from stormwater runoff appears to be the major source of nonpoint source pollution in Paxton Creek. Although the Center for Watershed Protection (2003), the Paxton Creek Watershed and Education Association (PCWEA), and other agencies have been involved with characterizing the impacts on Paxton Creek, there is a fairly limited amount of assessment data available, particularly with respect to discharge rates and sediment loads.

According to PA DEP, Paxton Creek is slated for TMDL development in 2005. PCWEA is currently working on the Draft Paxton Creek Watershed Conservation Plan, which will be available for review and comment by PA DCNR and project partners sometime in 2005. According to PCWEA, this plan will detail specific projects and/or BMPs to be incorporated in the watershed.

*Continued on page 32.*

# Paxton Creek Watershed, Dauphin County

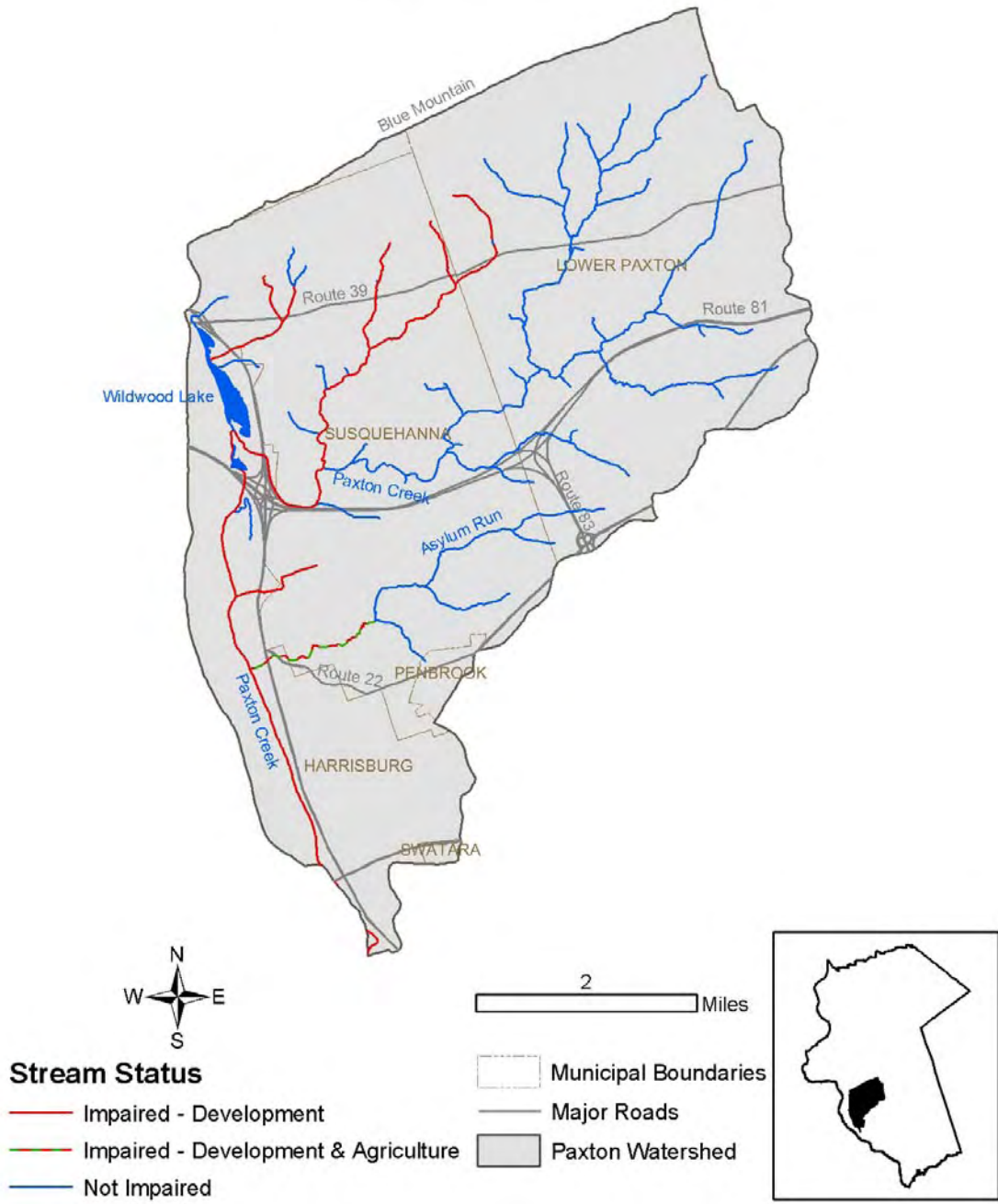


Figure 11.

## **PAXTON CREEK WATERSHED**

### **WATER RESOURCES/QUALITY (cont.)**

Development and associated stormwater runoff continues to increase in this already urbanized watershed and is likely to cause increased bank destabilization and excessive sedimentation.

A significant amount of land that is suited for development has already been developed. What remains for development are sites that pose risk for impacting our water, such as sloped sites, stream valleys, etc. Only with extra planning and study can these marginal sites be developed without significant impact to our water quality and stormwater quality.

This watershed is at risk for additional degradation. Addressing development, stormwater runoff, and the associated nutrient and sediment inputs will greatly decrease nutrients (particularly phosphorus) and sediment to the Chesapeake Bay.

## **SPRING CREEK WEST WATERSHED**

### **GENERAL GEOGRAPHY, SIZE AND LOCATION**

The Spring Creek West watershed, located in southwestern Dauphin County, drains an area of approximately 11.5 square miles. Six municipalities lie partially within the basin: the City of Harrisburg, the boroughs of Paxtang, Penbrook; and Lower Paxton, Susquehanna and Swatara Townships (*Figure 12*). The headwaters are located in Lower Paxton Township and to a lesser extent, Susquehanna and Swatara Townships.

### **GENERAL LAND USE**

The watershed has a widely varied mix of urban and suburban land uses. Land use here is older, medium-density, suburban residential development. Recent development has taken the form of less-dense residential, apartment complexes and large commercial areas. Historically, development, predominantly residential development, has expanded out from the more urban Harrisburg area following Route 22 and the Interstate 83-Derry Street corridors. However, significant industrial and commercial use also exists along the Interstate 83-Derry Street corridor, including the vast Rutherford Rail Yard. Recent decades have seen development begin to fill in the undeveloped areas between the two development prongs described above. A significant growth in commercial land use has developed around the Interstate 83 and Union Deposit Road interchange. Two schools, several apartment complexes, commercial areas and a hospital are located in proximity to Union Deposit Road. Single-family residential development continues to expand in this developing area, primarily to the south of Union Deposit Road towards the Route 83-Derry Street prong. Downstream, toward the junction of Spring Creek with the Susquehanna River, the watershed is much more urbanized, passing through the older development in south Harrisburg. A significant amount of commercial and industrial development is located along Paxton Street in Harrisburg.

### **WATER RESOURCES/QUALITY**

Spring Creek West's designation was recently changed by PA DEP from a WWF to a CWF. Spring Creek West, another urban watershed in the Harrisburg area, experiences chronic flooding similar to Paxton Creek. The frequency and magnitude of these high-water events causes excessive bank erosion and sedimentation, which results in poor habitat. Additionally, nutrients from combined sewer overflows enter the creek and cause nutrient enrichment and excessive algae growth in some areas (Skelly and Loy, 2002). More than 11 miles of stream within the Spring Creek West watershed are listed as impaired on PA DEP's 2004 303(d) list.

Given the largely built-out nature of this watershed, new impervious cover is less of a future problem than current stormwater runoff. Streams are not static systems and stream bank erosion from existing impervious cover runoff in the Spring Creek West watershed will likely worsen with time. Although they do not drain into Spring Creek West, several unnamed tributaries of the Susquehanna River in the vicinity of Spring Creek West are being included in this watershed due to similar impacts.

*Continued on page 35.*

# Spring Creek (west) Watershed, Dauphin County

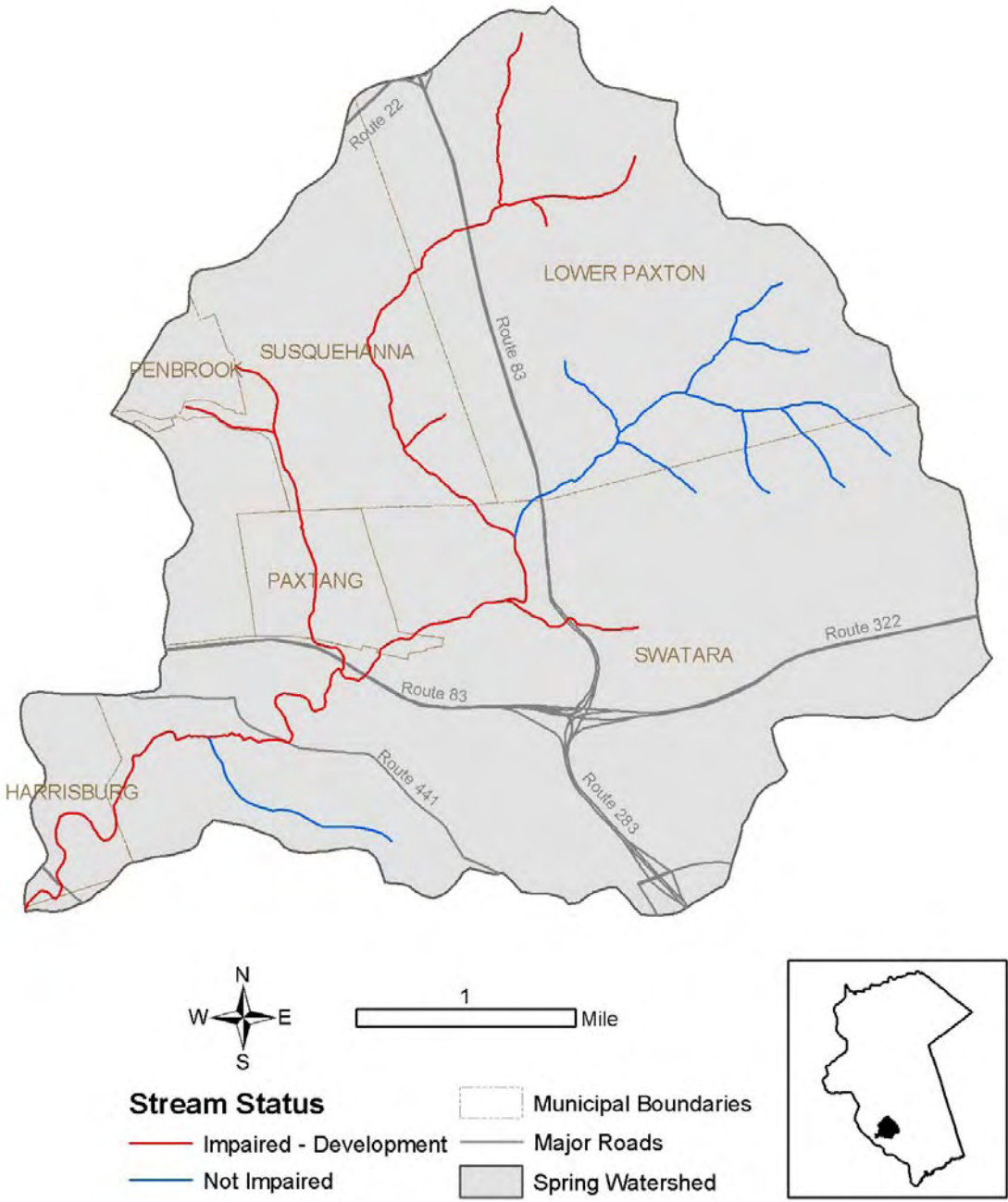


Figure 12.

## **SPRING CREEK WEST WATERSHED**

### **WATER RESOURCES/QUALITY (cont.)**

Addressing stormwater runoff in this watershed will help to reduce significant current and future stream bank erosion and sedimentation to the Chesapeake Bay. Presently, additional water quality, discharge, and macroinvertebrate data need to be collected to more fully understand watershed conditions.

# SWATARA CREEK WATERSHED

## GENERAL GEOGRAPHY, SIZE AND LOCATION

The Swatara Creek watershed drains an area of 571.0 square miles of Lebanon and Dauphin counties, of which 127.6 square miles (22%) lie in Dauphin County and include all or portions of 11 municipalities: the boroughs of Hummelstown, Middletown and Royalton, and Derry, Conewago, Londonderry, Swatara, Lower Swatara, and South, East and West Hanover Townships (*Figure 13*). Swatara Creek enters Dauphin County in East Hanover Township 2.75 miles south of US Route 22. The creek winds west for roughly 3.6 miles through flat, rolling agricultural land to the confluence with Bow Creek.

The diverse characteristics existing in the Swatara Creek watershed, and impacting its water quality, can be best characterized by splitting the watershed geographically into the sub-watersheds formed by the many major tributaries flowing into its main stem. These five sub-watersheds are listed below in their order geographically from east to west: Bow Creek, Manada Creek, Spring Creek East, Kellock Run and Beaver Creek, which includes a description of its major sub-watershed, Nyes Run.

### *Bow Creek Basin*

The Bow Creek sub-watershed lies entirely in East Hanover Township, covering 9.41 square miles of land area. Its headwaters begin near the southern slope of Blue Mountain in the north. The creek runs south across the broad valley floor, outside the rural villages of Grantville and Shellsville, before reaching the confluence with Swatara Creek. Bow Creek picks up many small, unnamed tributaries throughout the basin.

### *Manada Creek Basin*

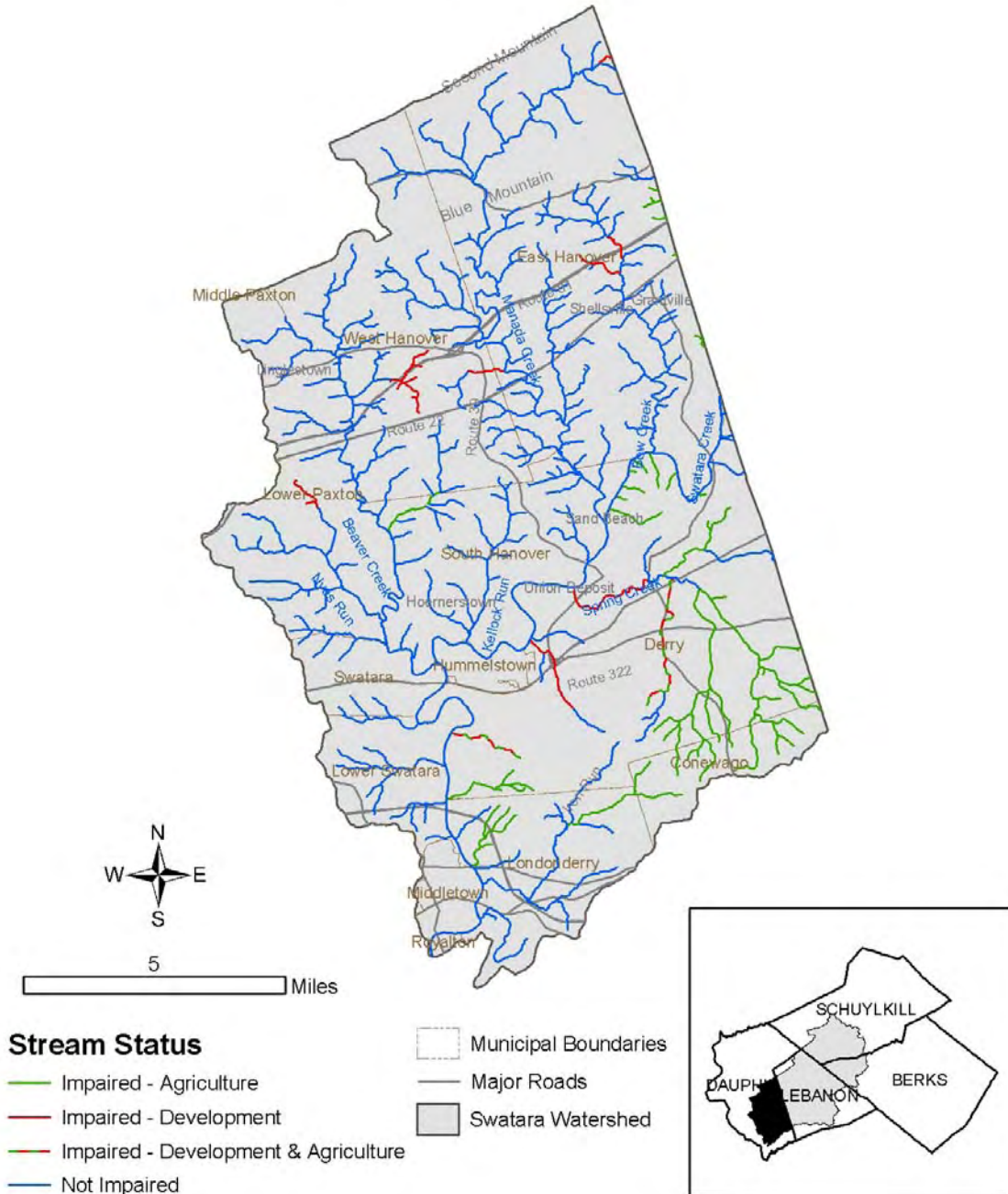
Manada Creek joins the Swatara Creek 1.75 miles west of Bow Creek at the village of Sand Beach. This sub-watershed covers 32.09 square miles of county land. Manada Creek's headwaters lie in western Lebanon County. The north section of the watershed in Dauphin County lies northeast of Fishing Creek in East Hanover Township, and runs along the valley created by Second Mountain to the north and Blue Mountain in the south. Manada then crosses into a broad valley south of Blue Mountain at Manada Gap, and flows south through the flat, rolling topography of southern East Hanover Township to meet the Swatara in Sand Beach, at the north tip of South Hanover Township. The Manada Creek watershed's western boundary is eastern West Hanover Township. Manada Creek has an extensive network of small to medium-sized unnamed tributaries.

### *Spring Creek East Basin*

Approximately three miles downstream from Sand Beach and the mouth of the Manada Creek, the Spring Creek East tributary joins the main stem of the Swatara at the village of Union Deposit. Spring Creek's origins are outside the village of Campbelltown, in Lebanon County.

*Continued on page 38.*

# Swatara Creek Watershed, Dauphin County



**Figure 13.**

## **SWATARA CREEK WATERSHED**

### **GENERAL GEOGRAPHY, SIZE AND LOCATION (cont.)**

#### *Spring Creek East Basin (cont)*

Seventy-three percent of the sub-watershed (17.6 square miles) lies within Dauphin County's borders. The main stem of Spring Creek enters Dauphin County in Derry Township and flows west through rolling flat land through the semi-urban towns of Palmdale and Hershey. Spring Creek picks up several large, unnamed tributaries that drain highlands located in the southern part of Derry Township, which also mark the basin's southern border.

#### *Kellock Run Basin*

In the seven-mile stretch from the village of Union Deposit to Hummelstown downstream, two more tributaries join the Swatara Creek, Kellock Run and Beaver Creek. Kellock Run is the smallest of the basins in the Swatara Creek watershed, only 4.43 square miles, and is located almost entirely in South Hanover Township. Less than 0.5 square miles are located in West Hanover Township. The watershed drains the rolling flat land of the eastern half of South Hanover Township. It flows south by the small village of Hoernerstown to the east and joins the Swatara Creek north of the Borough of Hummelstown. The Kellock watershed picks up several small, unnamed tributaries.

#### *Beaver Creek Basin*

Beaver Creek joins the Swatara west of the Borough of Hummelstown, just north of Route 322. The main channel of Beaver Creek divides its 27.21 square-mile drainage basin nearly equally in half. The eastern tributaries drain the western side of West Hanover Township south of Blue Mountain and the western edge and northwest corner of South Hanover Township. The western tributaries, including Nyes Run, drain eastern Lower Paxton Township in the areas of Linglestown and Paxtonia, and a small portion in northeastern Swatara Township including the town of Rutherford.

After the confluence with Beaver Creek, the Swatara Creek makes a wide meander before heading south to the Borough of Middletown and the creek's mouth at the Susquehanna River. The creek cuts the border between Derry and Londonderry Townships and Royalton Borough on the east; and Lower Swatara Township and Middletown Borough on the west. Land is generally flat or light sloping.

### **GENERAL LAND USE**

#### *Bow Creek Basin*

East Hanover Township's Comprehensive Plan designates the majority of land in the Bow Creek basin for continued agricultural use. Most of the Bow Creek stream network is also designated as conservation area. Medium-density residential development is designated to occur primarily south of Route 22. Some medium-density expansion of the Shellsville and Grantville area is recommended in the plan. Commercial growth will be limited to the areas currently in use, primarily along Route 22 and Interstate 81.

## **SWATARA CREEK WATERSHED**

### **GENERAL LAND USE (cont.)**

#### *Manada Creek Basin*

The Manada Creek basin is largely undeveloped, and consists primarily of forest, open fields and low-intensity agriculture. The north side of the watershed from the Second Mountain to the southern base of Blue Mountain is mostly forested, with several small low-density residential areas and some agriculture. The majority of land in this area is part of the Fort Indiantown Gap Military Reservation. Although most of the reservation is forested, significant areas are best characterized as open fields, shrubs, clear-cuts or bare earth.

South of Blue Mountain, to the mouth of Manada Creek, the vast majority of land area is agricultural or open fields. Various other land use types are interspersed throughout the basin. Forested areas exist in small plots and more commonly, along stream corridors. Small, isolated low and medium density residential areas including the village of Shellsville to the east exist throughout this area. Significant areas of low- and medium-density residential development are found in the vicinity of Route 22 near the middle of the watershed. The largest concentration of residential use is found along Route 22 in the medium-density Skyline View area and a lower density area just east of Skyline View. Commercial development is limited to the Route 22 corridor and a small pocket at the junction of Route 39 and Interstate 81.

#### *Spring Creek East Basin*

From the village of Sand Beach downstream to the village of Union Deposit, where Spring Creek East joins the Swatara Creek, land use changes to a more suburban/urban area in Derry Township receiving runoff from HersheyPark and the suburban areas of Hershey and Hummelstown. Land use within the watershed is primarily low-density residential and commercial development along transportation routes into Hershey. Several golf courses lie in the watershed. There is a significant amount of agricultural land, much of which is held by Hershey Trust. Forested lands and stream buffering are insignificant. Development will likely progress at a moderate pace, particularly residential development and will likely be low- to medium-density. Sale or retention of land by Hershey Trust will impact development. HersheyPark has been expanding in recent years, including construction of a new arena.

#### *Kellock Run Basin*

The Kellock Run basin consists of open fields and low-intensity agriculture. The small amount of existing forest is almost exclusively located along stream corridors, primarily the main channel of Kellock Run. Current residential development is split nearly in half between low- and medium-density types. Commercial development is nearly nonexistent.

## **SWATARA CREEK WATERSHED**

### **GENERAL LAND USE (cont.)**

#### *Beaver Creek Basin*

A significant majority of land in the Beaver Creek watershed is open space, low-intensity agriculture or forest. The southern slope of Blue Mountain is heavily forested, with some low-density residential development. Small- to medium-size forest areas dot the rest of the basin, especially along stream corridors.

Development in the eastern side of the basin is less intense, taking the form of low-density residential development in West Hanover Township. Commercial development is confined mostly to the Route 22 corridor and one pocket centered at the junction of Route 39 and Interstate 81. The largest area of residential development in West Hanover Township, the Skyline View area, straddles the boundary between the Beaver Creek and the Manada Creek basins.

The western half of the Beaver Creek watershed drains Swatara and Lower Paxton Townships, the county's most heavily developed municipalities. This development has been moving eastward for many years and is now having significant impacts on land use in the Beaver Creek basin. In Swatara Township, the residential area of Rutherford has existed for many years. South and east of Rutherford, recent years have seen significant commercial and light industrial development along the Route 322 corridor. The Rutherford Rail Yard, one of the basin's two major commercial areas, is also located in this region. In Lower Paxton Township, significant residential and commercial development has existed along the western edge of the basin for decades. Nyes Run, a major tributary to Beaver Creek, lies entirely in Lower Paxton Township. Significant residential development spans the entire length of the Nyes Run. The basin's initially developed areas include: the village of Linglestown, medium-density suburban residential areas east of Paxtonia and Colonial Park and commercial development in the Colonial Park area. In recent years, commercial development has moved east along the Interstate 81-Route 22 corridor. Medium- and high-density residential development has begun to fill in areas around older development and continues to steadily push east.

The main stem of Swatara Creek continues its flow south 5.75 miles through flat, forested, agricultural and suburban areas to the Pennsylvania Turnpike. From this point, Swatara Creek flows through the urban area of Middletown Borough 2.5 miles to the Susquehanna River. Between Middletown and the Susquehanna River another tributary, Iron Run, enters the creek.

### **WATER RESOURCES/QUALITY**

Most of the Swatara Creek drainage in Dauphin County is listed as a WWF. A portion of Manada Creek, a tributary of Swatara Creek, is listed as a CWF. The Swatara Creek basin drains a large area of several counties and, as a result, sees impacts from many sources of pollution such as mining, agriculture, wastewater treatment plants, and stormwater runoff. PA DEP lists more than 54 miles of impaired stream in the Dauphin County portion of the Swatara Creek watershed on its 2004 303(d) list.

# SWATARA CREEK WATERSHED

## WATER RESOURCES/QUALITY (cont.)

### *Bow Creek Basin*

Within Dauphin County, most nutrient impacts stem from poor agricultural practices and wastewater treatment plants. Point sources, such as wastewater treatment plants, are not addressed further in this document since their compliance with discharge requirements are under the authority of the Pennsylvania NPDES program. Sedimentation impacts come from poor agricultural practices, bank erosion, or poor erosion and sedimentation control practices from new development. While moderately elevated nutrient levels and sediment are the main concerns in the Dauphin County portion of the watershed, those concerns can vary by degree depending on the individual watershed.

The Bow Creek sub-watershed experiences moderate sedimentation, due in part to eroding stream banks and elevated nutrients that likely resulted from agricultural practices and point-source discharges.

### *Manada Creek Basin*

The Manada Creek sub-watershed experiences a relatively small amount of sedimentation due to earth disturbances, stream bank erosion and poor agricultural practices. Nutrient levels are likewise relatively low. Increasing development pressure in this watershed and associated runoff may contribute to increased sedimentation in the future.

### *Spring Creek East Basin*

Spring Creek and its tributaries suffer substantially from a combination of agriculture and urban development issues, mostly due to siltation. In this watershed, 93% of the stream miles in Dauphin County are listed as impaired. Agriculture dominates in the upper and middle reaches of Spring Creek and its tributaries, while storm sewers from the town of Hershey and surrounding development impact the lower reaches. DCCD monitoring has documented a very poor macroinvertebrate community near Spring Creek's mouth, including consistently high nutrient (nitrate and orthophosphate) concentrations. These conditions are influenced by the underlying limestone geology in this watershed, which allows a greater portion of nutrients on the landscape to reach streams. This is in contrast to most of the rest of Dauphin County, which is underlain by non-limestone geology. While this watershed yields large amounts of nutrients, its yields of sediment remain unclear. Stream monitoring efforts by DCCD near the mouth do not show obvious sedimentation issues, which stands in contrast to the extensive impairment due to sediment throughout the watershed. This requires issue requires further investigation to resolve.

### *Kellock Run Basin*

The Kellock Run sub-watershed is predominantly residential, where nutrients and sediment are not excessive at present. Increasing development pressure may result in increased sediment and nutrients to the Chesapeake Bay in the future.

## **SWATARA CREEK WATERSHED**

### **WATER RESOURCES/QUALITY (cont.)**

#### *Beaver Creek Basin*

The Beaver Creek sub-watershed is experiencing increasing development pressure and an increase in associated infrastructure improvements. These activities are leading to an increase in sediment loads due to runoff and construction-related stream channel disturbance. Nutrients are currently at low to moderate levels in Beaver Creek.

*Nyes Run Tributary* - The Nyes Run sub-watershed is largely developed and sustains increasing amounts of stormwater runoff, resulting in destabilized stream banks. Nutrient levels, due to currently inadequate wastewater infrastructure, are excessive during high-water events.

Decreasing agricultural activities and increased development may be just two of the future trends that are likely this watershed. Reducing nutrients and sediment from the varied sources within the Swatara Creek Watershed will contribute to the reduction of nutrient and sediment loads in the Chesapeake Bay. Additional information about watershed conditions may be found in the Swatara Creek Rivers Conservation Plan (Mackin Engineering, 2000).

# **CONEWAGO CREEK WATERSHED**

## **GENERAL GEOGRAPHY, SIZE AND LOCATION**

Conewago Creek forms the southern boundary of Dauphin County with Lancaster County. The Conewago Creek watershed drains a total of 52.2 square miles of these counties; 23.2 square miles (44%) lie in Dauphin County, and includes portions of or all of Conewago Township and Londonderry Township (*Figure 14*). The creek flows southwest along the western borders of Conewago and Londonderry Townships. The land slopes gently towards the creek's mouth at the Susquehanna River just east of Three Mile Island.

## **GENERAL LAND USE**

Conewago Creek flows approximately 13 miles through primarily agricultural lands with scattered residential dwellings. Land use is primarily agricultural, with some small, forested areas with insignificant buffering along most of the stream.

Development will likely progress at a slow to moderate pace and will likely be low- to medium-density residential development.

## **WATER RESOURCES/QUALITY**

All of the stream miles of the Conewago Creek are currently listed by PA DEP as TSFs. The Conewago Creek watershed is highly impacted by nutrients and sediment stemming from poor agricultural practices; more than 39 miles of the creek in Dauphin County are listed on PA DEP's 2004 303(d) list. Stream bank erosion and sediment and nutrient runoff from agricultural lands contribute heavily to the impaired condition in many of the tributaries of the Conewago Creek as well as the main stem. Consistently high levels of Nitrate-Nitrogen and Ortho-Phosphate have been recorded by agencies monitoring the stream, including DCCD. Habitat analyses have indicated that a large portion of the impairment is also due to excessive sedimentation caused by poor agricultural practices. There is also a reason to believe that additional input of nitrogen to the creek may also be due to groundwater influences in this watershed. Additional information on groundwater quality in this watershed will help determine the extent of nitrogen contribution by groundwater. While there are several point source discharges that could potentially influence water quality, point sources are not being addressed in this document since they are under the authority of the state's NPDES program.

The Conewago Creek watershed remains one of Dauphin County's largest contributors of sediment and nutrients (primarily agricultural) to the Chesapeake Bay and will likely remain so for the future. Addressing the sediment and nutrient loads in all of the tributaries of the Conewago Creek will greatly reduce sediment and nutrient (primarily nitrogen) loads to the Chesapeake Bay.

The Tri-County Conewago Creek Association (TCCCA) is currently funded by PA DEP to complete a TMDL Implementation Plan for the Conewago Creek watershed. The goal of this plan is to outline specific BMPs to be placed within the sub-watersheds of the Conewago Creek in order to meet sediment and nutrient reductions required in the TMDL. This plan is expected to be completed by 2007.

# Conewago Creek Watershed, Dauphin County

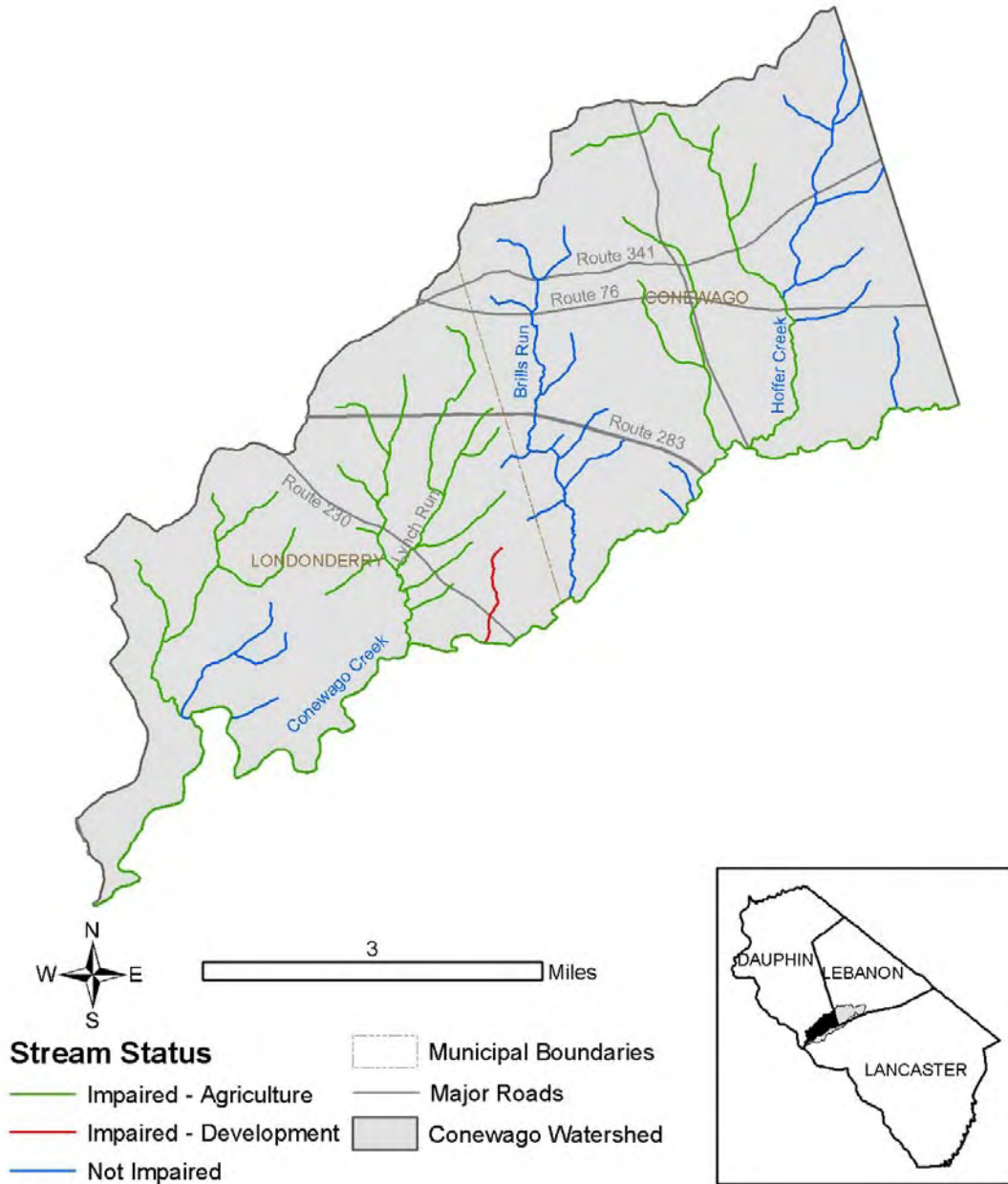


Figure 14.

### **III. CHESAPEAKE BAY TRIBUTARY STRATEGY AND IMPLEMENTATION PLAN**

## A. AGRICULTURE IMPLEMENTATION PLAN

### DAUPHIN COUNTY OVERVIEW

The PA Annual Summary 2003-2004 reported 147.7 square miles of total county land use (26%) as being in agricultural use. The PA DEP 2004 303(d) list identifies approximately 146.74 (11.3%) of the total stream miles within Dauphin County as impaired by activities associated with agriculture. Types of impairment include: nutrients, siltation, organic enrichment, turbidity, and flow alterations.

This agricultural implementation plan will propose specific BMP installation and educational outreach measures to mitigate these impacts based upon the type of animal agriculture, crops produced, and socioeconomic factors associated with three individual and identifiable regions within the county (*Appendix G*). Descriptions of these agricultural areas are outlined in Part I, Dauphin County General Description, as the Northern, Eastern and Southern regions of Dauphin County.

Dauphin County agriculture, as a whole, is a diverse and significant use of land area. Based on the USDA National Agricultural Statistics Service, PA Annual Summary 2003-2004 for Dauphin County, the following items characterize the county's agricultural composition:

- 855 farms, based on the 2002 NAICS definition from the U.S. Census Bureau, 300 farms are livestock operations; remaining farms may include nurseries, orchards, hatcheries and land leased to croppers (*Appendix H*).
- Average farm size is 111 acres.
- Number of farms by species, based on 300 livestock farms
  - Dairy - 95 farms (consisting of more than 10 cows)
  - Poultry - 93 farms
  - Sheep - 40 farms
  - Hog - 35 farms
  - Other - 37 farms
- Number of animals listed by species
  - Broiler chickens - 3,129,000
  - Laying hens - 635,000
  - Cattle and calves - 16,600
  - Hogs - 6,200
  - Milk cows - 6,100
  - Sheep and lambs - 3,000
- Acres of crops planted listed by crop (2002 estimate)
  - Corn -20,500 acres total, with 13,000 acres harvested for grain; 7,500 acres harvested for silage
  - Hay - 4,800 acres alfalfa; 14,700 acres other hay
  - Soybeans - 10,000 acres
  - Wheat - 5,200 acres
  - Oats - 1,900 acres
  - Barley - 1,700 acres

## **AGRICULTURE IMPLEMENTATION PLAN**

### **AGRICULTURAL REGION ONE**

This area encompasses land north of Peters Mountain, including the following watersheds: Mahantango Creek, Wiconisco Creek, Deep Creek, Pine Creek, Powell Creek, Armstrong Creek, and tributaries draining directly to the Susquehanna River. Reaches of Powell, Armstrong, Wiconisco (including its unnamed tributaries and the Little Wiconisco), and Pine creeks are identified as being impaired by agriculture. In this region, impacts from urbanization are rare, with the exception of the riverside towns of Halifax and Millersburg and the boroughs of Elizabethville, Lykens and Williamstown on the main stem of Wiconisco Creek (*Table 2, page 7*).

Currently, 7,599 acres of farmland in this region have been permanently eased through the Agricultural Land Preservation (ALP) program, and will perpetually remain in agricultural use. Nutrient management plans have been developed for 5,159 acres under the Nutrient Management Act (NMA), either as a result of NMA regulations or voluntary efforts to reduce pollution.

Farm size in Region One may be characterized as near average for the county, with the exception of the Amish community, which tends to divide parcels in order to provide farming opportunities for the next generation. This practice results in 40 to 50 cow dairy operations on 50 to 70-acre farms. The Amish population is most prominent in Upper Paxton, Mifflin, Washington and Lykens townships. Tillage practices on Amish operations have traditionally been clean till (moldboard plow). Recently, some of the more progressive members of this community have changed to no-till systems, and several progressive Amish dairy operations have changed to a grazing-based enterprise.

Non-Amish livestock operations in this region are generally mid-size dairies that house 100 cows on average, poultry operations of two to three units, and a few sow and/or hog feeding facilities. Cropping systems associated with these livestock enterprises generally include some alfalfa/grass hay in the rotation, with dairy operations cropping systems being more grass intensive than poultry or swine enterprises. Non-livestock farming operations in the region tend to be larger acreage operations of cash crops of corn and soybeans primarily planted no till.

### **AGRICULTURAL REGION TWO**

Located in the area north of Swatara Creek, south of Blue Mountain and east of Beaver Creek, Region Two includes the following watersheds: Beaver Creek, Kellock Run, Bow Creek, Manada Creek, Walnut Run, and unnamed tributaries to Swatara Creek (*Figure 2, page 7*). The unnamed tributaries to Beaver Creek and Bow Creek are identified as impaired by agriculture. None of the region's agricultural acreage is preserved through the ALP program. Nutrient management plans have been developed for 63 acres of land under NMA regulations.

## **AGRICULTURE IMPLEMENTATION PLAN**

### **AGRICULTURAL REGION TWO (cont.)**

Urban pressure is significant in this region and exists across the region from east to west in the forms of low to medium density residential and commercial/industrial use.

Traditional production livestock operations are very limited in number, and consist of two dairy operations housing 40 to 70 cows, approximately 10 beef cattle operations, and four poultry operations. A significant equine industry has developed, partly in support of Penn National Race Course located in the extreme northeast of the region. The racecourse facility, along with widespread interest in pleasure horses, is responsible for a large number of small- to medium-size equine facilities for training and boarding of horses.

The predominant cash crop in the region is hay; and to a lesser extent, corn and soybeans are grown also as cash crops. Production agriculture will continue to decline in this region.

### **AGRICULTURAL REGION THREE**

Region Three includes areas south of Swatara Creek to Conewago Creek at the Dauphin County line, and includes the following watersheds and their tributaries: Spring Creek East, Swatara Creek, Conewago Creek; and tributaries draining directly to the Susquehanna River. Spring Creek, Lynch Run, Hoffer Creek, Iron Run, several unnamed tributaries to Swatara Creek and the main stem of Conewago Creek are identified as impaired by agriculture (*Figure 2, page 7*).

Urban pressure is significant, and is evidenced by a decrease in the overall number of active livestock farms in the region over the past ten years. Region Three will also see a declining trend in production agriculture as urbanization in the form of low-density residential development will continue to expand south from the Hershey/Hummelstown area and east from the Borough of Middletown.

Region Three currently has 675 acres permanently eased through the ALP program. However, the ALP program has suffered in this region from lack of popularity, primarily due to the \$1,500/acre easement cap in relation to the high market value of the land when land use changes from agriculture to residential/commercial. Nutrient management plans have been developed for 637 acres of farmland, either as a result of NMA regulations or as voluntary efforts at reducing nutrient pollution.

Farms in this area are characteristically average size for the county, with one major exception – the approximately 10,000 acres of agricultural land owned and controlled by Hershey Trust in Derry Township. The majority of Hershey Trust's land holdings are leased to cash crop operations, which use a cropping rotation of corn grain, wheat and soybeans, primarily using no-till planting practices.

## **AGRICULTURE IMPLEMENTATION PLAN**

### **Agricultural Region Three (cont.)**

Livestock operations are more concentrated in this region than Region One. Dairy farms tend to house more than 100 cows; poultry operations are more concentrated (numbers of units and birds). Hog operations tend to be small-scale. To support the increased animal populations, the region's farm operators are more likely to lease additional farmland. Cropping systems tend to be more intensive in this region with less land in alfalfa/grass and more in cash crop production. Recreational equine operations are present in this region, but not to the concentrations found in Region Two.

# **AGRICULTURE IMPLEMENTATION PLAN**

## **CURRENT PROGRAMS AND ACCOMPLISHMENTS**

DCCD's Chesapeake Bay Tributary Strategy Agricultural Implementation Plan is based on and is an extension of the ongoing Phase I Restoration project for the Little Wiconisco Creek. Funded by Clean Water Act Section 319 funds, Phase I began in Summer 2003, and is scheduled to be completed in Fall 2006. A proposed Phase II is currently being prepared as a request for funding to be submitted in March 2005.

## **GOALS AND OBJECTIVES**

- Establish awareness among the agricultural landowners of Dauphin County as to the impaired condition of county streams, the impacts landowner actions and practices have on county streams and an understanding of what can be done to improve water quality.
- Distribute BMP funds using methods that will determine the maximum stream water quality benefit for dollars spent.
- Promote the need and importance of riparian buffers.
- Work with other funding sources (CREP, nutrient management grants, etc.) to install sufficient BMPs to achieve a tangible positive impact.

## **PLAN OF ACTION**

DCCD has identified the following 14-step plan to accomplish its goals under the Agricultural Implementation Plan.

1. Eighty percent of work will be concentrated in the approximately 146.74 stream miles impaired by activities associated with agriculture and identified on the PA DEP 2004 303(d) list. The remaining 20% of work may be reserved for parcels outside of the target areas but which exhibit significant negative stream impacts.
2. Conduct a file search of NRCS cooperator files and local tax parcel mapping to identify landowners without any conservation plan or with conservation plans that have not been reviewed in ten years. Prior work has revealed that 62.95% of cropland in the Little Wiconisco Creek watershed is not covered by a conservation plan.
3. Notify landowners identified in the search by letter outlining the need for conservation planning and the consequences of no planning. Follow-up will be made with non-respondents by personal contact.
4. Verify conservation plan implementation, identify problems and discuss future steps with landowners.
5. Conduct a streamside buffer evaluation using previously developed survey method.
6. Conduct a crops and tillage survey using a previously developed survey method.
7. Develop conservation plans in response to landowner notifications and one on one follow-up. Conservation planning will identify specific BMPs needed in each watershed and the number of BMP units required to mitigate water quality issues.

# AGRICULTURE IMPLEMENTATION PLAN

## PLAN OF ACTION (cont.)

8. Hold a summer No-Till workshop to emphasize the elements needed for successful no-till farming, the importance and benefits of cover crops, soil compaction, and manure application for no-till farming. A discussion of the County Tributary Strategy and Implementation Plan will also be included. The date for the 2005 workshop is July 27.
9. Implement a No-Till/Cover Crop pilot project to encourage the use of no-till and cover crops to farm operators who are currently using conventional tillage practices. This is a three-year pilot incentive program with a goal of converting 500 acres to no-till with cover crops. The incentive will be a \$27 per acre per year cash incentive for cover crop planting plus a \$9 per acre per year cash incentive for the same acres to be planted as no-till. An additional \$20 per acre will be available for those acres where it is determined that deep tillage is required to insure the success of the no till system.
10. Notify the public about the availability of grants for BMP installation within impaired watersheds. Efforts will target residents of impaired watersheds.
11. Rank applicants for eligibility to receive BMP installation grant funds. Order will be established using a previously developed ranking system that has proven successful in the Little Wiconisco Phase I project. Ranking will be completed by the existing DCCD Agriculture Committee, consisting of a farmer director chairman, two active farmers, and selected DCCD agricultural staff.
12. Design agricultural BMPs as required; prepare landowner contracts (*Appendix G*).
13. Install agricultural BMPs.
14. Develop new and follow up existing nutrient management plans to encourage full implementation.

## MEASURABLE ENVIRONMENTAL RESULTS/BENEFITS

Results of the above plan will be produced according to the following procedures:

- Since 1998, DCCD has been monitoring the water quality of all streams within Dauphin County (*Appendix A*). As a result of this monitoring, DCCD has begun to establish a baseline for water quality in each stream, with the understanding that monitoring will continue in the future in order to determine positive impacts from this Strategy.
- The priority ranking system used to determine the hierarchy for applicants' grant eligibility is designed to emphasize BMPs offering the greatest reduction in sediment/nutrient runoff at the least cost.
- All conservation planning will include before and after soil loss calculations using the revised universal soil loss equation (RUSLE II).

## **AGRICULTURE IMPLEMENTATION PLAN**

### **MEASURABLE ENVIRONMENTAL RESULTS/BENEFITS (cont.)**

- All landowners receiving cost-share grant funds for BMP installation will be required to develop a nutrient management plan that meets PA Tech Guide 590 Standards and/or Act 6 requirements, if applicable. In cases where no livestock are present, a plan will not be developed.
- All stream bank stabilization, stream bank fencing/planting and stream buffer BMPs will be reported through PA Stream Releaf Data Sheets.

### **WATERSHED PRIORITIZATION**

Based on agricultural usage as total land use and current levels of impact, the following priorities have been established, according to watershed:

High: Wiconisco, Powells, Armstrong, Mahantango, Conewago  
Moderate: Swatara  
Low: Spring, Fishing, Stony, Clark, Paxton

### **NEEDED RESOURCES**

- Funding for BMP installation
- In-house technical and design assistance
- USDA Farm Service Agency commitment to require Resource Management Service conservation planning by farm operators/landowners to remain eligible for commodity payments

### **POTENTIAL PARTNERSHIPS**

- USDA NRCS
- USDA Farm Services Agency
- Six county watershed groups
- PA DEP
- Penn State Cooperative Extension

## **B. DEVELOPMENT IMPLEMENTATION PLAN**

### **DAUPHIN COUNTY OVERVIEW**

Approximately 13% of Dauphin County's total land area can be deemed developed land. Negative effects of urbanization and development on streams are well documented. Increased pollutant loads (including nutrients and polluted stormwater runoff), increased channel erosion, sediment deposition and decreased base flow are attributed to increased development in watersheds. These effects are not limited to urban and suburban watersheds. Rural areas are also subject to development and in some cases, may be less prepared to properly manage runoff.

The best way to address the impacts of development in Dauphin County is to use a multi-faceted approach that views the county as a whole. The following sections delineate Dauphin County's overall plan to address all areas of land development - urban, suburban and rural - for the present and the future, implementing the five facets of: stormwater management, erosion and sediment control, dirt and gravel roads, floodplain management and education. These five elements are deemed especially relative by their ability to reduce sediment and nutrients delivered to the Chesapeake Bay.

### **1. STORMWATER MANAGEMENT (SWM)**

#### **PROGRAM OVERVIEW**

SWM is addressed at the municipal level through ordinances, and in some municipalities, through the implementation of programs to address NPDES Municipal Separate Storm Sewer Systems (MS4) requirements and Act 167 SWM planning. DCCD is one of only several conservation districts in the state actively involved in Act 167 planning and/or MS4 permitting. By providing education and resource assistance for stormwater regulations, DCCD has formed an effective working relationship with Dauphin County municipalities.

#### **CURRENT PROGRAMS AND ACCOMPLISHMENTS**

*Act 167 Planning* - SWM planning under Act 167 applies to new development, and provides SWM standards for peak discharge, water quality, infiltration and channel protection. Implementing the water quality standard will address, and potentially reduce, sediment and nutrient pollution as a component of the overall impacts of stormwater runoff. The channel protection standard is specifically aimed at minimizing channel erosion and the resulting sediment pollution. The infiltration standard will reduce the volume of stormwater delivered to receiving streams and is expected to have the effect of reducing stream erosion.

## DEVELOPMENT IMPLEMENTATION PLAN STORMWATER MANAGEMENT

### CURRENT PROGRAMS (cont.)

Act 167 planning currently is underway or completed for most of Dauphin County (Table 1). While coordination of the planning effort is performed by DCCD, implementation of SWM standards rests with municipalities through passage of ordinances. At the municipal level, specific BMPs are not necessarily required; set standards are used as guidelines. The method of how standards are achieved is largely at the discretion of the developer and project designer.

**Table 1**

WATERSHED	STATUS OF ACT 167 PLAN
Mahantango Creek	No plan underway.
Wiconisco Creek	Draft plan due for distribution in March 2005.
Armstrong Creek	Plan approved for implementation by PA DEP.
Powell Creek	Plan approved for implementation by PA DEP.
Clark Creek	Plan approved for implementation by PA DEP.
Stony Creek	Plan approved for implementation by PA DEP.
Fishing Creek	Plan approved for implementation by PA DEP.
Paxton Creek	Plan in process.
Spring Creek	Plan in process.
Swatara Creek	Plan in process for Bow Creek, Manada Creek, Beaver Creek and Kellock Run tributaries.
Conewago Creek	No plan underway.

*NPDES MS4 Requirements* - Seventeen municipalities in Dauphin County, including the county itself, are subject to MS4 regulations. These municipalities are all located south of Peters Mountain. It is likely that additional municipalities will be subject to these regulations in the future, perhaps as soon as 2008. For the purposes of this Implementation Plan, the most relevant MS4 requirements are those for construction site and post-construction SWM planning and implementation.

Municipalities that are subject to MS4 requirements must adopt or revise SWM ordinances that require post-construction stormwater management planning and implementation for water quality, infiltration and channel protection. As with Act 167 planning, this will be accomplished through the selection and design of BMPs.

# **DEVELOPMENT IMPLEMENTATION PLAN**

## **STORMWATER MANAGEMENT**

### **GOALS AND OBJECTIVES**

- Continue coordination of Act 167 planning for remaining unplanned watersheds in the county, to result in required ordinance implementation in affected county municipalities.
- Continue educational efforts aimed at municipal officials and staff.
- Reduce sediment/nutrient load through SWM BMPs, such as infiltration, filtration and increased E&S controls (*Appendix F*)

### **PLAN OF ACTION**

- Continue Act 167 planning and pursue planning for other county watersheds.
- Conduct multiple SWM workshops annually to educate relevant audience about SWM BMPs and regulatory requirements.
- Develop a prioritized list of potential remediation projects that will provide reduction in sediment and nutrients, and pursue funding for such projects.
- Increase advocacy at the municipal level for ordinance revisions and adoption of ordinances that provide higher levels of environmental protection including decreased sediment and nutrient delivery to streams. This may include providing model ordinances to interested municipalities.
- Provide and endorse methods of planning, such as low-impact design that would effectively reduce the amount of runoff from impervious surfaces.

### **MEASURABLE ENVIRONMENTAL RESULTS/BENEFITS**

The overall goal of this program is to achieve a marked decrease in sediment and nutrient loads to the Susquehanna River and Chesapeake Bay. Results of these efforts may be measured in terms of approved Act 167 plans and new or revised ordinances that require implementing post-construction SWM plans. The post-construction SWM plan will need to meet municipal standards for water quality, infiltration and channel protection. This will be accomplished by installing stormwater BMPs selected and designed to meet the specific standards of the ordinance. Although planning is coordinated by DCCD, implementation of SWM standards rests with the involved municipalities.

### **WATERSHED PRIORITIZATION**

The prioritization of watersheds for SWM efforts is based on existing and anticipated levels of development in the watersheds, the nature of the development, and the relative location of the watershed within Dauphin County

High Priority: Paxton, Spring West, Swatara

Moderate Priority: Wiconisco, Powells, Armstrong, Fishing

Low Priority: Clark, Stony, Mahantango, Conewago

# **DEVELOPMENT IMPLEMENTATION PLAN**

## ***STORMWATER MANAGEMENT***

### **NEEDED RESOURCES**

- Funding for Act 167 planning.
- Staff resources
- Cooperation from Dauphin county municipalities and surrounding counties

### **POTENTIAL PARTNERS**

- Municipalities
- Dauphin County Planning Agency
- Other counties
- PA DEP

## **2. *EROSION AND SEDIMENT CONTROL (E&S)***

### **PROGRAM OVERVIEW**

Sediment and associated nutrient pollution resulting from earth-disturbance activities, such as new development, are addressed through DCCD's E&S program. Under program regulations, all earth disturbance activities must develop, implement and maintain an E&S plan to reduce the effects of earthmoving. Earth disturbance activities in excess of five acres, and those activities disturbing between one acre and less than five acres with a point source discharge to surface waters of the Commonwealth must obtain a National Pollutant Discharge Elimination System (NPDES) permit for discharge of stormwater associated with construction activities.

E&S technicians review construction plans for compliance with Chapter 102 regulations and NPDES construction site permitting, with the goal of reducing soil erosion. This program is well established and experiences a solid working relationship with county municipalities.

### **CURRENT PROGRAMS AND ACCOMPLISHMENTS**

- Currently reviewing an average of 309 plans per year for compliance with Chapter 102 regulations. Reviews address an average of 979 acres of disturbed earth per year in Dauphin County.
- Process an average of 61 general NPDES permits annually for county earth-disturbance projects requiring a permit.
- Conduct site inspections at more than 400 construction sites annually to ensure proper implementation and maintenance of E&S pollution control programs.
- Host annual workshops for contractors, developers and municipal officials to update and explain current E&S regulations.

# **DEVELOPMENT IMPLEMENTATION PLAN**

## ***EROSION AND SEDIMENT CONTROL***

### **GOALS AND OBJECTIVES**

- Increase field presence at earth-disturbance sites to ensure implementation of plans.
- Continue educational efforts, through workshops and personal contact via phone inquiries.
- Continue to foster working relationships with local municipalities and increase the number of municipalities formalizing the District-Municipal Government relationship through execution of a Memorandum of Understanding.

### **PLAN OF ACTION**

- Continue administration of the Chapter 102 delegation agreement with DEP.
- Seek additional funding for technical staff.
- Develop a prioritized list of potential remediation projects that will provide reduction in sediment and nutrients and pursue funding for such projects.
- Increase advocacy at the municipal level for ordinance revisions and adoption of ordinances that provide higher levels of environmental protection including decreased sediment and nutrient delivery to streams. This may include providing model ordinances to interested municipalities.

### **MEASURABLE ENVIRONMENTAL RESULTS/BENEFITS**

Reduction in sediment and associated nutrients to streams and the Chesapeake Bay.

### **WATERSHED PRIORITIZATION**

All watersheds in Dauphin County are high priority for E&S program activities due to the high demand for program services in light of current and future development levels.

### **NEEDED RESOURCES**

- Increased funding for technical staff. PA DEP currently funds 16% of program costs.
- This program is a responsibility of PA DEP. If local conservation districts are unable to continue administering the program due to the unmet financial need, PA DEP must shoulder the burden.

### **POTENTIAL PARTNERS**

- Local municipalities
- PA DEP
- Developers/contractors
- PA Fish and Boat Commission

# **DEVELOPMENT IMPLEMENTATION PLAN**

## **3. DIRT AND GRAVEL ROADS**

### **PROGRAM OVERVIEW**

This program addresses sediment and associated nutrients associated with unpaved roads in Dauphin County, which provide access for major industries—agriculture, mining, forestry and recreation. Dust and sediment pollution resulting from poor maintenance of these roads are proven contributors to nonpoint source pollution of streams and groundwater.

### **CURRENT PROGRAMS AND ACCOMPLISHMENTS**

DCCD has a four-member Quality Assurance Board in place to administer this program, comprised of a nonvoting chairman, a member appointed by DCCD, a representative from the PA Fish and Boat Commission, and a USDA Natural Resource Conservation Service (NRCS) representative. Monies are provided to municipalities for funding safe, efficient and environmentally-sound maintenance to sections of dirt and gravel roads that have been identified as sources of dust and sediment.

- 56 worksites identified in Dauphin County.
- 8 sites completed.
- 182,078 feet of roadway have been stabilized

### **GOALS AND OBJECTIVES**

- Completion of remaining 48 Dirt and Gravel Roads worksites identified as threats.
- Assessment of an unknown number of private drives and access roads, which contribute significant sediment and associated nutrient load to county streams and the Chesapeake Bay.

### **PLAN OF ACTION**

- Continue administration of DCCD's Dirt and Gravel Roads program.
- Develop, fund and implement a pilot program to reduce sediment discharge from private gravel drives and access roads.
- Pursue technology transfer and application of E&S techniques to maintenance of municipal paved roads.

### **MEASURABLE ENVIRONMENTAL RESULTS/BENEFITS**

- Stabilization of dirt and gravel roads resulting in decreased sediment and associated nutrient loads to streams and the Chesapeake Bay.
- Transfer of environmentally sensitive maintenance practices to other paved municipal roads.

# **DEVELOPMENT IMPLEMENTATION PLAN**

## ***DIRT AND GRAVEL ROADS***

### **WATERSHED PRIORITIZATION**

The prioritization of watersheds for Dirt and Gravel Roads program activities is based on existing and anticipated levels of development in the watersheds, project size, and the relative location of the watershed within Dauphin County.

High Priority: Mahantango, Wiconisco, Armstrong, Powells, Stony, Fishing  
Moderate Priority: Conewago, Swatara, Clark  
Low Priority: Paxton, Spring West

### **NEEDED RESOURCES**

- Pilot project to adapt environmentally sensitive maintenance practices for utilization on private drives and access roads.
- Additional funding for projects.

### **POTENTIAL PARTNERS**

- Local municipalities
- USDA NRCS
- PA Fish and Boat Commission

## **4. FLOODPLAIN MANAGEMENT**

### **PROGRAM OVERVIEW**

In Pennsylvania, the Department of Community and Economic Development (PA DCED) is responsible for monitoring floodplain development and assisting local municipalities with adopting and implementing floodplain management ordinances. DCCD has been participating in a program for several years whereby the district on behalf of PA DCED provides assistance to municipalities through community contacts and visits, assistance with interpretation and implementation of regulations, workshops and ordinance reviews. Well-managed floodplains provide water quality benefits including reduction of sediment and associated nutrients to the Chesapeake Bay.

### **CURRENT PROGRAMS AND ACCOMPLISHMENTS**

Since 1997, DCCD has assisted PA DCED in its mission by conducting community assistance visits and contacts, reviewing existing and proposed floodplain ordinances, conducting workshops and aiding local governments with interpretation and application of floodplain regulations. DCCD's participation further strengthens cooperative efforts among state, county, and local agencies involved in resource management or regulatory functions by acting as a local resource regarding sound management and wise use of floodplains in Dauphin County.

# **DEVELOPMENT IMPLEMENTATION PLAN**

## ***FLOODPLAIN MANAGEMENT***

### **CURRENT PROGRAMS AND ACCOMPLISHMENTS (cont.)**

- Provide assistance to municipalities in interpreting and administering floodplain management regulations.
- Perform Community Assistance Contacts.
- Conduct annual workshops for municipal officials and staff on floodplain regulations.
- Review current and draft municipal ordinances.
- Maintain resource library.

### **GOALS AND OBJECTIVES**

- Continue current programs.
- Implementation of more restrictive floodplain ordinances.
- Floodplain reclamation projects.

### **PLAN OF ACTION**

- Continue cooperating with PA DCED in floodplain monitoring projects when available.
- Develop a prioritized list of potential remediation projects that will provide reduction in sediment and nutrients, and pursue funding for such projects.
- Increase advocacy at the municipal level for ordinance revisions and adoption of ordinances that provide higher levels of environmental protection including decreased sediment and nutrient delivery to streams. This may include providing model ordinances to interested municipalities.

### **MEASURABLE ENVIRONMENTAL RESULTS/BENEFITS**

Ordinance revisions that prohibit development in floodplains in at least some municipalities.

### **WATERSHED PRIORITIES**

All watersheds in Dauphin County are high priority for Floodplain Management program activities, due to the limited opportunity of including undeveloped areas to preserve them.

### **NEEDED RESOURCES**

- Continued availability of funding from PA DCED for the current program
- Funding for reclamation projects

# **DEVELOPMENT IMPLEMENTATION PLAN**

## **FLOODPLAIN MANAGEMENT**

### **POTENTIAL PARTNERS**

- PA DCED
- Dauphin County Planning Agency
- Municipalities
- Watershed organizations

## **5. EDUCATION**

### **PROGRAM OVERVIEW**

Natural resource education is a key thrust of DCCD's work and educational efforts are woven into the District's four development-related programs – E&S, SWM, Floodplain Management, and Dirt and Gravel Roads. Efforts target a wide variety of audiences: developers, designers, contractors, municipal staff and elected officials, businesses, community, watershed and other conservation organizations, schools and the general public. Depending on the nature of the program they address, educational efforts may focus on a specific target (ex. sediment for the Erosion and Sedimentation program), or on a broader target, such as the variety of pollutants and related issues that influence the Stormwater Management program.

DCCD's environmental education program is a vital link in helping Dauphin County residents understand the natural environment, appreciate local natural resources and become involved in efforts to insure a safe and healthy environment in which to live and work.

### **Municipal Ordinance Overview**

Sound management of development in terms of impacts to surface waters consists of sound and strong municipal ordinances. While most municipalities in Dauphin County have Zoning, Subdivision and Land Development (SLD), Floodplain and Stormwater ordinances, each type varies as to its effectiveness at protecting surface waters. A brief description of each ordinance type and its implications for this Strategy follows.

*Zoning Ordinances* – One use of zoning ordinances is to identify and implement protective measures for environmentally sensitive areas, which often takes the form of an Environmental Protection Overlay zone. Common areas targeted for additional protection include steep slopes, wetlands floodplains and riparian buffers. Currently in Dauphin County, most municipalities do not utilize zoning as a resource conservation method; several municipalities do not have zoning at all.

## **DEVELOPMENT IMPLEMENTATION PLAN**

### **EDUCATION**

#### **Municipal Ordinance Overview (cont.)**

Zoning ordinances can also be used to limit impervious cover, such as paved surfaces that are typically associated with development. Limiting impervious cover can decrease stormwater-related problems such as channel erosion by reducing the volume of stormwater generated from a given area.

*SLD Ordinances* – SLD ordinances that allow flexibility in design or employ principles of low-impact design provide greater opportunity for sound stormwater management and aid implementation of Act 167 SWM and MS4 ordinance standards. All Dauphin County municipalities either have adopted SLD ordinances or are subject to the county SLD ordinance; policies for the majority of municipalities reflect the general county ordinance.

*Floodplain Ordinances* – All municipalities in Dauphin County that have stream mileage have floodplain ordinances. Two types of floodplain ordinances are established in Dauphin County municipalities, differing in effectiveness and environmental benefit. The vast majority are standard ordinances that allow development within the floodplain, subject to elevation or flood-proofing requirements. However, critical environmental benefits of the floodplain, such as stream buffering, are compromised under this type of ordinance. A few municipalities have implemented stronger ordinances that prohibit all but minor and accessory use of the floodplain. In these cases, flood-carrying capacity, sediment and associated nutrient removal, and filtering aspects of the floodplain are better protected.

*SWM Ordinances* – This type of ordinance varies greatly across the county. In some municipalities, ordinances address only drainage requirements. In other municipalities, the standard ordinance requirement has been management of post-construction peak discharges to pre-development peak rates. Stormwater ordinances that more effectively manage runoff in terms of overall watershed hydrology, including both quantity and quality considerations are preferable.

#### **CURRENT PROGRAMS AND ACCOMPLISHMENTS**

DCCD is actively involved in educating its varied audiences, consisting of farmers, developers, teachers, politicians and the general public. Additionally, other groups such as watershed organizations and the Chesapeake Bay Education Office, are also conducting educational programs within Dauphin County to address conservation of county resources. Specific educational efforts include:

- conducting educational activities as a component of MS4 requirements in cooperation with local municipalities in order to ensure county compliance
- workshops targeting audiences for erosion and sedimentation control, stormwater management, dirt and gravel roads and floodplain management policies
- planned installation of SWM BMPs onsite at DCCD, which will serve as an educational demonstration, reaching a wide segment of audiences

# **DEVELOPMENT IMPLEMENTATION PLAN**

## ***EDUCATION***

### **CURRENT PROGRAMS AND ACCOMPLISHMENTS (cont.)**

- production of educational collateral materials that emphasize conservation of soil and water resources
- participating in community outreach activities, such as Community Earth Day and the Susquehanna River Celebration.

### **GOALS AND OBJECTIVES**

- Increase educational efforts targeting program-specific audiences, thereby increasing awareness and compliance with policies to reduce pollution of stormwater.
- Increase efforts encouraging municipal officials to adopt or revise stormwater ordinances.
- Increase awareness of DCCD as an informational resource for all Dauphin County residents regarding water and soil conservation issues.

### **PLAN OF ACTION**

- Schedule programs and workshops throughout the year, targeting audience according to topic.
- Provide updated, relevant information on DCCD website to serve as an informational tool to the various publics accessing the site.

### **MEASURABLE ENVIRONMENTAL RESULTS/BENEFITS**

The results of this effort in terms of measurable reductions in sediment and nutrients delivered to receiving streams will be difficult to measure directly. Tangible results will be ordinance implementation or revisions, particularly of those not directly regulated by MS4 or Act 167 planning.

### **WATERSHED PRIORITIZATION**

The prioritization of watersheds for education efforts is based on existing and anticipated levels of development in the watersheds, the nature of the development, and the relative location of the watershed within Dauphin County

High Priority: Paxton, Spring West, Swatara

Moderate Priority: Fishing, Powell, Armstrong, Wiconisco, Stony, Clark

Low Priority: Mahantango, Conewago

# **DEVELOPMENT IMPLEMENTATION PLAN**

## ***EDUCATION***

### **NEEDED RESOURCES (cont.)**

- District staffing
- Educational resources
- Funding to conduct educational efforts

### **POTENTIAL PARTNERSHIPS**

- Watershed organizations
- Chesapeake Bay Education Office
- Home builders associations
- Municipalities

## **C. ABANDONED MINE LANDS (AML) /ABANDONED MINE DRAINAGE (AMD) IMPLEMENTATION PLAN**

### **PROGRAM OVERVIEW**

Due to the nature of coal mining activities, most of the effects of AML/AMD are located in streams and in local stream corridors. Therefore this section, which addresses issues arising from AMD/AML, is broken down into the following watersheds, which have proven impacts associated with AMD/AML, according to priority: Upper Wiconisco Creek, Stony Creek (Dauphin and Lebanon Counties) and Mahantango Creek (Schuylkill County) and Clarks Creek.

Passive treatment of AMD discharges is generally recommended for all of the affected watersheds due to relatively low costs and labor requirements compared to active treatment. Specific implementation activities in AMD affected watersheds are presented below, along with a prioritization ranking for each watershed. Watersheds are prioritized based on the degree of AMD impact to each watershed/sub-watershed in Dauphin County and its contribution to sedimentation to the Chesapeake Bay and by the amount of data available for each discharge.

According to recent information from PA DEP, DCCD has already met the required BMPs required for reduction of AML sedimentation in Dauphin County. However, sedimentation from AMD, while not addressed by PA DEP, remains an important source of sediment to the Chesapeake Bay and is addressed in this section.

# **AML/AMD IMPLEMENTATION PLAN**

## **1. UPPER WICONISCO CREEK WATERSHED (not including Bear Creek)**

### **CURRENT PROGRAMS AND ACCOMPLISHMENTS**

Mine drainage in the Upper Wiconisco Creek Watershed is chemically diverse and flow rates are also highly variable. Countywide sampling efforts as well as funded watershed specific projects have resulted in a large amount of data for several of the discharges located within the Upper Wiconisco Creek Watershed. One noted area under focus since the mid-1980's is the sedimentation ponds at the Sheridan Banks site located in Schuylkill County.

### **GOALS AND OBJECTIVES**

- Treatment of sediment pollution at Big Lick Tunnel associated with effects of AMD in watershed.
- Work with local organizations to effectively monitor AMD at Keim Tunnel in order to determine the most effective plan of action for reducing sediment loads.
- Form a cooperative working relationship with Schuylkill County to address funding and construction of treatment systems for all AMD originating in Schuylkill County that flows into Dauphin County watersheds.
- Implement a plan that addresses the extensive damage to the Sheridan Banks AMD/AML site by cooperating with Schuylkill County and local partners.

### **PLAN OF ACTION**

The Big Lick Tunnel discharge historically exhibits variable flow and chemistry; therefore its treatment is problematic. It is likely however, that sedimentation ponds, possibly with the addition of limestone and constructed wetlands, or Vertical Flow Ponds (VFPs), will help to precipitate iron and generate alkalinity. It is advisable at this time to monitor mine discharges more frequently to determine the most appropriate system for treatment.

Little is known about the Keim Tunnel discharge, which is located on State Game Lands in Dauphin County, near the Bendigo airport. Operation Scarlift (Sanders and Thomas, 1973) indicates that this discharge is primarily acidic with an average discharge of 131 GPM. However, much more thorough and up-to-date monitoring data is required in order to determine the most appropriate system to treat Keim Tunnel discharge. Possible methods for treatment may include but are not limited to: sedimentation ponds, VFPs, or a Successive Alkalinity Producing System (SAPS). SAPS consists of a VFP followed by a sedimentation pond to precipitate iron.

## **AML/AMD IMPLEMENTATION PLAN**

### ***UPPER WICONISCO CREEK WATERSHED (not including Bear Creek)***

#### **PLAN OF ACTION (cont.)**

Discharges located in the Schuylkill County portion of the Upper Wiconisco Creek Watershed include Kalmia Tunnel and Porter Tunnel. Porter Tunnel however, has an active mining permit and its current owner is constructing a treatment system. Significant data gaps exist for the Kalmia Tunnel discharge and initiation of a monitoring program is required in order to determine treatment options. In order to alleviate all mine drainage impacts to the Dauphin County portions of the Upper Wiconisco Creek Watershed, treatment systems for all abandoned discharges in the Schuylkill County portion of the watershed must also be funded and constructed.

Along with AMD discharges located within the Schuylkill County portion of the watershed, Sheridan Banks, also in Schuylkill County remains as a source of coal fines washing into the Wiconisco Creek. Observations in 2003 have indicated that the sedimentation ponds built nearly 20 years ago have filled in and are in need of major repair and maintenance. In order to stave off future maintenance and associated labor costs with the current sedimentation ponds, it is recommended that the coal waste material located at Sheridan Banks be removed and the entire site reclaimed.

#### **MEASURABLE ENVIRONMENTAL RESULTS/BENEFITS**

With appropriate funding available for monitoring and construction, AMD discharges within the Upper Wiconisco Creek Watershed can be effectively treated, thereby significantly reducing AMD metals sedimentation to the Chesapeake Bay while meeting any future prescribed TMDL endpoints.

#### **WATERSHED PRIORITIZATION**

Due to the extensive land area impacted by AMD/AML, resulting in high levels of sediment that subsequently affect the Upper Wiconisco Creek watershed and the Chesapeake Bay, this watershed is ranked high priority.

#### **POTENTIAL PARTNERSHIPS**

- PA DEP, Growing Greener Grants Center
- PA DEP, Bureau of Abandoned Mine Reclamation
- United States Department of the Interior, Office of Surface Mining
- US EPA
- National Fish and Wildlife Foundation
- National Association of Counties

# **AML/AMD IMPLEMENTATION PLAN**

## **2. BEAR CREEK WATERSHED**

### **CURRENT PROGRAMS AND ACCOMPLISHMENTS**

DCCD has secured Section 319 funding through PA DEP to begin implementation activities to treat AMD from the Lykens Water Level Tunnel by construction of sedimentation ponds to settle out dissolved metals (primarily iron). Construction on the Lykens Water Level Tunnel Passive Treatment System, which will consist of three sedimentation ponds and associated conveyance, is slated to begin during 2005-06.

### **GOALS AND OBJECTIVES**

- Reduce sediment loads from AMD through implementation of a remediation project consisting of sedimentation ponds.
- Increase water quality levels.
- Enable the Bear Creek watershed to become a self-sustaining entity for aquatic life.
- Removal of Bear Creek waters from PA DEP 303(d) list.

### **PLAN OF ACTION**

Additional sedimentation ponds, constructed wetlands, and associated conveyance systems are planned to passively treat the several remaining discharges within Bear Creek watershed. Depending on post-construction monitoring results, connection of the treatment systems may be required to provide further treatment for the marginally net-alkaline discharge.

The possibility of recovering iron oxides from passive systems for sale is being explored and if this option is pursued, the ponds can be designed in a manner to facilitate the periodic removal of the iron oxide solids. The potential exists for future revenue from iron sludge sales and hydropower generation. These options could provide the basis for a dedicated, self-sustainable, long-term maintenance account.

Also, once all of the discharges are treated, the feasibility for removal of relict iron deposits within the streambed should be examined. If this historical iron deposition can be addressed in a cost-effective manner, it is likely that the creek will be capable of supporting aquatic life much sooner than if the iron deposits remained in the creek and sedimentation from AMD can be reduced to the Chesapeake Bay.

### **MEASURABLE ENVIRONMENTAL RESULTS/BENEFITS**

With appropriate funding for continued construction of treatment systems at Bear Creek, sedimentation to Bear Creek, Wiconisco Creek and ultimately to the Chesapeake Bay from iron loading will be reduced significantly and appropriate TMDL load reductions will be met. An 80% reduction in iron loading is expected for the current phase. Successive phases of passive treatment will likely reduce more than 95% of iron loading.

## **AML/AMD IMPLEMENTATION PLAN**

### ***BEAR CREEK WATERSHED***

#### **MEASURABLE ENVIRONMENTAL RESULTS/BENEFITS (cont.)**

Removal of the historical iron deposits from the streambed will also reduce sedimentation to the Chesapeake Bay and expedite the re-colonization of Bear Creek by benthic macroinvertebrates, which would result in the creek's expedited removal from the PA DEP 303(d) list.

#### **WATERSHED PRIORITIZATION**

Due to the extensive land area impacted by AMD/AML, resulting in high levels of sediment that subsequently affect the Upper Wiconisco Creek Watershed and the Chesapeake Bay, this watershed is ranked high priority.

#### **POTENTIAL PARTNERSHIPS**

- PA DEP, Growing Greener Grants Center
- PA DEP Bureau of Abandoned Mine Reclamation
- United States Dept. of Interior, Office of Surface Mining
- US EPA
- National Fish and Wildlife Foundation
- National Association of Counties

# **AML/AMD IMPLEMENTATION PLAN**

## **3. STONY CREEK WATERSHED**

### **CURRENT PROGRAMS AND ACCOMPLISHMENTS**

Efforts by the Doc Fritchey chapter of Trout Unlimited (DFTU) have resulted in some data for Stony Creek discharges. One diversion well is currently maintained by DFTU at Rausch Creek, Lebanon County to neutralize acidity. The exact number of discharges in Dauphin County affecting the Stony Creek watershed is unknown. AMD under current treatment by the DFTU diversion well is in Lebanon County and is notably acidic with very low metals content.

### **GOALS AND OBJECTIVES**

- Determine areas of AMD in Dauphin County that affect Stony Creek Watershed.
- Partner with Lebanon County and local organizations to monitor sediment levels, which will aid in the formation of a plan to address AMD.

### **PLAN OF ACTION**

Possible Dauphin County discharges in the Stony Creek Watershed must be located. A monitoring program needs to be put into place to gather data, which will allow for appropriate planning and construction of treatment systems.

### **MEASURABLE ENVIRONMENTAL RESULTS/BENEFITS**

Effective treatment systems for all of the discharges that may be located within the Stony Creek Watershed may be designed and constructed once sufficient data becomes available. More precise results cannot therefore be projected at this time until such data becomes available.

### **WATERSHED PRIORITIZATION**

The extent to which AMD affects this watershed is unknown, combined with knowledge of current conditions and its smaller size, this watershed is ranked medium priority.

### **POTENTIAL PARTNERSHIPS**

- PA DEP, Growing Greener Grants Center
- PA DEP, Bureau of Abandoned Mine Reclamation
- United States Department of the Interior, Office of Surface Mining
- US EPA
- National Fish and Wildlife Foundation
- National Association of Counties
- Doc Fritchey Chapter, Trout Unlimited

# **AML/AMD IMPLEMENTATION PLAN**

## **4. MAHANTANGO CREEK WATERSHED**

### **CURRENT PROGRAMS AND ACCOMPLISHMENTS**

Monitoring efforts performed by the Tri-Valley Watershed Association and the Schuylkill County Conservation District have provided a small amount of information on the water quality of the discharges within the Mahantango Creek Watershed. Limestone sand is currently being applied to Hans Yost Creek (a tributary of the Pine Creek sub-watershed in Schuylkill County), by the Tri-Valley Watershed Association to neutralize acidity but does not address metals sedimentation.

### **GOALS AND OBJECTIVES**

- Assist local watershed association and Schuylkill County Conservation District with obtaining funds to monitor water quality.
- Work cooperatively with relevant organizations to plan and construct an appropriate system to treat the discharges within the Mahantango Creek watershed and reduce AMD sedimentation to the Chesapeake Bay.

### **PLAN OF ACTION**

No portions of the Mahantango Creek watershed contained within Dauphin County are impaired by AMD. The Dauphin County portion of Pine Creek, a tributary of the Mahantango Creek, is listed by PA DEP as impaired by agriculture, not by AMD. However, headwater segments of Pine Creek and its tributaries in Schuylkill County are impaired by AMD. The AMD discharges affecting the Mahantango Creek watershed are not located within Dauphin County, but every effort should be made to gain funding to assist the Tri-Valley Watershed Association (TVWA) and Schuylkill County Conservation District (SCCD) in their monitoring efforts and thereby plan and construct an appropriate system to treat the discharges within the Mahantango Creek Watershed and reduce AMD sedimentation to the Chesapeake Bay.

### **MEASURABLE ENVIRONMENTAL RESULTS/BENEFITS**

Effective treatment systems for all of the discharges that may be located within the Mahantango Creek Watershed may be designed and constructed once sufficient data becomes available. Once remediation occurs, metals sedimentation to Chesapeake Bay can be reduced.

### **WATERSHED PRIORITIZATION**

The Mahantango Creek watershed is prioritized as medium priority, due to the complex nature of obtaining cooperation to form an effective partnership with groups outside of the county.

# **AML/AMD IMPLEMENTATION PLAN**

## ***MAHANTANGO CREEK WATERSHED***

### **POTENTIAL PARTNERSHIPS**

- PA DEP, Growing Greener Grants Center
- PA DEP Bureau of Abandoned Mine Reclamation
- United States Department of the Interior, Office of Surface Mining
- US EPA
- National Fish and Wildlife Foundation
- National Association of Counties

# **AML/AMD IMPLEMENTATION PLAN**

## **5. CLARK CREEK WATERSHED**

### **CURRENT PROGRAMS AND ACCOMPLISHMENTS**

- None

### **GOALS AND OBJECTIVES**

- To research the information identified in the Plan of Action in order to plan for AMD remediation if it is found.

### **PLAN OF ACTION**

There are no impaired stream segments listed for the Clarks Creek Watershed at this time and no BMPs are planned. There is however, some anecdotal information that suggests a potential iron-contaminated seep entering the creek below the DeHart Reservoir. If this information regarding potential AMD is substantiated, the discharge must be located, reported and monitored. Substantial monitoring data will allow for the planning and design of a passive treatment system to treat any discharge(s).

### **MEASURABLE ENVIRONMENTAL RESULTS/BENEFITS:**

Effective treatment systems for any discharges that may be located within the Clarks Creek Watershed may be designed and constructed once discharge verification and sufficient monitoring data becomes available. More precise results cannot therefore be projected at this time until such data becomes available.

### **WATERSHED PRIORITIZATION**

Due to the lack of available data, prioritization for this watershed is low. Prioritization may change upon confirmation of data defining areas of AMD.

### **POTENTIAL PARTNERSHIPS**

- PA DEP, Growing Greener Grants Center
- PA DEP Bureau of Abandoned Mine Reclamation
- United States Department of the Interior, Office of Surface Mining
- US EPA
- National Fish and Wildlife Foundation
- National Association of Counties

## **AML/AMD IMPLEMENTATION PLAN**

### **OVERALL NEEDED RESOURCES**

As with any AMD remediation project, long term monitoring (both pre and post-construction) provides data that can be used to assist engineering subcontractors in the initial design process and to determine system effectiveness after construction. Additionally, accurate post-construction monitoring can help to determine the frequency of maintenance activities such as sludge removal.

Adequate funding is vital to the continuation of remediation activities within the Bear Creek watershed and funding streams for monitoring and professional analysis of samples must be encouraged.

Until the paucity of up-to-date, quality data for many discharges is rectified, the types of effective treatment systems to be used in many instances, the associated cost of construction and the quantifiable expected results will remain unclear and AMD sedimentation loading to the Chesapeake Bay will continue.

Technical and financial assistance needed for remediation of AMD-related sedimentation within Dauphin County watersheds:

- Engineering assistance for conceptual and final designs for BMPs
- Engineering assistance with bid package for construction and construction oversight
- Technical assistance with development of operation and maintenance plans.
- Technical assistance with monitoring and sample analyses
- Increased financial assistance for design, construction, and maintenance of systems

Additionally, initial construction costs for AMD treatment systems are often high, but with passive treatment systems, operation and maintenance costs stretched out over the life of the system make passive treatment a very cost-effective way to treat AMD, restore affected streams, and reduce metals sedimentation to the Chesapeake Bay. The inability of many funding streams (including Growing Greener and Section 319 funds) to allow interest accrual by grant funds in an “AMD maintenance account” results in a very short-sighted approach to long-term maintenance. In order to ensure the viability of the initial construction investment, long-term maintenance must be addressed in a creative manner that is supported by agencies providing grant funds.

Stakeholder participation is the key to improving water quality and reducing AMD-related sedimentation to the Chesapeake Bay. Responsibility lies not only with the entities involved with remediation activities and BMP’s, but also with the stakeholders charged with overseeing the nation’s environmental health. In order to affect a lasting, positive change on the environment of AMD impacted watersheds and the Chesapeake Bay; federal entities must be willing and able to make changes in programs and/or legislation to address the widespread impacts of AMD.

## **D. ACID RAIN IMPLEMENTATION PLAN**

### **PROGRAM OVERVIEW**

Given that between one-fourth and one-third of all nitrogen inputs to the Chesapeake Bay and its watershed are from the atmosphere, this source requires consideration.

Approximately two-thirds to three-fourths of these inputs originate from fossil fuel combustion in automobiles, power-generating plants, and industry. However, most of the remainder is released as ammonia that originates overwhelmingly from agricultural animal operations. Previously it was thought that most of the ammonia from these operations was deposited within a few miles of the source, but recent information shows that ammonia is transported long distances to the Chesapeake Bay watershed. Research also shows that major contributions come from an area several times larger than the Bay watershed itself. These sources of nitrogen represent an important contribution to nitrogen enrichment in our streams, groundwater, and the Bay. Moreover, a portion of the nitrogen is deposited on the landscape as nitric acid, which is a significant component of acid rain. Acid rain is a problem for many reasons, most notably because it negatively affects streams with low acid neutralizing capacity and reduces soil productivity.

### **CURRENT PROGRAMS AND ACCOMPLISHMENTS**

DCCD's Water Resources program initiated a mitigation project in the West Branch Rattling Creek watershed in 2000 to address severe acidification due to acid rain. This project is necessary because the geology of this watershed provides little if any acid-neutralizing capacity to the stream, so the effects of acid rain are particularly strong. Results to date have indicated a significant improvement in the chemical quality of this stream as well as some improvement in the biological community. In addition, DCCD stream monitoring provides information on several streams that are considered at risk as the acid-neutralizing capacity in these watersheds is reduced by ongoing acid inputs.

### **GOALS AND OBJECTIVES**

The goal of the West Branch Rattling Creek Project is to eliminate the impact of acid rain in this stream and preserve its Exceptional Value listing in the state's Special Protection Waters Program. However, it must be noted that this project deals with a symptom of acid rain, but does not address the root of the problem. While dealing with issues such as vehicle and power plant fossil fuel emissions is largely the responsibility of federal and state governments, DCCD has a role to play. We can use the West Branch Rattling Creek Project and other information to educate farmers, the general public, and state representatives about this issue, its impacts on water quality, and solutions.

### **PLAN OF ACTION**

The West Branch Rattling Creek project should be continued to maintain and improve the health of this important stream. Educational efforts about acid rain and atmospheric nitrogen need to be increased.

## **ACID RAIN IMPLEMENTATION PLAN**

### **MEASURABLE ENVIRONMENTAL RESULTS/BENEFITS**

As noted above, the scope of this problem is large, and DCCD actions alone cannot be expected to result in positive change. However, our educational efforts, in concert with educational efforts of other organizations and most importantly, federal and state governments have the ability to reduce atmospheric nitrogen inputs to the Bay and its watershed and improve the health of acid rain impacted streams.

### **WATERSHED PRIORITIZATION**

The Rattling Creek watershed is the only area significantly impacted by acid rain in Dauphin County, although all streams receive a comparable amount of acid rain. Other streams are considered at risk due to low acid neutralizing capacity and may be impacted in the future due to ongoing acidification. These streams are located in the Armstrong, Powell, Clark, Stony, and Manada Creek watersheds.

### **NEEDED RESOURCES**

The West Branch Rattling Creek Project requires continual funding for the annual purchase of limestone sand, which is used to counteract the acidity. Educational efforts may require grant funding to produce informational materials.

### **POTENTIAL PARTNERS**

DCCD is already partnering with a local watershed association, PA DCNR, and PA DEP on the West Branch Rattling Creek Project. These partnerships should be continued.

## **IV. PLAN DEVELOPMENT PROCESS**

## **PLAN DEVELOPMENT PROCESS**

The Plan Development Process used for developing the *Dauphin County Chesapeake Bay Tributary Strategy* was basically a compilation and extension of information and knowledge that already existed within our Conservation District. Gathering the information presented in this report that relates to our watersheds and water quality issues and knowing what needs to be accomplished to protect and improve our waters proved largely to be an in-house exercise. It is what we do. It is who we are. It is what we are all about. We did not need to develop a lengthy process for discovering information, needs and priorities. Rather, what we did was develop a coordinated process for compilation of the information, staff knowledge, programs, working relationships, projects and years of experience related to water issues within our County. We take great pride in our technical knowledge of our waters and what needs to be done to protect them from additional degradation and how to mitigate those that are impaired. With adequate funding, the Dauphin County Conservation District can move forward with educational efforts and projects that enhance the clean-up of the Chesapeake Bay. The challenge and difficulty with the plan development process was to quantify Best Management Practices to meet the format and requirements of the State Chesapeake Bay Tributary Strategy Plan.

The contents of our Strategy are the product of the Conservation District's many years of work with a primary focus on our water. Validation of our information is presented herein under four topic headings: District Organization & Staff, District Strategic Plan Process, District Programs and Partnerships.

## **DISTRICT ORGANIZATION AND STAFF**

Many aspects of the organization of Conservation Districts across the State are similar, however, there are also many differences that define individual District's. We believe that the quality of our Directors, Staff and Committees raise the level of knowledge and proficiency above average. Our Directors have established themselves as a Board that establishes policy, maintains oversight and plans for the future. This is represented in our vision statement.

Our vision is to be a progressive natural resource agency recognized for:

- 1 Professionalism in the administration of programs
- 2 Technical knowledge regarding natural resource issues with an emphasis on water issues
- 3 Communication and educational skills to provide credible up-to-date information about our natural resources to all that we serve
- 4 Stewardship in understanding the complex interrelationships between man and the natural environment
- 5 Leadership in mitigating impaired resources.

## **PLAN DEVELOPMENT PROCESS**

### **DISTRICT ORGANIZATION AND STAFF (cont.)**

DCCD's technical staff is highly educated and experienced with professional experience relating to their area of work averaging 19.7 years per person. They are professionals with experience in the programs they administer. Complimenting the knowledge of the staff is the outreach of our Committee System. Nearly 30 individuals representing farmers, watershed associations, teachers, consultants, environmental agencies and municipalities serve on our committees. They are our grassroots connection to assure that what we do represents the best interest of all of our citizens.

### **DISTRICT STRATEGIC PLAN PROCESS**

In 2002, the Dauphin County Conservation District undertook an extensive strategic planning process. Our years of program experience plus this strategic planning process permit us to undertake this Chesapeake Bay Tributary Strategy Plan process without extensive public outreach. The strategic plan actively involved 16 agencies and organizations as well as representatives of local government, education, farmers, consultants and the public. This process focused mostly on water issues and provided action steps on how to best approach our water concerns. It provided our outreach with 1500 letters being sent to invite individuals and organizations to serve on our committees. In the final planning session where work priorities and needs were established, 53 individuals participated.

Our Strategic Plan contained "Action Steps" and "Measurable Results" for each issue identified. These action steps are the heart of what is provided in the *Chesapeake Bay Tributary Strategy Plan*. This Tributary Strategy Plan focuses on four areas of work, Agriculture, Development, Abandoned Mine Land and Discharges and Acid Rain. The foundation of each of these areas of work can be found in Strategic Plan.

### **DISTRICT PROGRAMS**

If we were to search Conservation Districts across the state, few would have more diversity of programs than Dauphin County's. In relation to various types of water quality and quantity issues, we seem to have it all. We have streams impaired by agriculture, urban development, abandoned mine land and mine drainage and even acid rain. We have programs, staff and grants working to mitigate and educate on each of these areas.

In addition to these impairments to water quality, our County Commissioners have requested that we be the lead agency in the coordination of all DEP Act 167 Stormwater Management Plans within our County. All of the primary watersheds noted in this Tributary Strategy except Mahantango Creek, Spring Creek East, and Conewago Creek have Stormwater Management Plans developed. Currently three of the older plans are being updated to incorporate current standards for infiltration and BMPs into ordinance requirements. These Act 167 Plans have provided an enormous amount of knowledge about our watersheds to the District Staff. Coordination of these plans is the first program area that may place us in the forefront of knowledge of our watersheds.

## PLAN DEVELOPMENT PROCESS

### DISTRICT PROGRAMS (cont.)

A second program area of strength is our Water Resources Program. Our two Water Resource staff provides a combined educational background in Aquatic Biology and Fisheries Management to shape a program based on knowledge and an understanding of our streams. Our countywide monitoring program has a written Quality Assurance & Quality Compliance protocol that is recognized by DEP and other agencies as working to universal standards. The combination of education/knowledge and monitoring has proved to be extremely valuable throughout this Tributary Strategy planning process. It has provided insight as to what areas to prioritize our work and grant funds in. We are preparing the TMDL on Bear Creek, our most severely impaired abandoned mine drainage stream. Our combination of chemical, biological and physical monitoring and testing provides our District with an understanding of our waters that is equaled by few, if any, other Conservation Districts in the state.

The other primary programs that we administer include the Erosion & Sediment Pollution Control/NPDES, Nutrient Management, Agricultural Conservation Planning, DCED Floodplain Management Outreach and the Dirt & Gravel Roads Program. On projects such as the development of this Strategy, all of our staff work together as a team to provide a comprehensive analysis and report.

### PARTNERSHIPS

Our success in the implementation of this Strategy lies not only with our internal operation and administration. Also, the information and knowledge assimilated for this plan would not be possible without an established track record of cooperative projects with our partners. Time does not permit a comprehensive list and explanation of the watershed organizations, agencies and nonprofit organizations that we have partnered with and continue to partner with for the successful implementation of projects. Listed below in random order are some of the watershed organizations, agencies and nonprofit organizations that assist us in our mission.

#### *Watershed Organizations:*

##### Wiconisco Creek Restoration Association

- \* SRBC Stream Assessment
- \* Little Wic. Ag Mitigation
- \* Bear CK. AMD Mitigation
- \* Public Education
- \* DCNR Rivers Conservation Plan
- \* Porter Tunnel AMD Testing
- \* Rattling Ck. Acid Rain Mitigation
- \* Shiffers Mill Dam Removal

##### Paxton Creek Education & Watershed Association

- \* Center for Watershed Protection BMPs
- \* Facilitate Various Grants
- \* Alliance C.B. Ordinance Workshops
- \* DCNR Rivers Conservation. Plan
- \* Triple Whammy Workshops
- \* Public Education

##### Powell/Armstrong Watershed Association

- \* Multiple Growing Greener Projects
- \* Monitoring Assistance & Equipment
- \* USGS Well Monitoring
- \* Public Education

## **PLAN DEVELOPMENT PROCESS**

Tri-Valley Watershed Association (Mahantango)

- \* Monitoring Assistance
- \* Buffer Tree Planting
- \* Education & Technical Assistance

Swatara Creek Watershed Association

- \* Yearly Sojourn
- \* Stream Snapshot
- \* Stream Clean-up
- \* Public Relations & Education

Tri-County Conewago Creek Watershed Association

- \* Stream Assessment
- \* Monitoring Assistance
- \* Stream Snapshot
- \* Stream Bank Fencing
- \* Public Education

Stony Creek Watershed Association

- \* Formation & Education

Spring Creek West Watershed Association

- \* Formation & Education

### *Agencies:*

DEP - Multiple Bureaus & Projects

PDA - Multiple Programs & Projects

DCED - Various Floodplain Programs

USGS - Bear Creek Monitoring, Powells/ Armstrong Well Monitoring/ Stream Gauge Stations

PFBC - E&S Compliance, Shiffers Mill Dam Removal, Stony Creek Restoration, Rattling Creek Fish Monitoring

PGC - Bear Creek Land Purchase. Stony Creek Restoration

PennDOT – Funding for various Wetland and Stream Mitigation Projects

USACOE - Wetland Mitigation Bear Creek Project

Fed. Highway Admin. – Wetland Mitigation Bear Creek Project

Dauphin County Planning Commission – Multiple Outreach & Education Events

Dauphin County Solid Waste – Household Hazardous Waste Collection

Dauphin County Emergency Management – Drought Task Force

USDA – NRCS – Agricultural technical assistance

DCNR – Dirt and Gravel Roads Program

### *Organizations:*

PA Organization for Watersheds and Rivers

Canaan Valley Institute

Dauphin County Association of Township Officials

Upper Dauphin Council of Governments

Chesapeake Bay Foundation

Alliance for the Chesapeake Bay

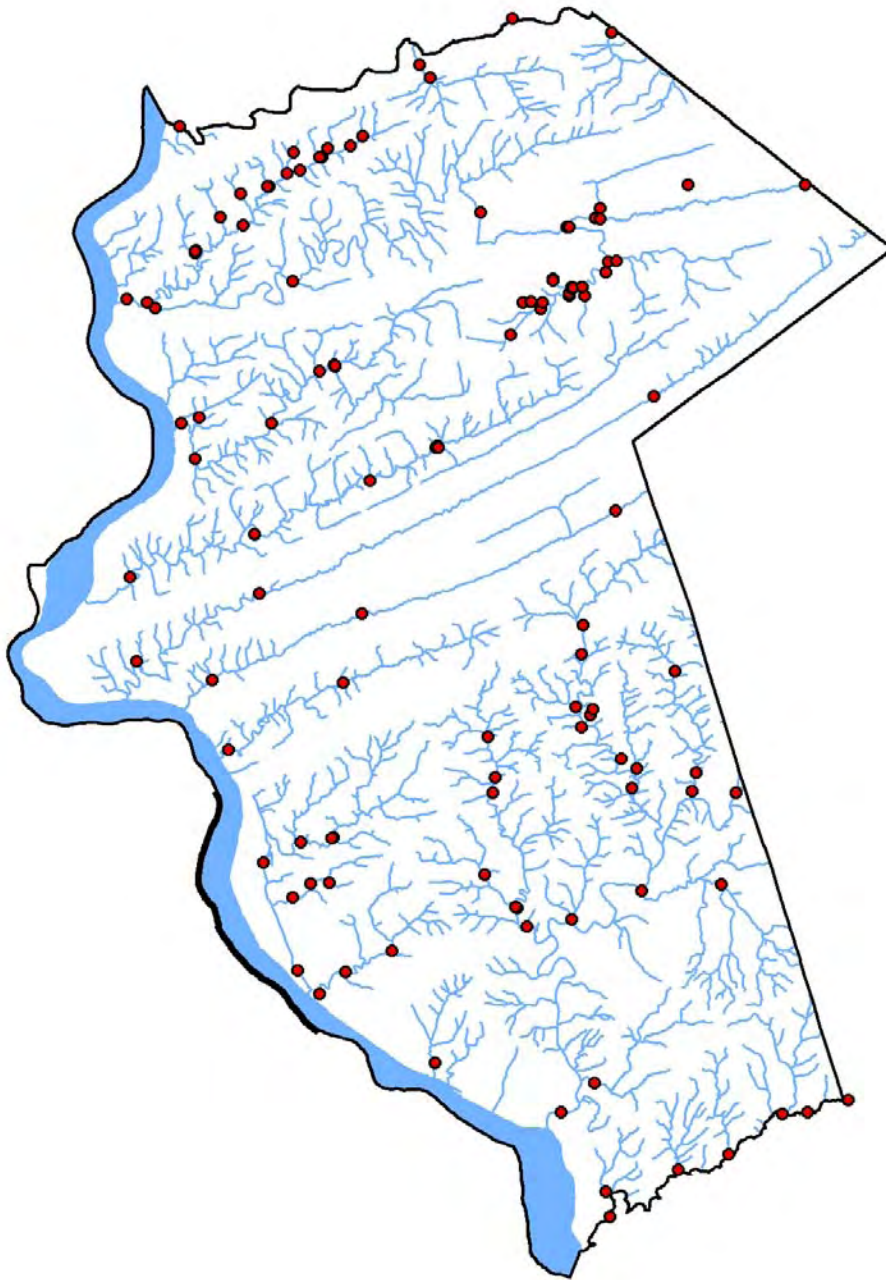
Eastern Pa. Coalition of Abandoned Mine Reclamation

Trout Unlimited

# **APPENDICES**

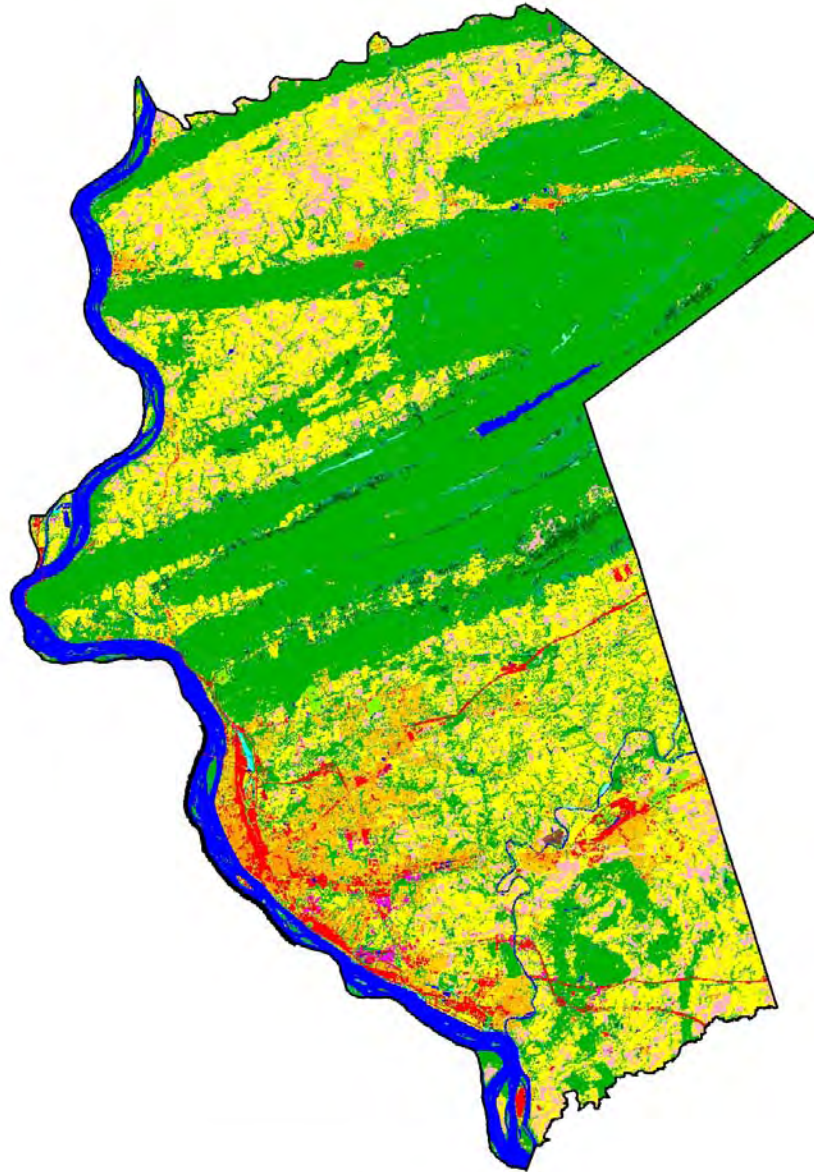
## Appendix A.

### Stream Sites Monitored by DCCD, 1998-2004



## Appendix B.

# Land Cover, Dauphin County



## **Appendix C.**

## **Appendix D.**

## Appendix E.

POPULATION AND  
LAND AREA OF  
AGRICULTURE  
REGIONS  
from 2003

REGION #1	MUNICIPALITY	POPULATION	AREA IN SQ. MI.	
	REED T.	182	5.9	
	HALIFAX T.	3329	27	
	WAYNE T.	1184	10	
	JEFFERSON T.	327	24.2	
	JACKSON T.	1728	42	
	UPPER PAXTON T.	3747	47	
	ELIZABETHVILLE B.	1500	0.5	
	GRATZ B.	700	3	
	WILLIAMSTOWN B.	1433	0.3	
	HALIFAX B.	900	1	
	WASHINGTON T.	2047	18.6	
	WICONISCO T.	1680	10.1	
	WILLIAMS T.	1135	8.8	
	MIFFLIN T.	676	15.26	
	LYKENS T.	1095	26.4	
	BERRYSBURG B.	365	1	
	MILLERSBURG B.	2800	1.43	
	LYKENS B.	1986	2.2	
	PILLOW B.	304	1.5	
TOTALS		27118	246.19	
REGION #3	DERRY T.	21273	28	
	LONDONDERRY T.	5217	22	
	CONEWAGO T.	2800	32	
	HUMMELSTOWN B.	4360	1.5	
	ROYALTON B.	963	0.33	
TOTALS		34613	83.83	
REGION #2	EAST HANOVER T.	5332	32.47	EXCLUDES LAND AREA NORTH OF BLUE MOUNTAIN
	WEST HANOVER T.	6505	15.07	EXCLUDES LAND AREA NORTH OF BLUE MOUNTAIN
	SOUTH HANOVER T.	4793	11.7	
TOTALS		16630	59.24	

## Appendix F.

### DAUPHIN COUNTY LAND USE

<b>LANDUSE</b>	<b>ACRES</b>	<b>MI.2</b>	<b>% OF COUNTY</b>
AGRICULTURE	70134	109.58	19.6
FOREST	166651	260.39	46.7
MIXED OPEN	50708	79.23	14.2
PERVIOUS DEVELOPED	30172	47.14	8.4
IMPERVIOUS DEVELOPED	18323	28.63	5.1
OPEN WATER	20799	32.50	5.8
TOTALS	356787	557.47	99.8

PORTION OF LOWER SUSQUEHANNA EAST  
WATERSHED - 22.3%

## Appendix G.

PRACTICE	UNITS	TOTAL IMPLEMENTATION	REPORTED 1985-2002	REMAINING	LAND USE
ABANDONED MINED LAND RECLAMATION	ACRES	137	150	+13	MO
ANIMAL WASTE MANAGEMENT SYSTEMS	AEUs	7968	7354		AG
CARBON SQUESTRATION	ACRES	6047	0		AG
CONSERVATION (FARM) PLANS	ACRES	46165	22396		AG
CONSERVATION TILLAGE	ACRES	21618	24293	+2675	AG
COVER CROPS (early)	ACRES	19930	0	19930	AG
DIRT AND GRAVEL ROAD PRACTICES	FEET	101106	23678	77428	UR/FO
EROSION AND SEDIMENT CONTROLS	ACRES	1430	1437	+7	UR
FOREST BUFFERS	ACRES	2475	51	2424	AG/UR/MO
GRASS BUFFERS	ACRES	1487	3	1484	AG/UR
HORSE PASTURE MANAGEMENT	ACRES	9943	0	9943	AG
LAND RETIREMENT	ACRES	5393	1307	4086	AG
MANAGED PRECISION AGRICULTURE	ACRES	23801	0	23801	AG
MORTALITY COMPOSTERS	AEUs	0	0	0	AG
NON-URBAN STREAM RESTORATION	FEET	0	0	0	AG/MO/FO
NO-TILL	ACRES	9965	0	9965	AG
NUTRIENT MANAGEMENT	ACRES	8062	26868	+18806	AG/MO
OFF STREAM WATERING W/FENCING	ACRES	3120	237	2883	AG
OFF STREAM WATERING W/O FENCING	ACRES	1872	31	1741	AG
PRECISION ROTATIONAL GRAZING	ACRES	749	0	749	AG
ROTATIONAL GRAZING	ACRES	499	119	380	AG
SEPTIC DENITRIFICATION (family units)	UNITS	18840	1515	17325	UR
STREET SWEEPING	ACRES	1837	0	1837	UR
SWM - FILTRATION	ACRES	14210	0	14210	UR
SWM - INFILTRATION PRACTICES	ACRES	14210	0	14210	UR
SWM - WET PONDS & WETLANDS	ACRES	14210	0	14210	UR
TREE PLANTING	ACRES	535	589	+54	AG/MO
URBAN SPRAWL REDUCTION	ACRES	146	0	146	UR

<b>PRACTICE</b>	<b>UNITS</b>	<b>TOTAL IMPLEMENTATION</b>	<b>REPORTED 1985-2002</b>	<b>REMAINING</b>	<b>LAND USE</b>
URBAN NUTRIENT MANAGEMENT	ACRES	26515	0	26515	UR
WETLAND RESTORATION	ACRES	80	16	64	MULTIPLE
URBAN STREAM RESTORATION	FEET	0	0	0	UR
FOREST HARVESTING PRACTICES	ACRES	0	0	0	FO
YIELD RESERVE	ACRES	8062	0	8062	AG
DAIRY - PRECISION FEEDING	AEUs	6244	0	6244	AG
DAIRY - AMMONIA EMISSION CONTROLS	AEUs	2081	0	2081	AG
SWINE - PHYTASE FEED ADDITIVE	AEUs	509	0	509	AG
SWINE - AMMONIA CONTROLS	AEUs	260	0	260	AG
POULTRY - PHYTASE FEED ADDITIVE	AEUs	4956	0	4956	AG
POULTRY - AMMONIA CONTROLS	AEUs	4213	0	4213	AG
Land Use: AG-Agriculture, MO-Mixed Open, UR-Urban, FO-Forest, Multiple-Multiple Land Use					

## Appendix H. Appendix H.

U.S. Census Bureau

### 2002 NAICS Definitions

## 11 Agriculture, Forestry, Fishing and Hunting

### The Sector as a Whole

The Agriculture, Forestry, Fishing and Hunting sector comprises establishments primarily engaged in growing crops, raising animals, harvesting timber, and harvesting fish and other animals from a farm, ranch, or their natural habitats.

The establishments in this sector are often described as farms, ranches, dairies, greenhouses, nurseries, orchards, or hatcheries. A farm may consist of a single tract of land or a number of separate tracts which may be held under different tenures. For example, one tract may be owned by the farm operator and another rented. It may be operated by the operator alone or with the assistance of members of the household or hired employees, or it may be operated by a partnership, corporation, or other type of organization. When a landowner has one or more tenants, renters, croppers, or managers, the land operated by each is considered a farm.

The sector distinguishes two basic activities: agricultural production and agricultural support activities. Agricultural production includes establishments performing the complete farm or ranch operation, such as farm owner-operators, tenant farm operators, and sharecroppers. Agricultural support activities include establishments that perform one or more activities associated with farm operation, such as soil preparation, planting, harvesting, and management, on a contract or fee basis.

Excluded from the Agriculture, Forestry, Hunting and Fishing sector are establishments primarily engaged in agricultural research and establishments primarily engaged in administering programs for regulating and conserving land, mineral, wildlife, and forest use. These establishments are classified in [Industry 54171](#), Research and Development in the Physical, Engineering, and Life Sciences; and [Industry 92412](#), Administration of Conservation Programs, respectively.

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