Middle Conodoguinet Creek Watershed Rivers Conservation Plan

Compiled by
The Pennsylvania Environmental Council

For the
Conodoguinet Creek Watershed Association

June 2004

Acknowledgements

This project was funded by the Pennsylvania Department of Natural Resources and Conservation.

The Conodoguinet Creek Watershed Association would like to thank the following people for contributing to the development of this document.

Eric Bear
Fred Bohls
Dale Bowman
Joan Brehm
Andy DeGregorio
Pat Devlin
Diana Dugas
Jane Earle
Ronald Freed
Gil Freedman
Craig Houston
Evan Jenkins
Richard Mains
Vince McCollum
Charlie McGarrell
Susan Parry
Lillie Porter
Alan Tamm
Kim Van Fleet
Stephanie Williams
Wilbur Wolf
Candie Wilderman
Christopher Woltemade

Alliance for Aquatic Resource Monitoring (ALLARM)
Alliance for the Chesapeake Bay
Canaan Valley Institute
Cumberland County Conservation District
Cumberland County Planning Commission
Pennsylvania Emergency Management Agency
Shippensburg University
Tri-County Planning Commission

Maps

Tables

Appendices

Executive Summary

I. Introduction & Background

The Conodoguinet Creek flows through Cumberland and Franklin counties of Southcentral Pennsylvania. From the Horse Valley next to Kittatinny Mountain at an elevation of 1680 feet, the Conodoguinet Creek flows 104 miles through the fertile Cumberland Valley of Pennsylvania, joining the Susquehanna River near Harrisburg. As it meanders north-eastwardly across a broad plain between Blue Mountain on the north and South Mountain on the south, the Conodoguinet flows through Buchanan State Forest and State Game Lands No. 76 then flows into Letterkenny Reservoir and changes course to a southeasterly flow. Coming from an Indian word meaning "a long way with many bends," the creek drains 524 square miles of diverse lands. Forested areas cover the upland basin, giving way to intense agriculture throughout the valley and rapidly expanding suburban areas downstream. The Conodoguinet meanders thru the suburban west shore of Harrisburg in a series of elaborate bends and loop where it meets the Susquehanna River.

The primary goal of this plan was to develop recommended management actions based on identified and prioritized problems and opportunities of water resource management inherent in the middle third of the Conodoguinet watershed. This was accomplished by first defining characteristics and resources of the study area, followed by identification of potential problems arising from both the static and dynamic characteristics of the area and by input from public meetings. The study concludes by presenting opportunities for implementable actions and recommendations for future study.

The recommended management actions encourage proper land use planning, including multi-municipal planning to address corridor-wide issues. Based on the growth potential of the corridor, increased development pressure is likely to occur. Heightened water quality and quantity related issues will likely affect the Middle Conodoguinet if not planned and managed carefully. This document is a resource to be used by the county and municipalities when creating and implementing land use plans and policies for the Middle Conodoguinet Creek corridor and watershed.

II. Project Area Characteristics

The River Conservation Plan covers a one-mile corridor on either side of the Conodoguinet Creek. The plan study area includes the middle portion of the Conodoguinet Creek watershed bounded by Alexanders Spring Creek, Green Spring Creek, Brandy Run, and Opossum Creek. This area includes all or part of the Borough of Newville, as well as, Upper and Lower Frankford, Upper and Lower Mifflin, West Pennsboro, North and South Newton, Southhampton, North and South Middleton, Dickinson, and Penn Townships in Cumberland County.

Land use within the project area is primarily agricultural. However, development pressure is encroaching into the watershed. The increasing population places additional demands for water supply and sanitary waste disposal, while producing

increased amounts of stormwater and polluted runoff, which often causes water quality and quantity problems.

The local economy is diverse in nature, including agriculture, industry, and professional services. Economics in this area are often related to the transportation network, which centers in the middle of Cumberland County. Local facilities and infrastructure such as emergency services, schools, libraries, and waste disposal are provided for within the area.

III. Physical Features – Land and Water Resources

The study area is rich in land and water resources. There are sixteen tributaries located in the project area. The Conodoguinet Creek watershed lies within in the Great Valley section of the Ridge and Valley physiographic province, which is characterized as a series of twisted mountains and valleys. The mountains are comprised largely of erosion resistant sandstone and quartzite; valleys generally contain either shale or limestone as the underlying rock. The area's topography, soils, hydrogeology are uniquely arranged in both a karst environment, which means sinkholes, and an abundance of high quality farmland. The Creek itself has unique qualities that demonstrate the area's distinctive environment. Water quality within the study area has been studied through the Pennsylvania Department of Environmental Protection's Stream Assessment program and through local monitoring projects. Water quality and quantity are impacted greatly by the karst environment, agriculturally related pollution, and other point and non-point sources of pollution.

IV. Biological Resources

The study area has a number of biological resources, including the local ecological environment and wildlife habitat. Cumberland County is located west of the Susquehanna River and lies in the state's Ridge and Valley Province. The Project Area encompasses a mix of forest to the north, agriculture, small towns and suburbs. Development patterns in the county have been greatly influenced by the dominant features of the landscape itself. The Great Valley, incorporating central Cumberland County, contains the majority of the urban and intensely agricultural areas. However, Cumberland County still contains a patchwork of natural and human-dominated habitats, including cropland, pasture, young and old forests, ponds, streams, and rivers. These areas are used for hunting, fishing, hiking, birdwatching, and other activities, which make the region an attractive place to live. The same pieces of the landscape, which provide scenic and recreational opportunities, also function as habitat for a great diversity of plants and animals, including some that are rare, threatened and endangered species. Cumberland County contains intact examples of natural communities and sites for species rare in the state or even globally rare.

V. Cultural Resources

From Paleolithic times to the early colonial period and up to the present day, the Conodoguinet has been an integral part of Cumberland County and its history. The fertile soils, level terrain, and the abundant and voluminous springs played an important role in the settlement of the Cumberland Valley. In the past the Conodoguinet has

served as a source of water, food, power for industry, a means for transportation, and as a place of natural beauty. Today its legacy lives on. Like so many places, current land use within the middle reaches of the Conodoguinet watershed was dictated by land use long ago. There are a large number of historic sites in the study area, including historic mills, homes, bridges, and archeological sites. In terms of recreation, there are several types of recreational facilities offering a variety of uses located within or adjacent to the middle reaches of the Conodoguinet Creek watershed and on the Creek itself. Greenways offer an important functional link between recreation systems. Connecting community places, such as parks, schools and nature areas, to the regional greenways and greenway links is done with functional links. There are three regional greenways located in the project area: the Conodoguinet Creek, the Cumberland Valley Rails to Trails corridor and Big Spring/Doubling Gap Run. These connect areas in Cumberland County with areas outside the county.

VI. Community Input - Issues, Concerns, Constraints, and Opportunities

Community outreach included asking for input on issues, concerns, constraints, and opportunities within the watershed. Two public meetings were held during the plan process. The first was held to kick-off the plan and generally spread the word that the plan was underway. The Advisory and Technical Committee was created after the first meeting. In March of 2001, a letter was sent to the municipalities explaining the purpose of the plan and asking for further input on comments received at first public meetings. Two of the townships responded. In accordance with the plan process, the second public meeting was held as an informational review and input meeting on the plan process and the plan's draft goals and recommended actions. Another piece of the public participation was a community survey also completed as part of the public participation effort.

VII. Management Options and Recommendations

Based upon available resources identified through the planning process, several management options and recommendations have been developed to address the various issues, concerns, constraints, and opportunities within the Middle Conodoguinet Creek corridor. Recommendations include resource protection, land use issues, and habitat issues. Implementation of these recommendations will help restore, maintain, and enhance the Middle Conodoguinet Creek watershed. There are many agencies and organizations immediately available to assist in the Middle Conodoguinet Creek watershed with implementation of these recommendations.

I. Introduction & Background

A. The Conodoguinet

The Conodoguinet Creek flows through Cumberland and Franklin counties of Southcentral Pennsylvania. From the Horse Valley next to Kittatinny Mountain at an elevation of 1680 feet, the Conodoguinet Creek flows 104 miles through the fertile Cumberland Valley of Pennsylvania, joining the Susquehanna River near Harrisburg. As it meanders north-eastwardly across a broad plain between Blue Mountain on the north and South Mountain on the south, the Conodoguinet flows through Buchanan State Forest and State Game Lands No. 76 then flows into Letterkenny Reservoir and changes course to a southeasterly flow. Coming from an Indian word meaning "a long way with many bends," the creek drains 524 square miles of diverse lands. Forested areas cover the upland basin, giving way to intense agriculture throughout the valley and rapidly expanding suburban areas downstream. The Conodoguinet meanders thru the suburban west shore of Harrisburg in a series of elaborate bends and loop where it meets the Susquehanna River.

B. History of Planning Activities

Because of limited resources within the Conodoguinet Creek Watershed Association (CCWA), it was decided to divide the watershed into thirds and confine this study to one-third of the watershed. As the middle third of the watershed was determined to have the greatest potential for change in the near future, it was concluded that this area would also have the greatest potential to identify issues and opportunities; therefore, it was selected as the area to be recommended for this study. Coming under increasing development pressure as people move into this highly desirable agricultural area of Southcentral Pennsylvania, the area is expected to experience increased loss of prime agricultural land to residential, commercial, and industrial development. Increased development in this central portion of the watershed has had a major impact on water quality and quantity and the area's overall ecosystem. These are the primary concerns and potential for planned growth opportunities addressed in this study.

The PA Department of Conservation and Natural Resources (DCNR) awarded a Rivers Conservation Planning grant to the CCWA in 1999. A steering committee was formed at the onset of the project. This committee met regularly throughout the planning process. A public meeting was held October 12, 2000 to inform the public about the study and to gather information on the problems, local issues, and concerns. Identified topics became the focus of the plan.

Watershed association volunteers largely assisted in plan development. Data was collected, analyzed, and developed into the draft RCP, which was presented for public review at the second public meeting, held on September 29, 2001. Many comments were received and the plan amended accordingly. The plan presented herein is the final version prepared by the CCWA in conjunction with Pennsylvania Environmental Council and additional input from the public.

Upon final approval of the plan, it will be submitted for inclusion on the Pennsylvania Rivers Registry. Inclusion on this list will allow DCNR to provide matching grants to entities that are interested in implementing the recommended Middle Conodoguinet management options.

C. Goals and Objectives

The primary goal of this plan was to develop recommended management actions based on identified and prioritized problems and opportunities of water resource management inherent in the middle third of the Conodoguinet watershed. This was accomplished by first defining characteristics and resources of the study area, followed by identification of potential problems arising from both the static and dynamic characteristics of the area and by input from public meetings. The study concludes by presenting opportunities for implementable actions and recommendations for future study.

The recommended management actions encourage proper land use planning, including multi-municipal planning to address corridor-wide issues. Based on the growth potential of the corridor, increased development pressure is likely to occur. Heightened water quality and quantity related issues will likely affect the Middle Conodoguinet if not planned and managed carefully. This document is a resource to be used by the county and municipalities when creating and implementing land use plans and policies for the Middle Conodoguinet Creek corridor and watershed.

II. Project Area Characteristics

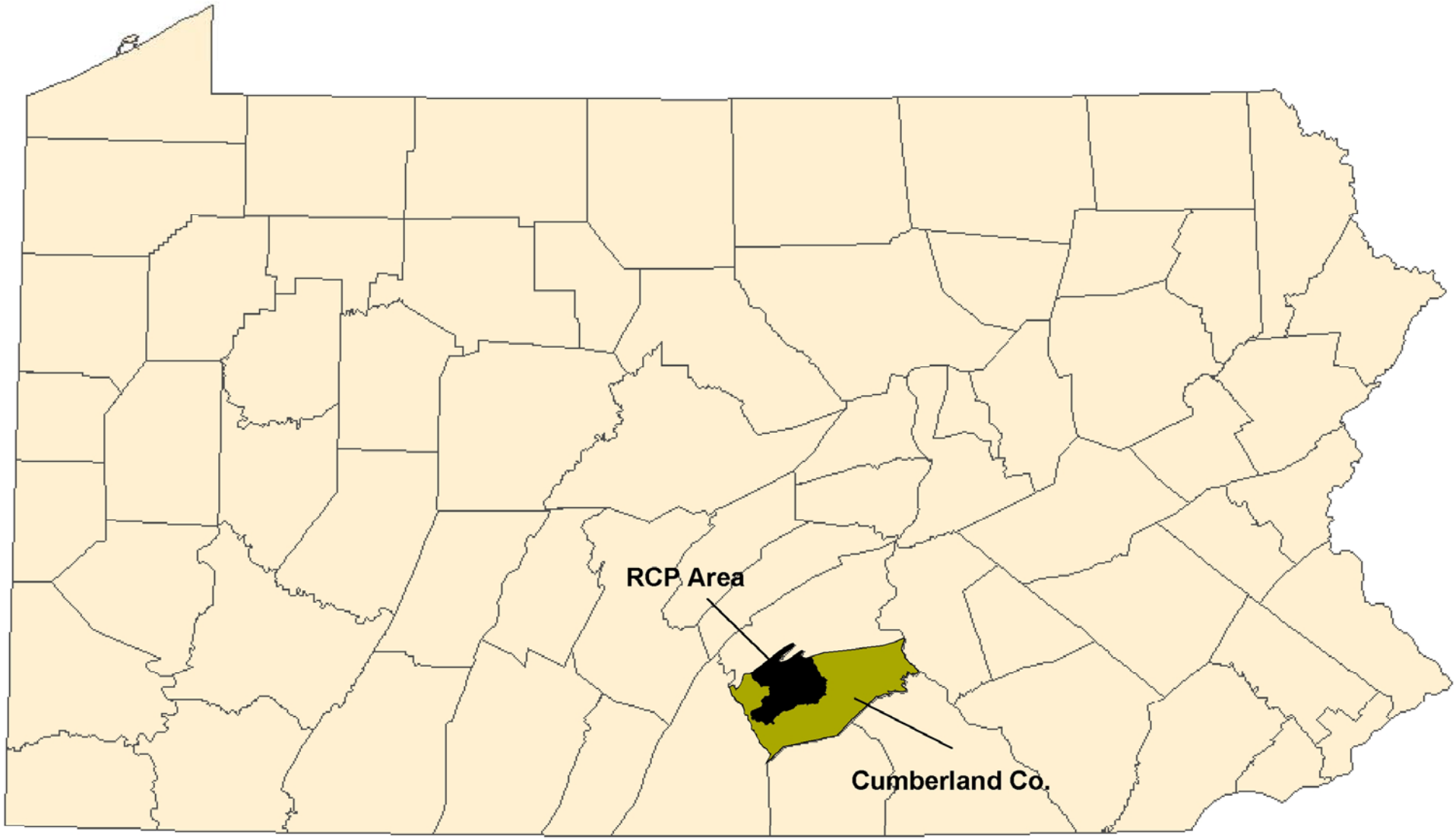
A. The Middle Conodoguinet

Located in northern Cumberland County and the upper third of Franklin County, the watershed consists of 681 relatively small tributary streams, many of which are unnamed tributaries. The largest tributary watersheds are Middle Spring Creek, with a 47.7 square mile drainage basin, and Muddy Run at 42.1 square miles. All other tributaries have drainage areas less than 26 square miles. The Conodoguinet Creek is part of the Chesapeake Bay system, one of the most important and productive estuaries in the eastern United States.

The River Conservation Plan covers a one-mile corridor on either side of the Conodoguinet Creek. The plan study area includes the middle portion of the Conodoguinet Creek watershed bounded by Alexanders Spring Creek, Green Spring Creek, Brandy Run, and Opossum Creek. This area includes all or part of the Borough of Newville, as well as, Upper and Lower Frankford, Upper and Lower Mifflin, West Pennsboro, North and South Newton, Southhampton, North and South Middleton, Dickinson, and Penn Townships in Cumberland County.

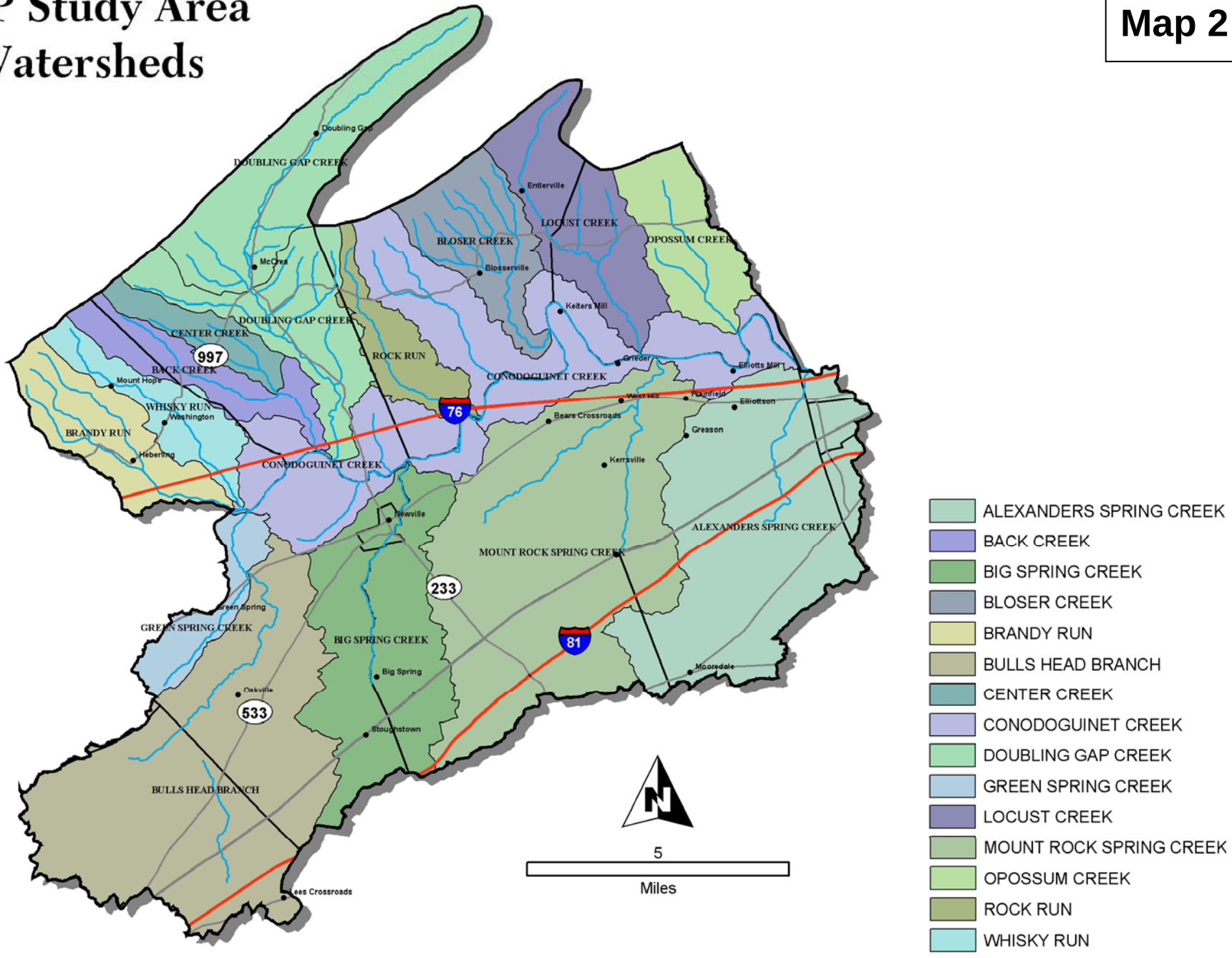
Pennsylvania Location of RCP area

Map 1



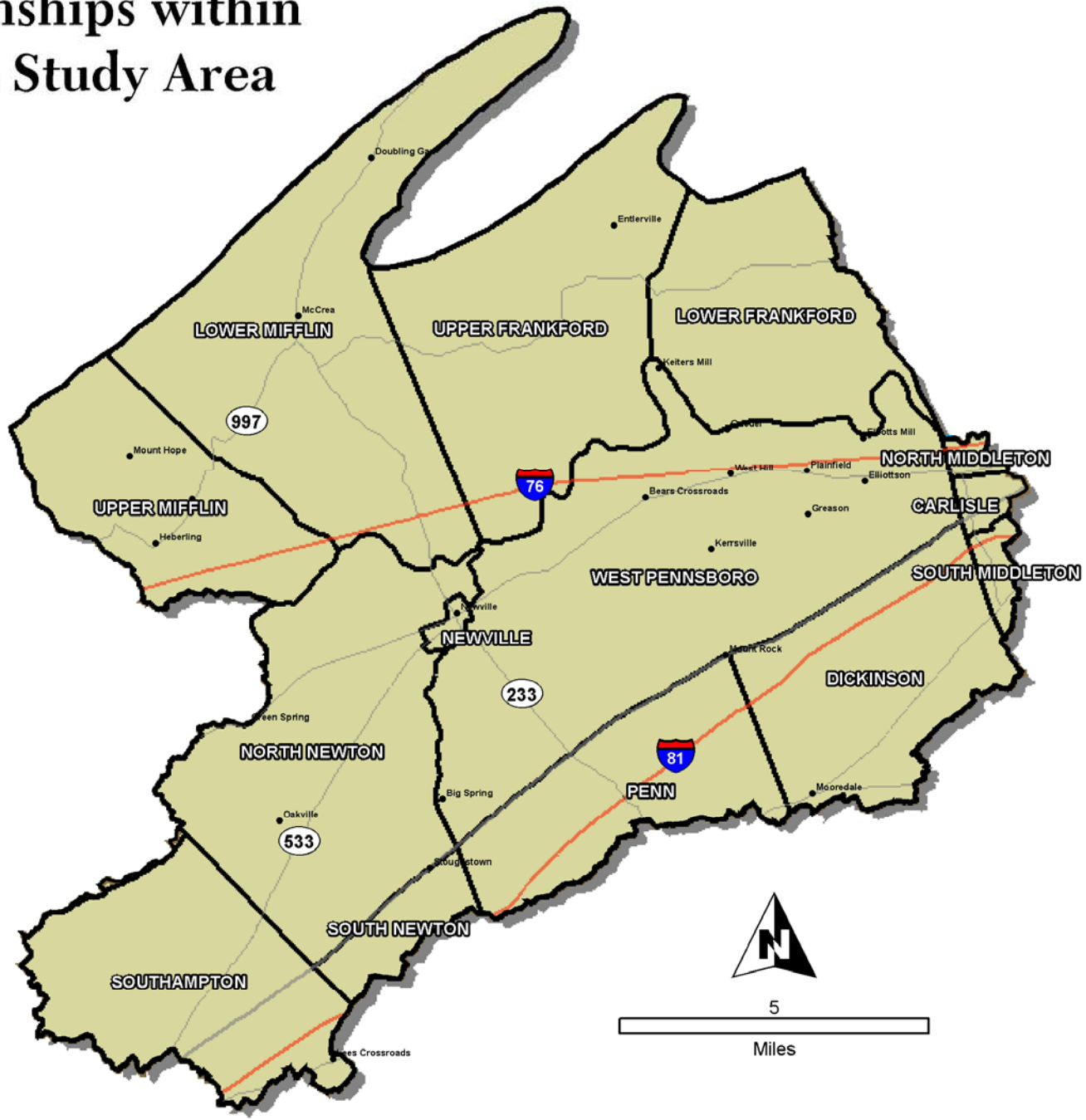
RCP Study Area Watersheds

Map 2



Townships within the Study Area

Map 3



B. Land Use and Zoning

County and Local Government land use planning efforts include Comprehensive Plans, Zoning Ordinances, and Subdivision and Land Development Ordinances. These documents provide guidelines and regulations regarding land use. Cumberland County is currently undergoing a Comprehensive Planning process, including a Greenway and Open Space component. The following table lists the Townships within the study area that have comprehensive plans, zoning ordinances, and subdivision and land development ordinances.

Table 1 Comprehensive Plans, Zoning and Subdivision Ordinances

Cumberland County Municipalities	Comprehensive Plan	Zoning Ordinance	Subdivision and Land Development Ordinance
Dickinson Twp	Yes	Yes	Yes
Lower Frankford Twp	Yes	Yes	Yes
Lower Mifflin Twp	Yes	Yes	Yes
Newville Borough	Yes	Yes	Yes
North Middleton Twp	Yes	Yes	Yes
North Newton Twp	Yes	No	Yes
Penn Twp	Yes	No	Yes
South Middleton Twp	Yes	Yes	Yes
South Newton Twp	Yes	Yes	Yes
Southampton Twp	Yes	No	Yes
Upper Frankford Twp	Yes	No	Yes
Upper Mifflin Twp	No	No	Yes
West Pennsboro Twp	Yes	Yes	Yes

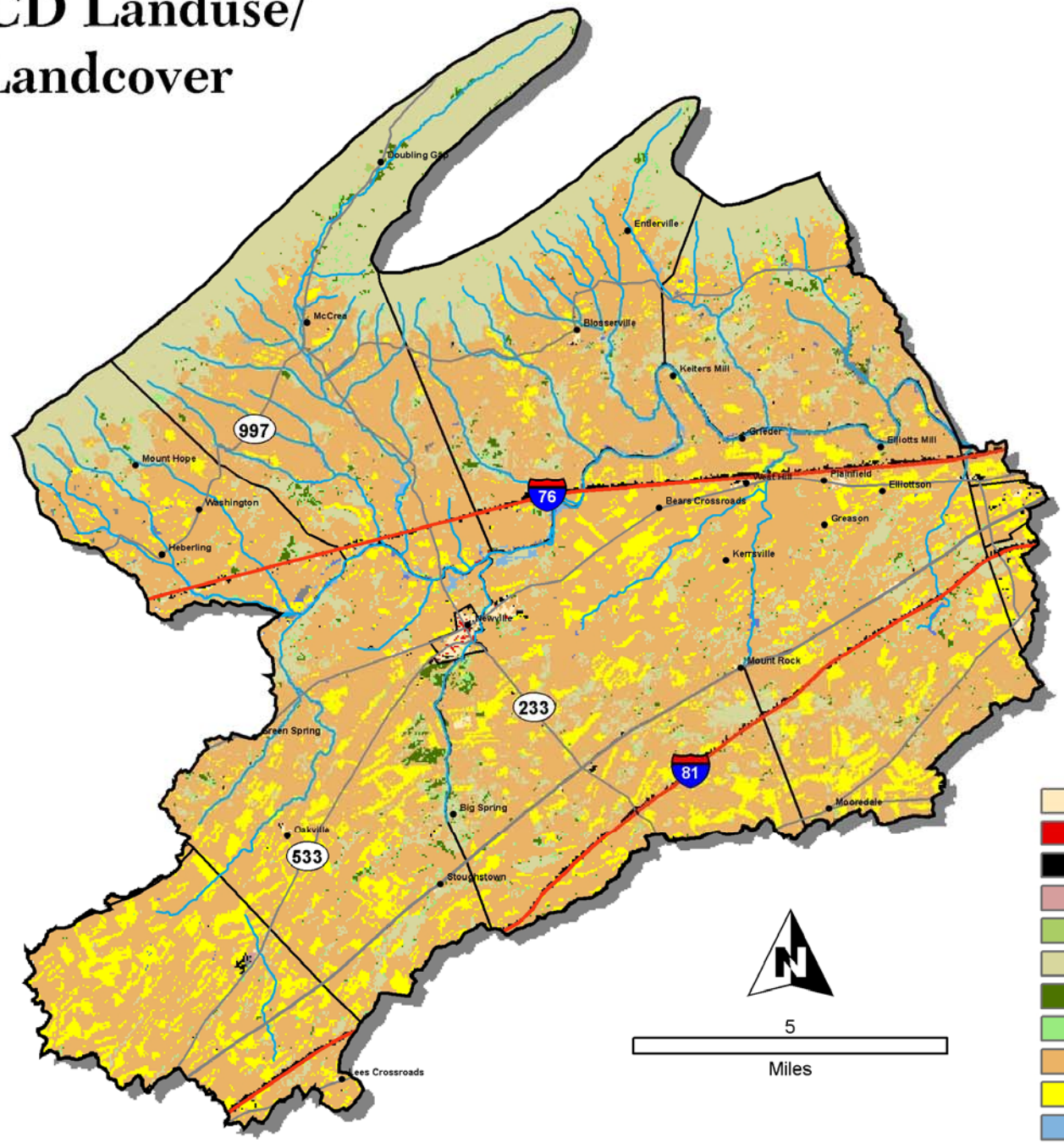
(Source: Governor's Center for Local Government Services, Municipal Statistics, County/ Municipal/ School District Information – www.inventpa.com).

A relatively large percent (28.4%) of the Conodoguinet Creek watershed is still forested in comparison to other land uses in the watershed. The majority of the forested acres, however, are in the mountainous portions of the upper watershed in Franklin County, on the steep slopes of Blue Mountain in northern Cumberland County, or on the northern flank of South Mountain in southwestern Cumberland County. Much of the forested areas in the upper areas of the watershed are state-owned, with scattered houses and camps. However, other than a few State Gamelands, the woodland in the area covered by this plan is privately owned.

The middle half of the subbasin is largely agricultural, taking advantage of the productive limestone soils and the flat-lying terrain. The highest percentage of agricultural land use is in the watersheds of the limestone spring creeks; the highest is 92.9% in the Bulls Head/ Green Spring Creek watershed.

NLCD Landuse/ Landcover

Map 4



- Low Intensity Residential 0.4%
- High Intensity Residential .03%
- Commercial/Industrial/Transportation 0.9%
- Quarries/Strip Mines/Gravel Pits .01%
- Transitional .01%
- Decidous Forest 20.6%
- Evergreen Forest 1%
- Mixed Forest 1.6%
- Pasture/Hay 62.3%
- Row Crops 11.7%
- Woody Wetlands 0.5%
- Emergent Herbaceous Wetlands 0.2%

Prime agricultural lands are still fairly abundant in the central and western portions of Cumberland County and northern Franklin County. The northern shale valley and mountain foothills also have some farms, but soils there are shallower and stonier and are not as productive as the limestone soils and the terrain is much hillier than in the limestone valley. Much of shale belt below Blue Mountain contains woodlots, scattered rural houses and villages, and more recently, residential developments.

C. Social/Economic Profile

An assessment of the population and economic trends is a critical component of any resource characterization. Cumberland County's continuing growth in population and economic diversification has many ramifications for the Conodoguinet Creek watershed. Open lands are being converted at increasing rates, and development on these lands removes riparian buffers and produces increasing amounts of stormwater and "polluted runoff" (nutrient, sediment, toxicant non-point source pollution). The increasing population places additional demands for domestic water supply and for sanitary waste disposal, both of which have direct implications for the Middle Conodoguinet Creek watershed.

1. Population Trends

Cumberland County is a region of Pennsylvania where the population continues to grow. Currently the central and western portions of the county retain a fairly rural environment, which is punctuated by a number of small towns and boroughs. Prime agricultural lands are still fairly abundant in the central and western portions of the county. The eastern portion of the Cumberland County is already highly urbanized, but prior to the 1960's it was much like its western component.

During the past several decades, Cumberland County has become a major hub in the transportation industry, as well as becoming a desirable location for many new businesses, industry, and warehousing. This is true especially for the area around the borough of Carlisle. To date, much of the real estate east of Carlisle, especially along Route 11 (where most trucking terminals are located), has been developed. Also, since real estate has become scarce east of Carlisle, land west of Carlisle is now taking on a new appeal to developers and businesses alike.

This expanding and diversified economy is just one factor contributing to the rapid increase in the local population. Other factors include domestic migration, international migration, births, and deaths. The county's population has more than doubled since 1950. Between 1980 and 1990, it increased by 8.7%, whereas Pennsylvania's population increased by 0.1%. Additionally, Cumberland County is the state's 18th most populated county and has the 13th highest growth rate.

According to the 2000 US Census, the population of Cumberland County is now 210,674. This figure shows a net population change of 15,417 persons since the 1990 US Census (195,257people). Although population has increased overall, intra-county migration has also occurred. In recent years, numerous people have moved from urban to rural areas within the county. This movement of individuals accounts

for an increase of the number of inhabitants in 20 of the county's 22 townships as well as the decline in residents for seven of the 11 boroughs.

In 1990 the combined populations of the 11 townships of the Middle Conodoguinet region equaled 34,020 people or 17.4% of the total number of people living in the county. According to the 2000 US Census, all but one of the townships within the Middle Conodoguinet Creek area have experienced population growth. The greatest amount of growth has occurred in Lower Frankford, Upper Mifflin, Southampton, and South Middleton Townships (23 – 36% increase). The populations of Dickinson, Penn, and North Newton Townships have increased by 17 – 23% while West Pennsboro, Upper Frankford, and South Newton grew by 0 – 11 %. Lower Mifflin was the only township showing a decline in population (-10 – 0%).

The county's population is expected to continue to grow at the current rate well into this century. Continued growth results in demands for new housing. As demands for new housing increases, the pressure for development of rural areas including prime farmland presents an issue. The end result if left unchecked will be the loss of these agricultural lands and the income generated by many family owned farms.

Another associated problem of growth is increased impervious surface, which results in related stormwater issues. As a side note, the majority of homes in these areas rely on private wells as well as on lot septic systems for waste disposal. Therefore, the population movement from urban centers to more rural surroundings will most likely affect both water quality and quantity in the future.

2. Economy and Employment

Cumberland County retained its rural characteristics until the advent of the industrial age. It was during this time that a number of enterprises were established and the overall character of the county began to change. A large number of iron deposits throughout the region were the source of the raw material needed in the iron making industry. The heavily forested mountains supplied the trees that were used in making charcoal, a vital component to iron production. By the early 1900s, most of the mountains in the area had been logged.

By 1928, other manufacturing pursuits dominated the regional economy. The largest industry was textile mills followed by the production of leather and rubber goods, metal and metal products, shoes, food, food products, carpets, and rugs. Many of these industries were located within the towns and boroughs of the county without encroaching upon the local agrarian community. Some are still in existence today employing a number of county residents.

In 1928, the local farming community was producing products, such as corn, wheat, oats, rye, potatoes, and hay. A number of fruit producing ventures (apples, peaches, and pears) also existed. Additionally, the local farms that produced milk, eggs, honey, wool, and a variety of livestock operations supported the rural economy.

Everything remained status quo until the end of World War Two. After the war, housing developments increased throughout the area. Rural areas, including farmland that had remained undeveloped throughout the history of the county was beginning to be developed.

Traditionally the county's economy was agricultural interspersed with manufacturing. Over the years the economy has become significantly more diverse with less dependence on agriculture. In 1987, total agricultural sales exceeded $67 million. During the period of 1974-1987, the primary farm industry indicators remained fairly constant, however, in the period of 1982-1987, the number of farms decreased by 6.7% and the total land in agricultural use decreased by 5.8% (10,560 acres). In 1990, the largest percentage (22.7%) of the county's workforce was employed in professional and related services (doctors, nurses, attorneys, engineers, accountants, consultants, etc.) Wholesale and retail trade (21.9%) and manufacturing (14.1%) were the next largest source of employment while at the other end of the scale, only 1.9% of the workforce was employed in agriculture, forestry, fisheries and mining. In addition to other trades, the transportation industry has exploded in this region over the past few decades. See section 3.a. for more information on transportation.

3. Transportation Routes and Facilities

a. Roadways

Several primary, secondary, and tertiary transportation routes are located within or partially within the project area. On any given day of the week over 75,000 vehicles including cars, trucks, buses, and tractor-trailers can be found on I-81 and the Pennsylvania Turnpike alone. U.S. Route 11 and Allen Road each carry over 10,000 vehicles per day. Map 5 and Table 2 for more detailed information on the areas roadways.

Cumberland County is within two to four hours of a number of major metropolitan areas including New York City, Baltimore, Philadelphia, and Pittsburgh. Two major divided highways pass through the watershed, the north/south I-81 and the east/west Pennsylvania Turnpike (I-76) (Map 5). The convergence of these major highways has made Cumberland County a major transportation and warehousing hub for the trucking industry. Trucking and storage terminals and commercial development are expanding the paved areas mainly along US Route 11 around the Borough of Carlisle. The trucking company terminals in and around Carlisle employ several thousand people. Most of the trucking companies are either general freight companies, which transport a wide variety of general commodities such as foods, clothing, household goods, pharmaceuticals, chemicals, and low-level radioactive wastes or specialized freight carriers transporting cargo that requires specialized equipment for transportation.

Table 2 Vehicle Trips

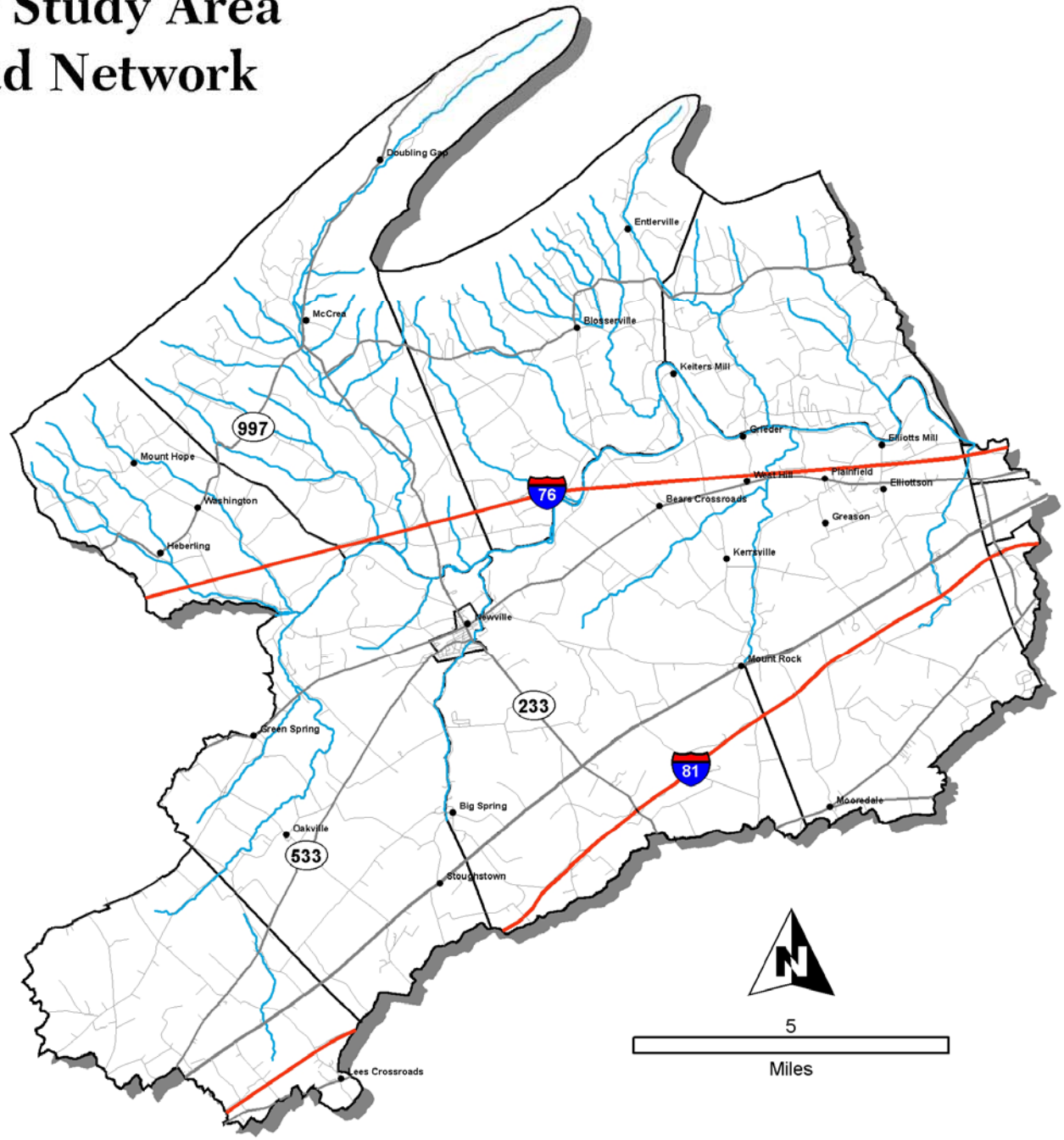
Highway or Route	Avg. vehicles/day	Location
Pennsylvania Turnpike	21,000	
Interstate 81	41,000	Southampton Township to North Middleton Township
Route 11	11,000	Allen Rd. (SR465) to Carlisle
	10,000	McCallister Church Rd. to Allen Rd.
	6,900	Mount Rock Rd. to McCallister Church Rd.
	4,700	SR 233 to Mount Rock Rd
	4,500	Stoughstown Rd to SR 233
	2,900	SR 533 to Stoughstown Rd
Allen Rd. (SR465)	12,000	Interstate 81 to Route 11
	4,700	Route 11 to SR 641 (Newville Rd.)
	13,000	Interstate 81 to SR 465
SR 641 (Newville Rd.)	5,900	Carlisle to Bears Crossroads
	6,700	Bears crossroads to Newville
SR 533	1,900	Newville to Shippensburg
SR 233	650	Doubling Gap to McCrea
	1,300	McCrea to SR4008
	4,200	SR 4008 to Newville
	4,900	Newville to Interstate 81
	3,100	Interstate 81 to Rt 3006
SR 944	950	SR 74 to Bloserville
	300	Bloserville to Rt 4019
	500	Rt 4019 to Rt 4012
	350	Rt 4012 to SR 233
SR 997	450	McCrea to Little Washington
	300	Little Washington to Heberlig
	600	Heberlig to SR 696

(Source: Cumberland County Traffic Volume Map published 2002, available on the PENNDOT website at ftp://ftp.dot.state.pa.us/public/pdf/BPR_pdf_files/MAPS/Traffic/Traffic_Volume/2001/cumberland_2001_tv.pdf)

On a daily basis, an estimated average of a half million tons of hazardous materials pass through the Carlisle area on tractor-trailers and trucks on the Interstates, as well as many of the state secondary routes. Much of this freight has also passed through the Middle Conodoguinet Creek watershed without a significant spill incident. A potential for accidental spills, however, does exist due to increasing vehicular traffic on these roads and the likelihood that accidents will occur.

RCP Study Area Road Network

Map 5



b. Rail Lines

There are no active rail lines within the study area. Abandoned rails include a Conrail Line that runs between Shippensburg and Carlisle. This line is currently being developed as a rail trail from Shippensburg to Newville.

4. Pipelines

Several underground pipelines cross the lands of the middle portion of Conodoguinet Creek watershed. A variety of petroleum products, ranging from natural gas to jet fuel, are transported through these pipelines. Most of the pipelines are over 40-50 years old.

5. Municipal, Fire, Medical, and Police Services and Facilities

All of the townships within the middle reaches of the Conodoguinet Creek watershed have municipal buildings, which serve as a hub for township operations. All municipalities in this region are serviced by their own municipal fire departments or through mutual agreements with neighboring communities. The following departments service all or parts of this area: Carlisle Fire Departments including Empire Hook and Ladder, Union Fire Company, Cumberland-Goodwill Fire and Rescue, and Friendship Fire Company, Mount Holly Springs Fire Department, Newburg-Hopewell Fire Department, Newville Fire Department, North Middleton Fire Department, Penn Township Fire Department, Shippensburg Fire Departments including Cumberland Valley Hose Co., West End Fire and Rescue, and Vigilant Hose Company, South Newton Fire Department, Upper Frankford Township Fire Department, and West Pennsboro Township Fire Department.

Emergency medical services are provided by a number of emergency medical service companies including Carlisle Community Ambulance, Shippensburg Ambulance Association, Newville Community Ambulance, Cumberland Ambulance Service which offers both Basic Life Support (BLS) and Advanced Life Support (ALS), and Chambersburg ALS (with a location in Southampton Township). Life Lion's two helicopter ships, stationed at the Milton S. Hershey Medical Center in Hershey, are available when needed. The Pennsylvania State police excluding Newville Borough, which has their own police force, services the majority of this region.

6. Education and Schools

Cumberland County is served by a number of public and private education institutions. There are nine school districts, which serve Cumberland County. Three serve residents living in the Middle Conodoguinet watershed. These school systems include Big Spring School District, Carlisle Area School District, and Shippensburg Area School District.

7. Libraries

There are a number of private and public libraries available to county residents. The public libraries fall under the Cumberland County Library System (CCLS). The system mission is to plan, develop, coordinate, and provide free, comprehensive

public library services for all residents of Cumberland County through a cooperative network of federated public libraries. The CCLS has two libraries, Bosler and West Shore, which act as reference resource centers. The CCLS also offers homebound delivery and nursing home service that provide large print books, audiocassettes and programming materials. Any county resident may register at and use library services at no charge. None of the public libraries are located within the middle region of the watershed, which is the focus of this report. Other libraries available to county residents include academic libraries, law libraries, special libraries, and libraries associated with state supported institutions.

8. Waste Removal and Recycling

Private hauling firms handle most of the solid waste collection within the municipalities. Residents in the study area are responsible for making their own arrangements with county licensed waste haulers.

Mandatory curbside recycling programs in accordance with Act 101 are required in North Middleton and South Middleton Townships. In all of the other municipalities, recycling is strictly a voluntary effort. There are three recycling drop-off centers near the study area: the Dickinson Township Voluntary Drop-off Recycling Program at the Dickinson Township Building (last Saturday of every month), the New Hope Recycling Drop-off at the Hopewell Township Building (first Saturday of the month), and the Big Spring Area Recycling at the Newville Lions Fairground in Newville (third Saturday of the month).

The county holds two hazardous waste drop-off days every year, in the spring and fall, at locations designated by the Cumberland County Solid Waste Authority. Similarly, the county holds two tire and appliance recycling drop-off days every year and one computer and electronics drop-off day. The county also hosts an annual telephone book recycling program and an ongoing compost program.

9. Hazard Waste Sites - Landfills

Currently only one landfill, Cumberland County Landfill, operates within the confines of the region targeted by this plan. There are several old unlined landfills that are no longer in use that, when in operation, were receiving sites for all sorts of refuse, including industrial and household wastes. Additionally, there are old small dumps on a number of the farms in this area. Each of these sites, depending on what is buried, has the potential to be a source of ground and surface water pollution.

III. Physical Features – Land and Water Resources

The study area is rich in land and water resources. There are sixteen tributaries located in the project area. The Conodoguinet Creek watershed lies within in the Great Valley section of the Ridge and Valley physiographic province, which is characterized as a series of twisted mountains and valleys. The mountains are comprised largely of erosion resistant sandstone and quartzite; valleys generally contain either shale or limestone as the underlying rock. The area's topography, soils, hydrogeology are uniquely arranged in both a karst environment, which means sinkholes, and an abundance of high quality farmland. Water quality and Quantity are impacted greatly by the karst environment, agriculturally related pollution, and other point and non-point sources of pollution. Water quality within the study area has been studied through the Pennsylvania Department of Environmental Protection's Stream Assessment program and through local monitoring projects.

A. Tributaries

Sixteen tributaries to the Conodoguinet Creek are located in the project area. These have a combined length of 71 miles.

Stream Name	Length (ft)
Brandy Run	21,800
Whiskey Run	21,700
Back Creek	13,750
Center Creek	22,900
Doubling Gap Creek	56,250
Rock Creek	23,300
unnamed tributary	17,000
Bloser Creek	21,600
Locust Creek	25,000
Opossum Creek	17,500
Alexander Spring	20,800
Mt. Rock Spring	21,600
unnamed tributary	20,800
Bulls Head Branch	25,800
Green Spring	20,800
Big Spring Creek	25,000

B. Topography

The topography largely determines surface water flow drainage patterns. Topography is controlled by the nature of the underlying bedrock. Sandstones present in Southcentral Pennsylvania typically are the most erosion-resistant rocks; hence sandstones normally form the highest elevations and the steepest slopes in Pennsylvania. Shale bedrock erodes somewhat less slowly than sandstones and forms a more hilly terrain in mountain foothills or valleys. Limestone and dolomite bedrock, known collectively as carbonates, generally erode rapidly in the relatively humid climate of Southcentral Pennsylvania, resulting in a relatively flat landscape. The dissolvable carbonate areas are prone to forming sinkholes or depressions that form when the

surface carbonate rock dissolves and the overlying ground collapses into the dissolved void.

C. Soils

Soils reflect the bedrock of their origin. Soils derived from shale are shallow, fine grained and rocky with slow or poor infiltration rates. Carbonate-derived soils are excellent for farming; however, infiltration rates are slow except at faults and ponding can occur during the rainy season, especially at sinkholes and depressions. Some areas of the limestone valley have large rock outcrops exposed with little or no soil covering. These outcrop areas are not suitable for crops and may be used for pasture or kept in woodlots.

Four soil associations are found in the study area of the Middle Conodoguinet Creek watershed:

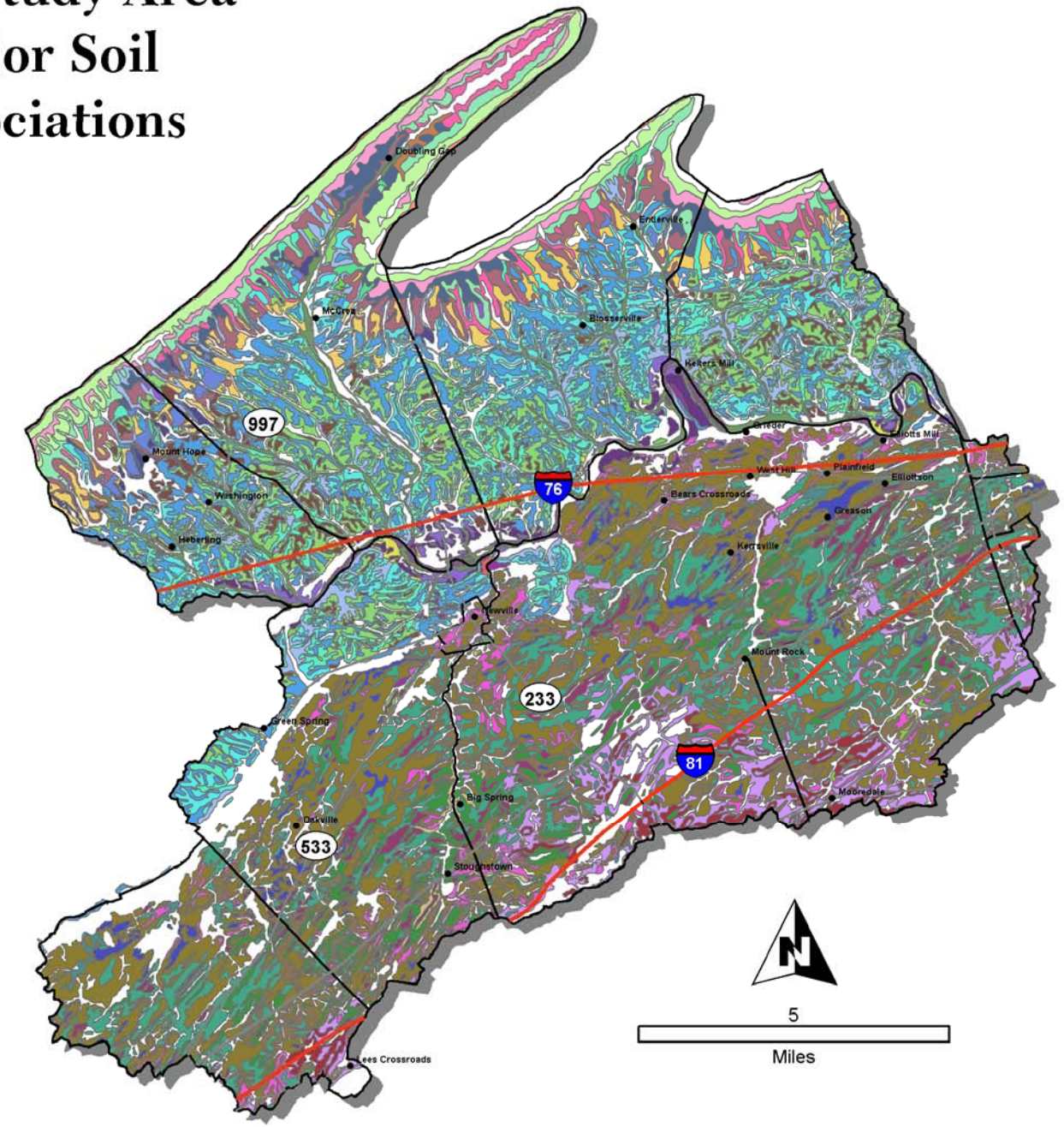
- **Berks-Weikert-Bedington Association -** Encompasses the entire area north and small sections south of the Conodoguinet Creek, were formed in material weathered from shale, siltstone, and sandstone. These soils are gently sloping to moderately steep soils when on the sides of hills and ridges, and moderately steep to very steep soils when on the sides of ridges and hills, along streams, and deeply cut drainage ways. In most areas, these soils are used as cropland, pasture, and woodland, for which the soil is fairly suited. They are also used as home sites, and in a few areas, as industrial sites. Soil limitations include most non-farm uses, especially on-site waste disposal.
- **Hagerstown-Duffield Association -** Formed in material weathered from limestone, contains best agricultural soils in Cumberland County. These soils are nearly level to gently sloping soils when found on valley floors and sloping and moderately steep soils when found on intermediate ridges. In most areas, they are used for cropland, pasture, and woodland. However, they are also used as housing and industrial sites. Soil limitations include home sites and most other non-farm uses.
- **Hazleton-Laidig-Buchanan Association -** Found along the top of Blue Mountain, was formed in material weathered from gray and brown quartzite, sandstone, siltstone, and shale. This association consists of nearly level to sloping or moderately steep to very steep soils on the sides of ridges and mountains in upland areas. Most of this soil area is in woodland. The soils here are too stony or too steep to be used for agricultural uses. Where the slopes are more level, trees have been cleared and stones been removed to use the land for pasture. Soil limitations include most non-farm uses because of rapid and moderately rapid permeability, the high content of coarse fragments, and depth to bedrock, slope, large stones on the surface, and a seasonal high water table. The Buchanan type soil has severe limitations for most non-farm uses, especially for home sites and on-site waste disposal.
- **Monongahela-Atkins-Middlebury Association -** Underlies the creek and constitutes its floodplain, was formed from alluvium. This association consists of nearly level and gently sloping soils along streams and river terraces and nearly level soils on floodplains. In most areas, these soils are used as pasture or

woodland and are also used for cropland and home sites. They are well suited to fairly suited for crops and pasture, and, in a few areas, for non-farm uses. Soil limitations include home sites, on-site waste disposal, and many non-farm uses.

See Map 6, Major Soil Associations for a detailed map of the soil types in the Middle Conodoguinet watershed.

RCP Study Area Major Soil Associations

Map 6



Aw
BdB
BdC
BeB
BeC
BeD
BhB
BhD
BuB
BuC
BxB
BxC
DuA
DuB
DuC
HaA
HaB
HaC
HaD
HcB
HcC
HdB
HdD
HdF
HeB
HfB
HfD
HfF
LdB
LdC
LgB
LgD
Mf
MnA
MnB
MnC
WeB
WeC
WeD
WkF

Table 3 Summary of Parent Material, Uses and Limitations

SOIL CHARACTERISTICS			
Soil Association	**Parent Material**	**Favored Uses**	**Limitations***
Berks-Weikert-Bedington	Shale, Siltstone, Sandstone	Cropland, Pasture, Woodland	Depth to Bedrock, Flooding
Hagerstown-Duffield	Limestone	Cropland, Pasture, Woodland	Slope, Depth to Bedrock, Hazard of Groundwater Contamination, Sinkholes
Hazleton-Laidig-Buchanan	Quartzite, Sandstone, Siltstone, Shale	Woodland	Slope, Depth to Bedrock, Surface Stones, Seasonal High Water Table, Slow Permeability
Monongahela-Atkins-Middlebury	Shale, Sandstone	Pasture, Woodland	Slope, Seasonal High Water Table, Slow Permeability, Flooding

(Source: Soil Survey of Cumberland and Perry Counties, Pennsylvania, 1986)

Table 4 Quantity of Different Soil Types

SOIL	Acreage in County
Berks shaly and stony silt loam	49,206
Weikert very shaly silt loam	22,622
Bedington shaly silt loam	8,109
3-8% slope	4,736*
Atkins silt loam	4,814
Middlebury soils	1,306
All	1,306*
Hagerstown silt loam, and rocky	68,150
0-3% slopes	33,088*
3-8% slopes	4,252*
Duffield silt loam	18,623
0-3% slopes	2,431*
3-8% slopes	16,192*
Neshaminy gravelly and very stony silt loam	2,287
3-8% slopes	886*

* - Represents prime agricultural soils;
(Source: Soil Survey of Cumberland and Perry Counties, Pennsylvania, 1986)

1. Soil Fertility

The soils of the Cumberland County vary greatly in fertility. Soils associated with the carbonate areas are more fertile than those found in shale areas. An assessment of the soil's natural fertility provides an indication of the amount of additional fertilizer that may need to be applied. This is important because fertilizer is subject to runoff and/or groundwater infiltration depending on amount used, geology, and time of year it is applied. Therefore, the potential exists for increased nitrogen loading into both surface and groundwater systems. (See Section III.E for more information on water quality.)

2. Prime Farmland

Approximately 110,000 acres in Cumberland County, or approximately 31% of the total land area contains prime agricultural soils ("...land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and water supply needed to economically produce a sustained high yield of crops when it is treated and managed using acceptable farming methods. Prime farmland produces the highest yields with minimal inputs of energy and economic resources..." [US Department of Agriculture, 1986].)

Cumberland County has the distinction of being a leader in agriculture production. The county ranks 9th out of 67 Pennsylvania counties in overall production of agricultural products. It ranks 5th in apples, 6th in wheat and barley, 7th in corn for silage, 7th in hogs, 8th in milk and 9th in cattle and calves. The Cumberland Valley is recognized as having some of the most productive soils in the state. Much of crop production comes from farms in the center of valley that have predominately soils in the Hagerstown association of soils.

Major Soil Associations in Map 6 show that most of the Middle Conodoguinet Creek watershed is covered in soils suited to farming. The Hazelton-Laidig-Buchanan is the only soil association that is not good for agricultural uses.

a. Act 319 - Farmland and Forest Land Assessment Act (Clean and Green)

This 1974 law allows farmers to pay property taxes based on the agricultural value of their land rather than the land's higher development value. By doing so, farm and forest owners are able to escape higher land values and higher property taxes driven by nearby or regional development. Three land uses are eligible: agricultural, agricultural reserve, and forest reserve. As of August 2003, Cumberland County had 2518 parcels of land, consisting of 138,130.4 acres enrolled in the program.

b. Pennsylvania Agricultural Conservation Easement Program

In a 1987 referendum, voters authorized $100 million in bonds to be used to purchase easements from farmland owners of lands within Agricultural Security Areas. Such easements prevent development or improvement of the land except for agricultural production. In Cumberland County, by 1993, 40,835 acres (12% of the county) of farmland had been placed in Agricultural Security Areas.

The interest in enrollment in local municipal Agricultural Security Areas continues to increase each year. Presently 15 townships have established an ASA that includes approximately 55,000 acres. It is necessary for land to be included in an ASA before an easement could be acquired on the land.

c. Farmland Preservation Within the Project Area

Following is a listing of the townships within the project area and their associated preservation activities:

Table 5. Farmland Preservation in Project Area

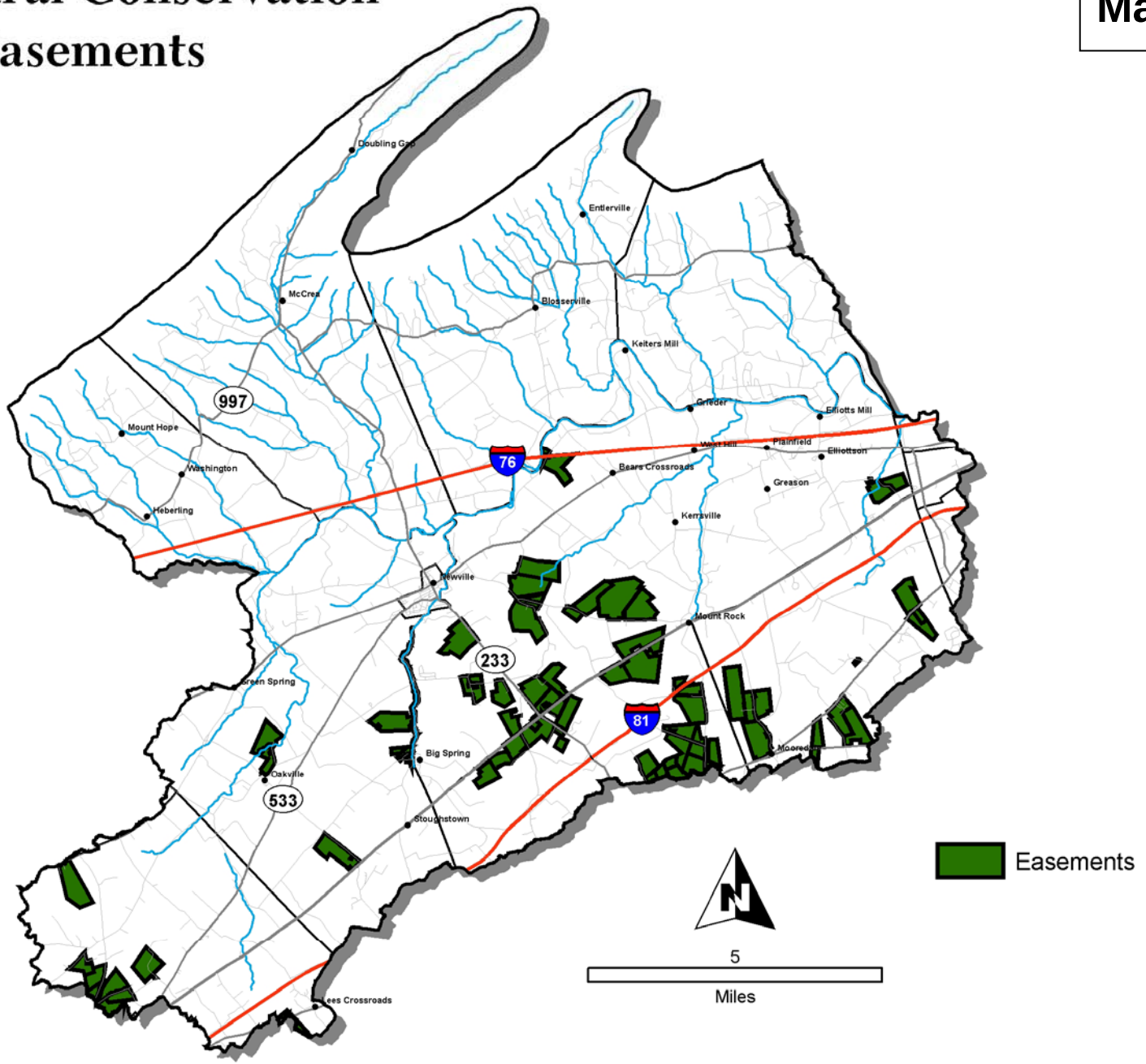
	Agricultural Security Areas		Easements			Applications Pending	
Township	**Parcels**	**Acres**	**#**	**Acres**	**Total Cost**	**#**	**Acres**
Dickinson	56	3,452	8	959	$2,002,695	13	1,304
Lower Frankford	40	2,540	0	-	$0	0	-
Lower Mifflin	63	5,436	0	-	$0	4	1,051
North Middleton	27	2,248	1	99	$225,880	5	502
North Newton	41	3,846	3	379	$558,204	9	1,078
Penn	93	6,447	11	1,850	$3,245,144	17	1,689
South Middleton	84	4,242	5	818	$1,809,758	2	289
South Newton	12	997	0	-	$0	2	60
Southampton	93	7,804	10	1,227	$2,632,467	10	1,061
Upper Frankford	58	4,006	0	-	$0	3	756
Upper Mifflin	45	3,357	0	-	$0	6	1,054
West Pennsboro	111	7,888	14	2,046	$3,390,994	16	1,486
TOTALS	**723**	**52,263**	**52**	**7,378**	**$13,865,142**	**87**	**10,330**

(Source: Farmland Preservation Board, Farmland Protection Statistics, County of Cumberland, 8/25/2003.)

Map 7, shows Agricultural Conservation Easements within the study area.

Agricultural Conservation Easements

Map 7



D. Hydrogeology

The Conodoguinet Creek watershed lies within in the Great Valley section of the Ridge and Valley physiographic province, which is characterized as a series of twisted mountains and valleys. The mountains are comprised largely of erosion resistant sandstone and quartzite; valleys generally contain either shale or limestone as the underlying rock. Blue (North) Mountain is one limb of a fold, and forms the northern edge of the watershed. The fold is more complicated in detail and twisted into a tighter fold in the vicinity of Doubling Gap and a smaller fold just east of the McClures Gap area. South Mountain, part of the Blue Ridge Eco-region, forms the southwestern border of the broad valley occupied by both the Conodoguinet and the Yellow Breeches Creeks.

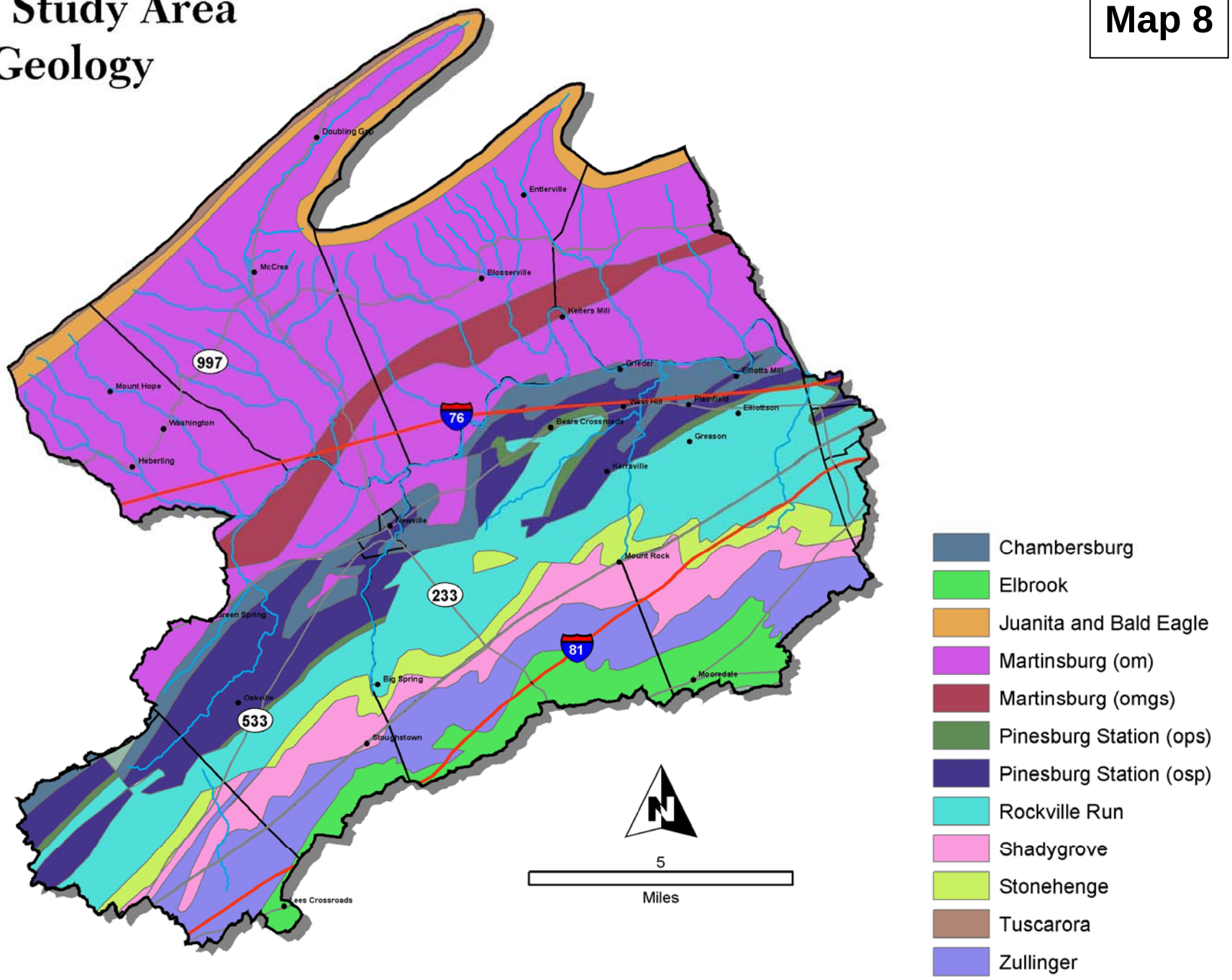
The land on the north side of the Conodoguinet Creek is underlain by Martinsburg Formation shale, graywacke, and Blue Mountain sandstone (approximately 54% of the watershed.) The area generally to the south of the Conodoguinet is underlain by argillaceous carbonates (containing clay), calcareous shales, and shales (approximately 46% of the watershed). There is also a diabase dike which trends north-south just east of Carlisle.

These sedimentary rocks were formed during the Ordovician period, a time that the eastern part of the United States subsided below sea level and formed a great water area known as the Appalachian Gulf. Repeated fluctuations in sea level promoted shoreline migrations; this in combination with uplift and subsidence yielded areas of shallow water carbonate deposits and deeper water flysch (marine sediment) deposits which produced the shales and graywackes. The resultant Martinsburg Formation is comprised of three members, which consist of dark-gray shale and thin interbeds of siltstone, metabentonite, and fine-grained graywacke.

The remaining limestone area to the south is comprised of the Chambersburg Formation, Myerstown Formation, St. Paul Group, Pinesburg Station Formation, Rockdale Run Formation, Epler Formation, Stonehenge Formation, Stoufferstown Formation, Shadygrove Formation, Zullinger Formation, Ellbrook Formation, Waynesboro Formation, and the Tomstown Formation.

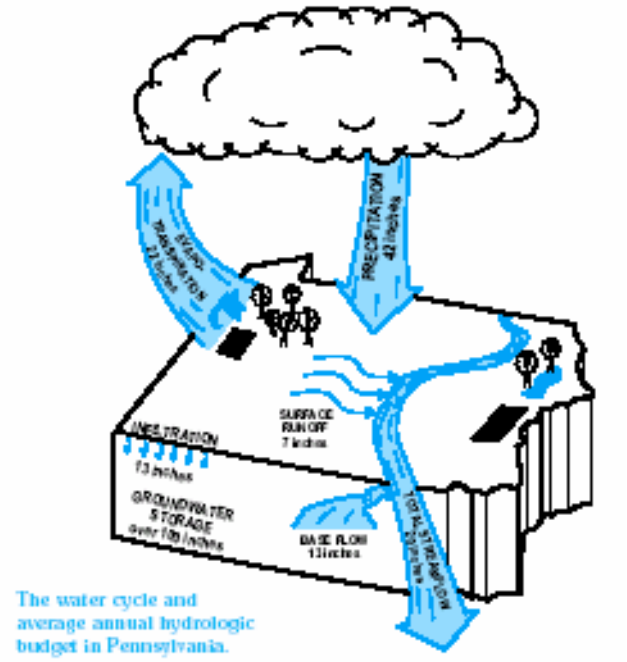
RCP Study Area Geology

Map 8



1. Hydrologic Relationships

The discussion of the hydrogeology of the Conodoguinet Creek requires a clear understanding of the water cycle in Pennsylvania. The Pennsylvania Geological Survey has produced a fine primer on water that is available at http://www.dcnr.state.pa.us/topogeo/education/es3.pdf. An important illustration for the discussion of the hydrogeology of the Middle Conodoguinet is the Water Cycle illustration. Water from precipitation falls on the landscapes and is partially retained on the vegetation and in the soils. The water that cannot infiltrate into the subsurface runs along the surface to the creeks. Surface water is considered water above the surface of the earth while groundwater is water below the surface of the earth. Water movement between the surface and subsurface is a complex phenomenon that is only occasionally clearly shown in the springs and disappearing stream segments of the Middle Conodoguinet Valley. Water responds to the force of gravity and therefore water movement both at the surface and in the ground is determined by elevation, topography, and the underlying geology. The complex process of water movement from the surface to the subsurface is affected by factors that include soil composition, soil structure, soil pore structure, preexisting moisture content, rate of water application, vegetation uptake, and other factors. As a result of these multiple factors, water travels at different rates through each of the soil types into the equally complex flow in the underlying rocks. Generally, water moves quickly through pore spaces such as in the larger particles of sandy soil and sandstone and more slowly through the smaller pore spaces in the shale and limestone.



The water cycle and average annual hydrologic budget in Pennsylvania.

Geologic features including the rock type, the size of the pores or spaces between rock grains (porosity), the dip of the rock layers or strata, and secondary features

such as solution channels or voids in the rock affect groundwater storage, movement, and availability as water supplies. The interconnecting porosity, which is an attribute of the geologic features, determines the extent to which water can pass through rock, the path of the water flow, and how much water can be held in the rock.

Shale, which was formed from the consolidation of clays, ultimately weathers back into clays. The pore spaces of clays tend to compact readily with mechanical forces. The inherent small pore spaces between the small clay grains and the human induced mechanical compaction of the clay generally limit the amount of rainfall that can enter the groundwater and promote surface runoff. Shale does have other geologic attributes that factor into water flow. Shale fractures as part of the weathering process and remnants of tectonic processes have imparted numerous joints and fractures. These allow for groundwater recharge. In shale areas, the water table, or top of saturated zone, is often close to the surface and may be the result of filling up of the available storage in fractures and pore spaces. Where the fractures in the shale are extensive these areas may serve as good aquifers for individual water wells. The fractures carry and store the water much as a network of pipes. Pollutants introduced into the network can quickly flow to a withdrawal such as a house well or a stream. Groundwater moves down slope in response to gravity. Water passage is predominantly through the macro features such as fractures in the shale before reaching stream channels as base flow. Typical transport rates for the Martinsburg Shale, which underlies most of the area north of the Conodoguinet to the Blue Mountain watershed divide, are approximately 2.5 to 7.5 feet per day.

The steep slopes and hilly terrain that are typical of the areas underlain by shale bedrock typically have high surface runoff and are not generally considered prime areas of infiltration. Because of the small particle sizes produced in the weathering process, erosion can be high in the shale areas from rainwater and snowmelt. Where substantial riparian vegetation is present in stream valleys within these shale areas, the vegetation can help filter pollutants from both the surface water and from the groundwater before it enters the stream.

Carbonate rocks are generally very dense and have few primary openings between rock grains. However, carbonates are soluble and often dissolve along joints, fractures, and bedding planes. These areas of dissolution enlarge with time to form a network of underground channels that can hold a significant amount of groundwater. The flat lying terrain of limestone valleys tends to allow less runoff and a higher potential for infiltration. Carbonate areas can serve as important regional aquifers because they store substantial quantities of water and the water in the network is interconnected.

The southern slope of Blue Mountain and most of the northern half of Cumberland County are comprised of shale interbedded with limestone and dolomite of the Martinsburg Formation. The steep slopes of Blue Mountain and its foothills form a series of parallel ridges and valleys containing many small southeasterly flowing

tributaries. The hilly terrain, rocky soils and slow infiltration rates make this section less suitable for farming than the southern half of the watershed. Groundwater in the shale has moderately high hardness and high iron content.

The southern portion of the watershed lies in the Cumberland Valley, which is comprised of limestone and dolomite rock. Unlike the northern watershed boundary that has an easy to recognize high elevation divide with many surface streams, the limestone valley forms a low, flat watershed boundary that is difficult to delineate.

The Middle Conodoguinet Creek is fed by a number of small tributaries to the north such as Whiskey Run, Doubling Gap Creek, and Locust Creek. Each of these creeks and their respective tributaries have eroded the soil and rock to create the rolling landscape of Upper and Lower Frankford, and Upper and Lower Mifflin Townships. The rock here is an Ordovician-aged (400+ million years old) shale, which is rich in clay and breaks down into a clay-rich soil. Soils rich in clay tend to limit infiltration of water, thereby enhancing surface runoff and causing surface erosion. The shale bedrock extends a bit south of the Conodoguinet's channel where the bedrock changes abruptly to a rock composed chiefly of limestone. The character of the limestone is markedly different that that of the shale.

The limestone terrain south of Conodoguinet Creek is generally flatter than it is to the north. Linear ridges trend east-west, marking the location of resistant beds of limestone and dolostone that have been tilted and faulted by tectonic forces that shaped the entire east coast 200-300 million years ago. Here, tributary streams appear to be fewer in number and shorter in length. Of note, Green Spring Creek, Big Spring Creek, Mount Rock Spring Creek, and Alexander Spring Creek deliver water to the Conodoguinet from the south. As their names imply, each creek is fed by a spring that pours groundwater to the surface at a discrete point. The springs, and the watersheds that feed them, are part of a geologic system known as "karst," a type of landscape characterized by caves, sinking surface streams, springs, and sinkholes.

The limestone valley exhibits a type of landscape known as *karst* topography, which is characterized by very few surface streams. Those surface streams that are present readily disappear below the surface or appear at high volume springs, sinkholes, and caves. Most of the groundwater flow in this karst terrain is through solution channels. Diabase dikes extending north/south through the valley also act as groundwater dams and diversions. Water entering the groundwater system in the limestone valley quickly moves into a more the regional aquifer that feeds both the Conodoguinet and the Yellow Breeches Creeks. There is generally a direct connection between the surface and ground waters in the limestone valley. Hence unlike the shale area to the north, little contact time with the riparian vegetation and little potential for removal of contaminants is available before groundwater enters surface water as stream baseflow. Fractures, faults and sinkholes, and dissolution along these features act as the primary conduits for groundwater flow. Water movement within these conduits may be on the order of a hundred feet per day. As

a result, they easily carry pollutants and contaminants through the valley to discharge away from a pollution source.

Since most of the water flow is within the subsurface, the Cumberland Valley has very few surface streams. The few surface streams that do exist are large northerly flowing limestone spring creeks. The USGS and computer modeling of the Cumberland Valley (USGS Water Resources Investigation Report 94-4090) documented that significant interbasin flow exists. Surface and subsurface flow has been diverted from the adjacent interbasin, Yellow Breeches Creek watershed, into the Conodoguinet Creek. Up to 11.5% of the groundwater that would normally flow into the Yellow Breeches Creek is funneled into the Conodoguinet Creek.

Several large springs are present in the study area. Big Spring is one of the ten highest volume springs in the state. Green Spring Creek, Big Spring Creek, Mount Rock Spring Creek, and Alexander Spring Creek are the larger spring tributaries in the watershed study area that deliver water to the Conodoguinet Creek from the south. These spring tributaries are shorter in length than their counterparts flowing southeast from the shale area but are capable of carrying much higher volumes of water. They also are more prone to losing their surface flow since they flow through karst. During droughts, the groundwater table may be lowered and the surface flow of some of the spring tributaries may no longer reach the Conodoguinet Creek.

Surface and groundwater movement in the Conodoguinet watershed is largely dependent on the underlying geology. Due to the low porosity and low permeability of shale areas little rainfall enters the groundwater. Approximately 88% of rain runs off the land via many small tributaries. Conversely, the carbonate area has significant aquifer recharge and little surface runoff, which can be attributed to the high porosity and permeability of the carbonate bedrock (only 17% of rain runs-off).

The Conodoguinet receives 57 to 75% of its base flow from groundwater. Discharge in shale geology averages 55%, whereas carbonate discharge averages between 72 to 87%. Streamflow, during and up to three days after a rainfall, is derived largely from runoff in shale areas. Thereafter, stream flow is maintained increasingly by carbonate rock discharges where groundwater generally flows to the north and northeast. There are a few places where stream reaches are near valley walls and water is lost though the regolith to the groundwater system.

South of the creek, the groundwater divide varies from the surface water divide, most notably in the Walnut Bottom area where the groundwater divide between the Yellow Breeches and the Conodoguinet is to the south of the Conodoguinet. In addition, nearby Big Spring, which discharges to the Conodoguinet, is recharged by the South Mountain colluvial aquifer and diverts about 5-10% of the Yellow Breeches flow to the Conodoguinet (9,000 gallons per minute). Two areas of groundwater mounding occur (in small areas of shale surrounded by carbonate rocks) northeast of Shippensburg and southwest of Newville.

In the northern half of the carbonate area, groundwater levels are shallower than to the south. During periods of high recharge (winter, spring, and heavy rainfalls), the groundwater level rises to within a few feet of the surface, causing flooding of basements.

2. Environmental Concerns in Karst Topography

The karst landscape that forms on limestone rock has the potential for some unique environmental concerns. For example, the rapid formation of sinkholes threatens roads, buildings, and utility lines by the sudden collapse of soil into underground cavities in the rock. These depressions have also served as convenient places to discard trash and old items like cars and kitchen appliances that threaten water quality. Limestone aquifers are highly susceptible to contamination because of the rapid infiltration of surface waters and fast flow of water through rock fractures that do little to filter the water. In some locations, surface streams flow directly underground, and then follow an unknown, subterranean route to a point where the groundwater emerges to the surface as a spring. Once in a limestone aquifer, a contaminant might move thousands of feet in one day, a rate millions of times faster than groundwater in a rock like the shale of the northern watershed. In the event of an accidental leak, contaminants may have moved a great distance, in an unknown direction, by the time emergency environmental response teams arrive on scene.

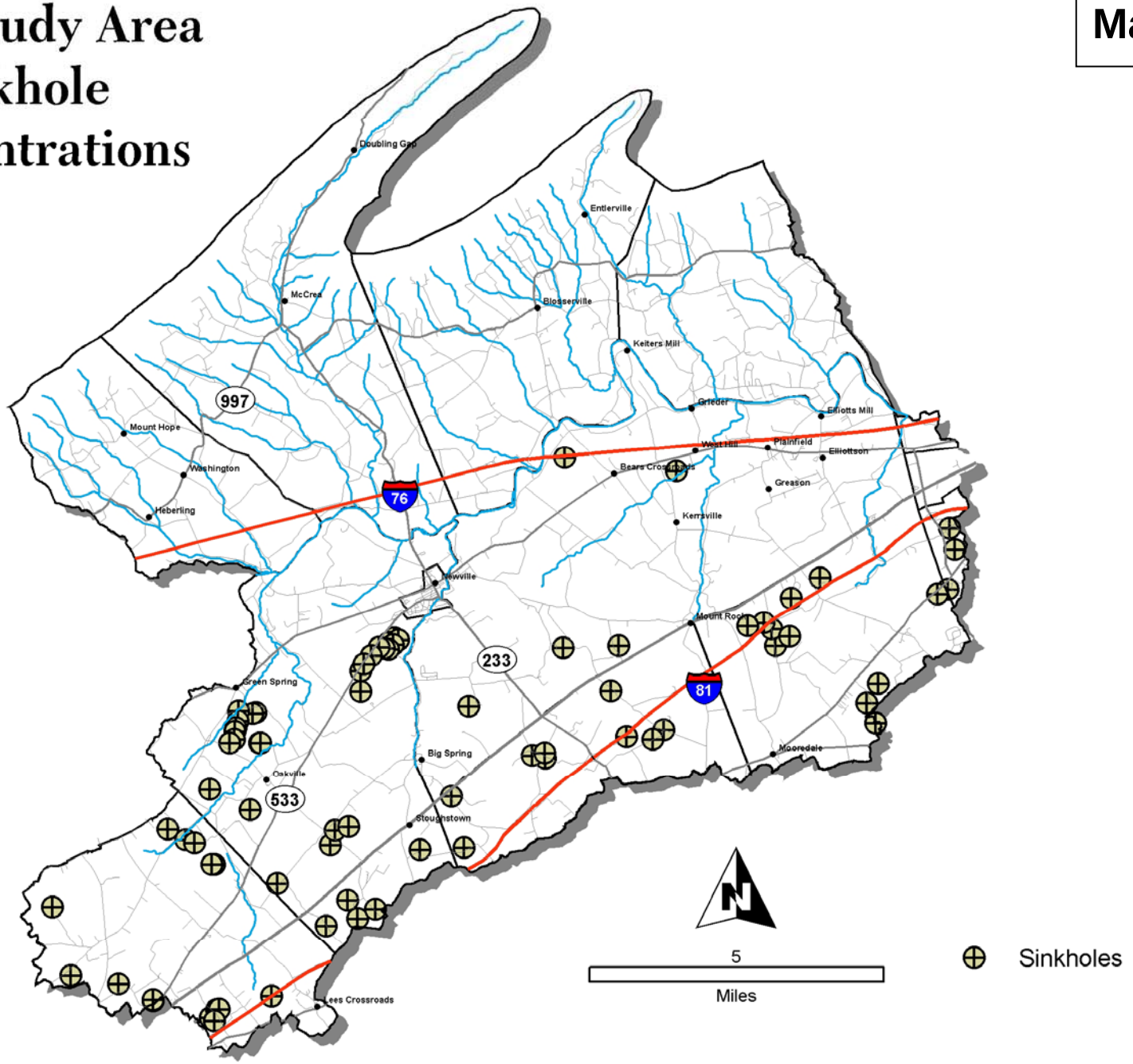
Karst topography presents several implications for land use planning. The LeTort Regional Authority (LRA, 1993) reported that human activities that concentrate water, such as stormwater management, leaking sewer lines, farm ponds, detention basins, and treatment lagoons can slowly dissolve enough of the carbonate bedrock to cause subsidence and eventually the creation of a sinkhole. Pollution enters the creek either through surface runoff to the north, or through entry into the carbonate groundwater system to the south. Derivation of public water supplies from surface water and groundwater sources will generally have the same effect on the creek's baseflow. Unlike the Yellow Breeches, which is predominantly recharged by a saturated carbonate system, the Conodoguinet does not receive sufficient recharge to prevent water level declines through the summer due to natural discharge.

3. Sinkholes

Sinkholes – the natural drains of limestone topography – occur where the underlying bedrock has been undermined by the collapse of an underground channel or where it has been dissolved by concentrated percolation from the surface. The DCNR Bureau of Topographic & Geologic Survey has documented and listed sinkholes in PA, located on their website. The Cumberland County list has 382 sinkhole locations listed by township and Lat/Long. Approximately 125 of these sinkholes are located in the study area, all of which appear to be in limestone geology.

RCP Study Area Sinkhole Concentrations

Map 9



4. Wetlands

Wetland communities such as small streams, swamps, marshes, and bogs are interspersed throughout the Cumberland Valley. A wetland is characterized by soil that is periodically saturated or covered with water. Wetlands are the most productive and the most rare habitat type in Pennsylvania. These areas support the greatest number of wildlife species. Wetlands also provide important functions for man. They improve water quality by filtering nutrients, wastes, toxic chemicals such as heavy metals, and sediment from water. They assist with flood protection by serving as water storage areas and slow the velocity of stormwater and rainwater, thereby protecting adjacent and downstream properties from inundation. Streamside wetlands reduce erosion by storing overflow from rivers and stormwater runoff.

Five main types of wetlands are found in the middle reaches of the Conodoguinet Creek watershed. The five types of wetlands include the following:

- Lower Perennial Riverine (slow moving, low gradient, and deep water habitat contained within a channel)
- Forested Palustrine (woody vegetation taller than eighteen feet amidst freshwater)
- Emergent Palustrine (Rooted, erect, and herbaceous vegetation partially submerged in freshwater)
- Scrub-Shrub Palustrine (woody vegetation less than eighteen feet in height amidst freshwater)
- Unconsolidated Bottom Palustrine (fresh water with less than 30 percent of vegetation cover and at least 25 percent small stone cover).

5. Floodplains

As of April 2003, Cumberland County is undertaking a Hazard Mitigation Plan for the entire county. The project goal is to develop a Hazard Mitigation Plan for Cumberland County that will lead to a reduction in the loss of life and property, human suffering, economic disruption and disaster assistance costs resulting from natural and man-made hazards. The plan is part of the overall County Comprehensive Plan and will look at potential hazards presented by the Conodoguinet Creek.

6. Farm Ponds

During the past 50 years, farmers and rural landowners built scores of small ponds to aid in water management and to provide a water supply that would not normally be available on the farm. Properly constructed and well-maintained farm ponds provide habitat for fish and associated aquatic organisms. Land surrounding the ponds can be developed into excellent wildlife habitat. Fruit-producing wildlife shrubs and conifers can be planted, and if livestock are kept away from the pond the resulting brushy vegetation will provide nesting cover. Pond islands offer protection from land predators and are preferred by nesting waterfowl. Nesting devices can be installed for a variety of animals.

7. Spring Seeps

Spring seeps occur throughout the mountainous areas in the northeastern United States. Seeps exist where water percolates through the soil and emerges from the ground on lower slopes. The surfacing of this ground water creates snow-free areas in the winter. These areas may be the only places in woodlands where wildlife, such as the wild turkey, can move and feed. Seeps are generally a resource that should be protected; all valuable mast-producing trees and shrubs in the vicinity of seeps should also be retained. Encouragement of herbaceous vegetation around seeps and the planting of food shrubs or evergreen cover are desirable.

E. Additional Watershed Resources

Every stream and lake in Pennsylvania has a designated use under Chapter 93 of Title 25 of the Pennsylvania Code, Department of Environmental Protection's Water Quality Standards. Classifications are based on the type of fishery present and other uses such as water supplies, navigation, and recreation. Designated uses are protected when the Department issues a permit or approval for an activity, which has the potential to impact the use.

The Conodoguinet Creek watershed has protected water uses for water supply, recreation and aquatic life. The main stem and its unnamed tributaries within the study area are classified for Warm Water Fishes. Named tributary watersheds are classified as either warm water fishes, trout stocked fishes, or cold-water fishes. Each of these classifications has a different level of protection. Some portions of the watershed have received special protection as either exceptional value or high quality classifications. The water quality of special protection waters is subject to special antidegradation regulations. In exceptional value waters, water quality is to be maintained, in high quality waters, the water quality is to be maintained unless there is social or economic justification or no alternatives to discharge locations can be found.

1. Aquifer Recharge

Several public water systems are located within the study area. However, private wells are the major drinking water supplies for the rural residents of the Middle Conodoguinet Creek watershed. Groundwater is replenished by infiltration of rainfall into the ground and into the water table, below which all the spaces in the rock are filled with water. Chemicals we put onto the land may also enter the groundwater. Water underground in the rocks reaches the surface as springs and streams. Water is also withdrawn through wells. Geologic structures that can supply large enough quantities of water for water supplies are called aquifers.

Replenishment of aquifers is critical for long-term water supply. Impervious surfaces such as pavement and roofs prevent water from infiltrating. The water table fluctuates in response to the amount of annual rainfall and the number of wells withdrawing water from it. The most critical aquifer areas in the Middle Conodoguinet Creek watershed are in the limestone portion of the watershed. Protection of these limestone aquifers should be a major goal for the Middle Conodoguinet Creek watershed.

a. Wellhead Protection Areas

There is one wellhead protection area designated within the project area. South Middleton Township has implemented a wellhead protection ordinance to protect the well recharge areas. Part of the wellhead protection zone is located south of Route 81 just west of the South Middleton/Dickinson Township border, extending in a southwest-north east plume on either side of Walnut Bottom Road.

There are several wells throughout the study area that currently are not protected by any ordinances. Hydrologic relationships are further discussed in

PA Geological Survey publication ES 3 "The Geology of Pennsylvania's Groundwater" is an easy to understand publication on understanding groundwater recharge.

b. Public and Community Water Systems

Several public and community water systems provide water supply within the study area. Of these water systems, seven are associated with mobile home parks in the Middle Conodoguinet watershed including the following:

System	Population Served
Betty Nelson Mobile Home Park (MHP)	250
Big Spring Terrace MHP	388
Burkholders MHP	195
Conodoguinet Mobile Estates	270
Cooper's Mobile Home Park	26
Country View Estates	60
Mt. View Terrace MHP	179

Other public and community water systems that serve municipalities in the study area include Carlisle Region Water Pollution Center Facility, North Middleton Authority, Huckleberry Land Water Assoc. Inc., Mt. Holly Springs Borough Authority, Newville Borough Water & Sewer (Cool Spring Water Filtration Plant), Shippensburg Borough Authority, Southern Cumberland Water Association, and South Middleton Township Municipal Authority. The sources for these systems are primarily ground water. However, surface waters are also used as sources, including the Conodoguinet Creek. However, water withdrawals from the Conodoguinet are outside of the study area.

Total average water use in Cumberland County (1990): 19,414,000 gallons/day. According to the Harrisburg Met Area Regional Water Supply report, 54, this figure is broken into Residential and Commercial Usage as follows:

Residential Usage:

- Population 195, 260
- Large System: 119,300
- Small System: 31,670

o Self-Supplied: 44,290

Total Residential Usage Per Day (1990 average): 12,614,000 gallons/day
Per Capita Usage Per Day (1990 average): 65 gallons/day

Commercial and Industrial Usage:
6,800,000 gallons/day Public/Private

2. Riparian Zones

Riparian zones are narrow strips of land bordering streams. The importance of vegetated buffers to riparian ecosystems and downstream receiving water has gained considerable attention in the Chesapeake Bay region. Vegetated riparian buffers reduce polluted runoff, reduce nutrient loading from groundwater, and help stabilize streambanks.

The Cumberland County portion of the main stem has a narrow riparian buffer along much of its length, but soil erosion is extensive enough in tributaries and upstream in Franklin County to cause the Conodoguinet Creek to run high and muddy after every moderate to heavy rainfall. The spring creeks originating in the limestone valley have generally suffered more degradation from the surrounding agricultural and suburban land uses than their more rural or forested shale-based counterparts. The spring creeks have also experienced loss in water quantity. Since many portions of eastern Cumberland County depend upon the Conodoguinet Creek watershed for drinking water, maintenance of adequate streamside vegetation is very important to overall water quality.

Much of the current emphasis in riparian buffers is derived from a three-zone system as recommended by the U.S. Forest Service (Welsch, 1991).

- *Zone 1*: Approximately 15 feet wide from the top of the streambank. The purpose of this portion of the buffer is to help stabilize the streambank, provide shade to moderate and stabilize water temperatures, and serves as a source of coarse woody debris to the stream's ecosystem. Large, mature trees complimented with a dense shrub layer should be found within the reaches of zone 1.
- *Zone 2*: Approximately 60 feet wide from the edge of Zone 1. This zone is where most of the sediment filtration and deposition, nutrient uptake, and anaerobic denitrification take place, it is critical that flow through this portion of the buffer be in the form of sheet flow (versus concentrated flow). Predominant vegetation should consist of native riparian trees and shrubs. For optimal performance, the vegetation needs to be managed to promote a healthy and rapidly growing system. Soil compaction and vegetation disturbance should be minimized wherever possible.
- *Zone 3*: Approximately 20 feet wide from the edge of Zone 2. The most important function of this zone is to convert concentrated stormwater flows to dispersed, sheet flows. Additionally, some sediment filtration and nutrient uptake occur in this area. Vegetation consists of dense grasses and forbs, which must be maintained by mowing, haying, grazing or other means or removal. Water

bars and/or spreaders may be required to convert concentrated flows.

In 1994 the Chesapeake Bay Program (Lowrance, 1994) assembled "Best Professional Judgments" (BPJ's) into the nutrient removal capabilities of vegetated riparian buffers. After reviewing and summarizing the literature work turned toward an examination of how water moves through a landscape. The research team divided the watershed into physiographic provinces. For the Conodoguinet region (valley and ridge, underlain by limestone and sandstone/shale bedrock), the team's BPJ's suggest:

a. In limestone regions, there will be a low [need to locate the amounts equated to low, medium and high] potential for nitrate removal because most of surface and subsurface flows quickly enters regional aquifers, which are then intercepted by major rivers. Therefore, seepage areas, springs and floodplains will have the most potential for nitrate removal. Deep-rooted vegetation should be used to control nitrate in these areas.

b. There will be medium to high potential for nitrate removal because there is less movement of subsurface water into regional aquifers, and due to the prevalence of seepage areas moving nitrate into biologically active soil horizons.

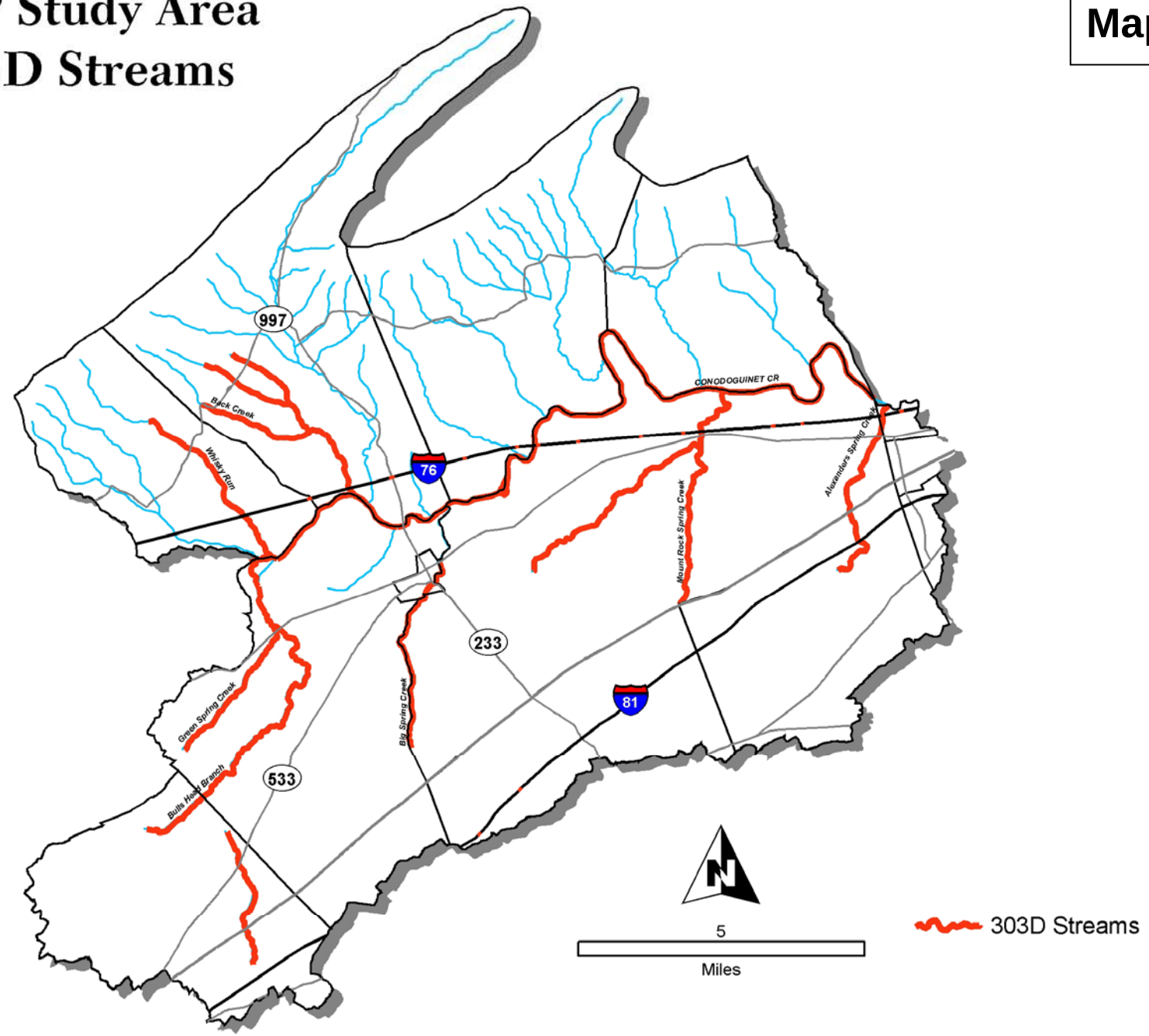
3. Water Quality

Seventy-one percent of the entire Conodoguinet Creek watershed was inventoried under the Department's Unassessed Waters Program in 1997. Out of 714 miles assessed, 204 miles or 27% were determined to be impaired (degraded) and were placed on the Department of Environmental Protection's 303d list of Impaired Waters. By 2002, the entire Conodoguinet Creek watershed was inventoried. Several stream sections of the main stem Conodoguinet are currently impaired. Map 10 graphically shows the stream assessment. Appendix C has detailed information on the sections of the 2002 303d list that pertains to the middle Conodoguinet Creek watershed. Appendix C presents the classifications, the impaired miles and the sources and causes of impairment within the study area of Middle Conodoguinet Creek watershed. More information on these classifications can be found in the DEP publication in Chapter 93 or on the website at www.dep.state.pa.us.

The majority of the impaired waters are in the Cumberland County and eastern Franklin County portion of the watershed. All the limestone tributaries in the study area, Green Spring Creek, and its tributary Bulls Head Branch, Big Spring Creek, Mount Rock Spring Creek, and Alexanders Spring Creek, were determined to be entirely or partially impaired. The shale tributary Back Creek and its tributary Center Creek are also partly or entirely impaired. Determination of impairment is based on either chemical water quality analyses or on analyses of aquatic life or habitat. Impaired water quality means that the water chemistry or habitat is not ideal for the health of aquatic life, animals, or humans consuming the water, and non-attainment of designated uses. Streams flowing mainly through pristine forested areas have little or no impairment; nutrient concentrations are low and grasses or trees line the streambanks. A high diversity of aquatic organisms inhabits unimpaired waters.

RCP Study Area
303D Streams

Map 10



Waters impaired by excess nutrients or sediment generally have a much lower diversity of aquatic life and are dominated by a few pollution tolerant organisms. Habitat impairment is usually visible as a lack of streamside buffers, eroded streambanks, excessive growths of algae, heavily silted substrate or muddy water.

Sources of impairment in the Conodoguinet Creek watershed were identified as agriculture, land disposal, habitat modification, construction, and urban runoff/storm sewers. The 303d list states that much of the impairment is caused by nutrients and organic enrichment/low dissolved oxygen (DO); however, DO is not measured directly. Organic enrichment is often determined by the presence of extensive algal blooms, which are assumed to contribute to low DO, and the absence of pollution sensitive aquatic species. Improper runoff controls at construction sites can lead to excessive sedimentation in reach streams and therefore, construction is major source of impairment.

The high number of impaired miles in the limestone tributaries is a product of the large amount of agriculture in their watersheds as well as the characteristics of the bedrock. Limestone bedrock weathers readily into excellent topsoil for agriculture and also maintains excellent filtration capacities. Limestone bedrock also readily moves contaminants thorough fractures into the groundwater system, which reaches the surface through springs. Nitrates are less likely to enter the groundwater in areas with shale bedrock due to their lower permeability. Shale tributary watersheds are often less intensively farmed than limestone watersheds and larger portions of their watershed may also be forested.

Stream impairment due to nutrients is a common occurrence in agricultural areas, especially in streams flowing through limestone bedrock. The most common nutrients are nitrates and phosphates, which come from runoff of animal waste and fertilizers. Nitrates and phosphates are necessary nutrients for aquatic plant growth, which support the rest of the food chain. Nitrogen and phosphate levels in water fluctuate considerably due to the uptake and release by organisms and by sediments. Leaky on-lot septic systems and sewage treatment plant discharges and can also contribute nutrients to streams and to groundwater. Nutrient impairment is usually determined by the nitrate-nitrogen concentrations of a stream. The Pennsylvania drinking water standard for nitrates is 10 mg/l. Nitrates exceeding 10 mg/l in drinking water can cause blue-baby syndrome in infants up to 6 months old. Most natural streams have nitrate concentrations less than one mg/l. Phosphate concentrations are extremely low in unpolluted water. Phosphate is often the limiting factor for plant growth in streams.

Elevated nitrogen and phosphorus can lead to increased productivity of plants and algae. Aquatic plants use oxygen at night and stream animals use oxygen during the day. Elevated algal productivity can cause depressed dissolved oxygen (DO) levels when an abundance of aquatic life is drawing on a limited oxygen supply. Oxygen is used up when organisms die. Excess nitrogen (ammonia) also occurs when bacteria convert ammonia-nitrogen to nitrate-nitrogen, lowering the DO.

Ammonia is generally rare in aquatic systems. Ducks and geese contribute a heavy load of ammonia nitrogen in their droppings.

a. Point Sources of Pollution

Point sources of pollution are one type of pollution that affect water quality. The two most prevalent point sources in the study area are sewage treatment facilities and impoundments. Map 11 shows the points that have effluent permits, National Pollution Discharge Elimination System Permits (NPDES), within the study area. NPDES permits authorize discharges into navigable waters.

1) Sewage Treatment Facilities

Only one sewage treatment facility (Newville) is located within the middle section of the Conodoguinet watershed. It is located along the Big Spring Creek just east of Newville borough. It serves Newville borough, West Pennsboro and North Newton Townships. Small package plants service several places including local trailer parks in this region. These private plants are found in Lower Frankford Twp. (2), Upper Frankford Twp. (1), Lower Mifflin Twp. (1), North Newton Twp. (2), and Penn Twp. (2). Remaining homes and businesses in the area are exclusively serviced by private on-lot sewage disposal systems (septic).

Many of these systems are old, poorly designed, or located too close to wells that supply water for household needs. The threat of ground water contamination is high with these older systems, especially in areas where rapid growth and development have occurred. Newer systems must adhere to state standards before installation is approved. As the county's population continues to grow so will the demand for water consumption as well as the need for sewage treatment plants. Currently one municipality West Pennsboro Township is in the process of sighting a new wastewater treatment facility near the Conodoguinet Creek in the area of Bears Crossroads.

2) Impoundments

Three low head dams are located within the middle reaches of the Conodoguinet Creek watershed, two are on the Conodoguinet Creek: one is located about two miles below Route 233 and the other at Heishman’s Mill. The third dam is located on the Big Spring Creek tributary at Laughlin Mill.

Dams along the Creek have been found to enhance the problems of phosphorous enrichment and sedimentation in the creek above the dam. As water slows, sediments in suspension tend to drop out. This creates the potential for eutrophication, where a waterbody becomes more and more nutrient enriched and silted and eventually losses most of its aquatic life. The build-up of sediment behind impoundments further slows water flow, which increases nutrient contact with plants and enhances rooting capabilities of plants.

Sediments can also reduce the chemical purity of water by introducing toxic compounds such as aluminum, nickel, and iron that become attached to the silt

particles. Sediments can also harm aquatic life. Silt and sediment collects in the gills of aquatic species such as larval stages of mayflies, caddisflies, and stoneflies causing them to suffocate. Sediments can cause further damage by smothering fish eggs.

A large and shallow tributary of the Susquehanna River, the entire length of the Conodoguinet Creek is at the center of statewide efforts to rebuild healthy populations of American shad and other migratory fish species. In 1997, the Pennsylvania Fish and Boat Commission (PFBC) began restoration efforts by stocking American shad fry and pre-spawn river herring in the Conodoguinet Creek in hopes of imprinting a population to the watershed. While 2002 was a poor year for returning migratory fish in the Susquehanna and its tributaries – attributable in part due to an inverted weather pattern of a warm late winter and a cold spring – PFBC staff are hoping the imprinted adult shad will return in good number to the Conodoguinet in the spring of 2003.

As part of a comprehensive effort to return migratory fish species to the Conodoguinet, restoration partners including American Rivers have identified and begun addressing major blockages to migration on the creek, some in new and different ways. Several projects have occurred along the Conodoguinet Creek, although outside the Middle Conodoguinet study area. In November 2001, the PA Department of Environmental Protection removed the 300-foot wide orphaned Good Hope Dam in Camp Hill, the first major blockage on the creek. The removal cost $37,000, which came from Pennsylvania's Growing Greener funds as well as funding from the Fish America Foundation. Additional funds from Growing Greener have been spent on restoration of the stream buffer, including grading, seeding and planting with native trees and shrubs to provide wildlife habitat and improve water quality in the creek.

The second blockage, a water authority dam owned by the City of Carlisle, was outfitted with a fish ladder to allow migratory and resident fish to move up and over the remaining dam. This ladder was installed in winter 2002 and the Cave Hill Dam in Carlisle now passes resident fish. Biologists hope it will pass American shad and river herring if they return to the creek this year.

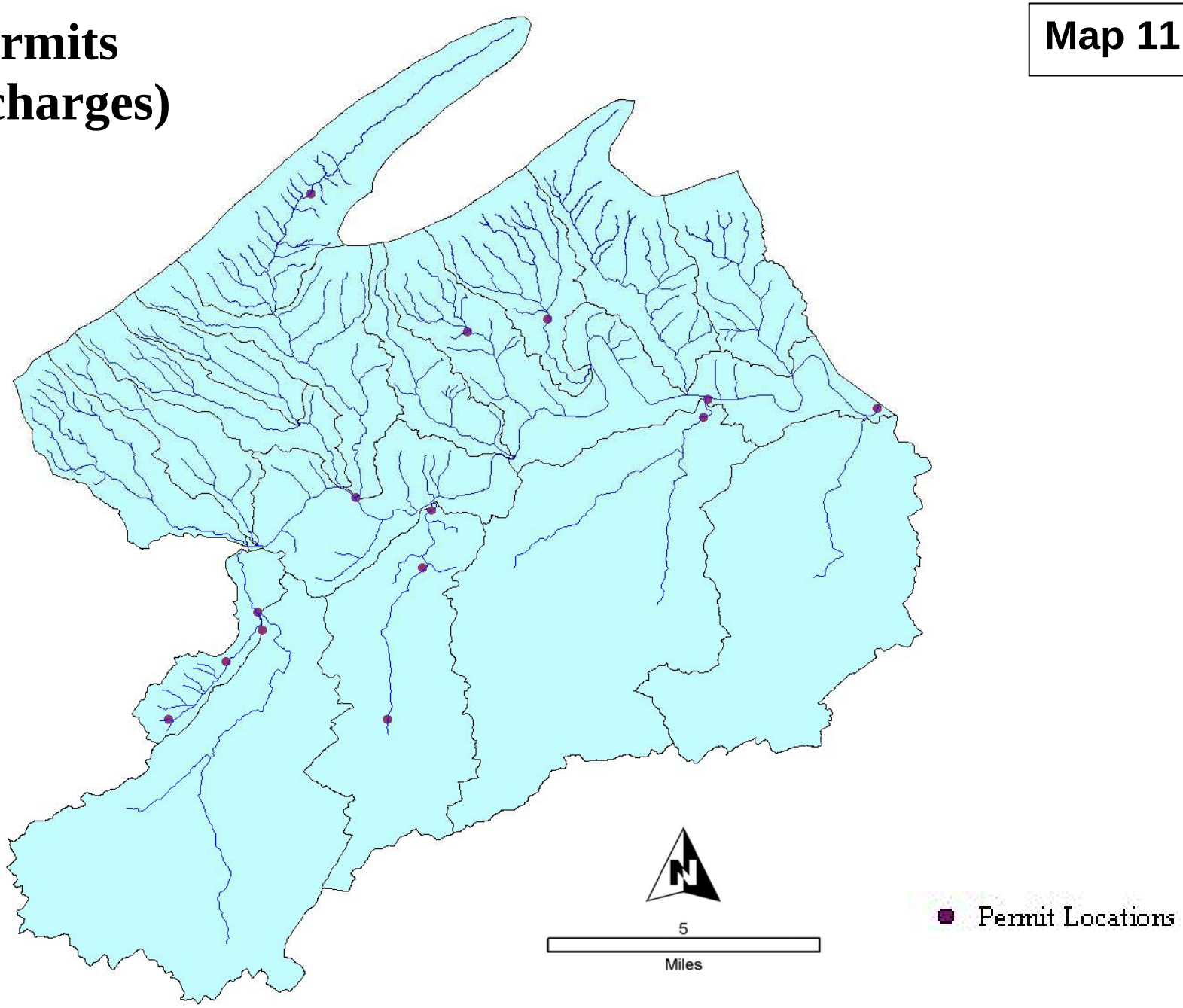
A blockage within the study area is located in West Pennsboro Township at Heishman's Mill, a historic grain mill restored by the current owner who wishes the dam to remain. At this site, American Rivers and state agency partners are working to install a bypass channel that would create a small new segment of stream around the dam and allow migratory and other fish to move upstream and downstream past the dam. The project is scheduled for completion in summer 2003 and will be one of the first bypass channels built in this country. Finally, the last blockage on the main-stem creek, Black Dam, is scheduled for removal in June 2003. This 350-foot wide and 10-foot high cement dam located just east of Newville blocks fish access to an additional 22 miles of spawning habitat upstream.

A variety of monitoring projects are currently taking place at these dam sites or former dam sites on Conodoguinet Creek, including government agency-sponsored efforts, university studies, and citizen volunteer monitoring projects.

PLEASE SEE ADDENDUM FOR AN UPDATE ON THE 303D LISTING.

NPDES Permits
(Point Discharges)

Map 11



b. Non-Point Sources of Pollution

Non-point sources of pollution threatening the creek include urban stormwater runoff from paved and unpaved surfaces and agricultural contributions (manure, soil, fertilizer and pesticide erosion). Phosphorous can enter the creek in this manner, from the runoff and erosion of lawn fertilizer, animal droppings, litter, vegetation and grass clippings, and sewer line losses. The above substances also bear responsibility for high quantities of nitrate, which exist but do not appear to be a large problem for the creek (Lemke, unpublished).

1) Storm Water Runoff

As suburbanization/urbanization extends across the county and the land area covered by impermeable surfaces increases, rainwater, which would infiltrate into the ground under "natural" conditions, is prevented from doing so. Instead it is diverted directly into storm sewers or small tributaries of the creek. From these areas it flows into the creek. This results in a pre-disposition to down-stream flooding during heavy-rains, and to very low water levels during dry seasons (due to lack of aquifer recharge). Additionally, a 1993 study by the Nationwide Urban Runoff Program (NURP) showed that 40%-80% of nutrient pollution comes from stormwater runoff and that bacterial contamination can rise up to 1000% after runoff's addition to a creek (Wilderman). When developed areas get a shower, it is not only dirt that washes down the drain; but pesticides, herbicides, oil, litter, and anything that anyone throws on the street, parking lot, or yard, as well.

The Middle Conodoguinet is mostly rural. The Borough of Newville is the most urbanized area within the watershed. Currently the Borough does not have a stormwater ordinance in place. However, the Subdivision and Land Development Ordinance includes stormwater runoff restrictions for developments, as well as, specific requirements for the Big Spring Creek watershed.

2) Agricultural Runoff

Many agricultural activities disturb the soil and add nutrients to the water. Cattle access to streams, plowing and tilling, improperly managed manure application, and barnyard runoff contribute to sediment and nutrient loading to waterways. Modern agriculture has become increasingly competitive with much industrial consolidation occurring. Many soil and water conservation practices may not be cost effective in the short term. Also, regulatory controls are weak or not enforced.

<u>Pesticides and Herbicides</u>

A number of pesticides (herbicides, insecticides, and fungicides) are commonly used in Pennsylvania agriculture. Alachlor, metaochlor, Chlorimuron-ethyl and Metribuzin are commonly used on soybean crops while Atrizine, Metolachlor, and Pendimethalin are the top three herbicides used on corn crops in Pennsylvania. In 1998 alone 28,800 acres and 11,700 acres were planted with corn and soybeans respectively. Various herbicides were applied to many of these crops. Insecticides including Chloropyrifos, Tefluthrin, and Cyfurthrin were also used on corn.

Various studies have focused on herbicide use in Cumberland County. A 1989 Pennsylvania Department of Agriculture survey within watersheds of two Conodoguinet Creek tributaries (Alexanders and Mount Rock indicated that cyanazine, atrazine, alachlor, or metachlor are the herbicides most often used, especially for corn. A 1994 USGS report revealed that six different types of herbicide residues (four triazine herbicides and two atrazine soil metabolites) were found in spring water entering two tributaries (Alexander Spring Run and Mount Rock Creek) of the Conodoguinet Creek. The authors of this study also sampled 50 domestic wells and found the same herbicides and metabolites in 42 of the wells. Cyanizine, metolachlor, and alachlor applied to lands in the recharge area were not detected in the water discharged from the springs. Although none of the levels exceeded the United States Environmental Protection Agency's individual MCL's for lifetime exposure in public drinking water, this study indicates that herbicide and pesticide runoff is a potential threat to groundwater quality and thereby the creek (Hippe 1994).

Field applied herbicides volatilize to the atmosphere, accumulate in the soils, degrade in subsurface areas, and leach to groundwater. The potential to leach to groundwater is affected by both soils and geology. Soil thickness, soil composition, flow paths in soil, sinkholes, and fractures influence the rate and amount of pesticide residues that ultimately reach underground waters. The highest potential for groundwater infiltration by pesticides is in carbonate regions whereas the potential is lowest in shale areas. Fractures in shale bedrock are generally much smaller, thereby inhibiting rapid movement of water and pesticides.

Livestock

Lack of streambank fencing allows livestock direct access to both streams and streamside vegetation. The direct result is livestock defecating and urinating directly into waterways as well as consumption of all vegetation within the reaches of the streams and/or creeks. Other impacts include loss of streamside vegetation and compacting of soils in and around stream areas. This overall degradation increases the likelihood of additional runoff reaching waterways as well as increased sediment loading.

Large-scale animal operations (cattle, poultry, and hog) also have the potential to be direct sources of surface or groundwater contamination especially if they are poorly designed or managed. Although few large-scale animal operations currently exist within the middle reaches of the Conodoguinet Creek watershed the possibility of future siting of these types of facilities in this area is quite possible.

3) On-Lot Septic Systems

Domestic sewage and wastewater are treated and disposed of by various methods, ranging from large municipally owned sewage treatment plants to community or individual on-lot systems, also known as septic systems. Malfunctioning sewage disposal systems, regardless of type, pose a serious threat to public health and the environment. They can pollute public and private drinking water sources, often by

discharging directly to the groundwater, and they can expose humans and animals to various bacteria, viruses and parasites. Repairs to these systems often can lead to financial hardships for affected municipalities or homeowners. Map 12 shows Soil Suitability for Absorption Fields within the study area.

Improper siting of systems, design and construction irregularities, and lack of maintenance of on-lot septic systems can lead to nitrate, microbial pathogen (bacteria, virus, parasite), and synthetic organic chemical contamination of ground water and surface waters. The level of threat to the water resources of the Conodoguinet Creek watershed from on-lot systems varies between the limestone and the shale regions of the watershed. Surface water contamination is more likely to occur on lands adjacent to and north of the creek where there are many more small tributaries, shallow, stony, shale associated soils. In the well-drained limestone soils groundwater contamination is more likely to occur. Generally, more than half of the on lot systems still in use in the Commonwealth were installed prior to 1960. Because these systems are older the likelihood that they are undersized, and the fact that they were installed prior to any regulatory oversight, it is possible that many of these systems are failing to adequately remove nutrients. The Select Committee on Non-point Source Nutrient Management indicated that even properly functioning systems remove only about 21% of the nitrogen in sewage. "Researchers at the University of Rhode Island found that the quantity of nitrogen contributed to groundwater by residential septic systems at a density of two dwellings per acre was approximately the same as that from a cornfield." The recent nutrient management legislation requires DEP to initiate research to quantify the nutrient contributions from on-lot septic systems.

The Pennsylvania Sewage Facilities Act (Act 537) Program was enacted in 1966 to correct existing sewage disposal problems and prevent future problems. To meet this objective, the law requires proper planning of all types of sewage systems, permitting of individual and community on-lot systems and uniform standards for on-lot systems. With technical assistance, financial assistance, and oversight from the Department of Environmental Protection (DEP), municipalities and local agencies administer the Act 537 program.

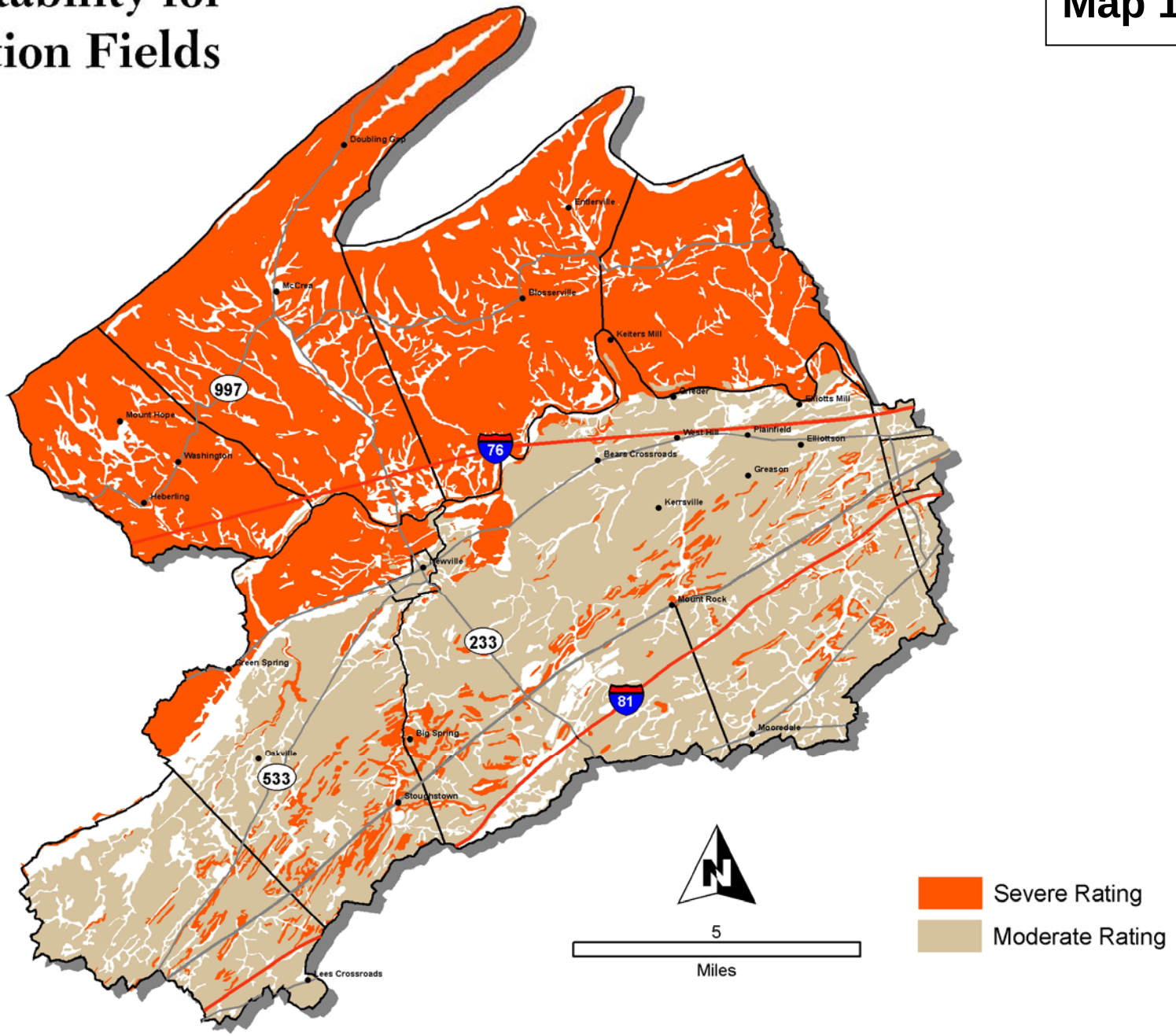
Cumberland County has most recently updated their Act 537 Sewage Facilities Plan in 1995. An estimated 27% of county residential units use on-lot septic systems. Most of the soils in the Conodoguinet Creek watershed have moderate to severe limitations for septic systems. The use limitations of these soil associations are summarized in Table 3 and Table 4, Section III.C.

Long Term Use of On-Lot Systems

Proper operation and maintenance of on-lot systems is essential for long-term use of the systems and for the protection of public health and the environment. The regulations, adopted under Act 537, require municipalities to include a sewage management program when they develop or revise an official plan.

Soil Suitability for Absorption Fields

Map 12



Properly designed and installed sewage disposal systems function better and longer with proper maintenance. Without maintenance, systems may fail over time; neutralizing the efforts and resources devoted by a municipality to assure proper design and installation of these systems. Municipal sewage management programs can vary from a simple pumping program to a more complex municipal inspection program. Municipalities should consider selecting an appropriate method based on their specific needs and the resources available. It is the responsibility of the municipality to select the appropriate management program.

Only in cases where sewage malfunctions are widespread in an area and endanger public health will DEP consider requiring a municipality to adopt a sewage management program. In those cases, however, DEP will not specify which management program the municipality must select.

Sewage management programs can be very cost effective. When a management program is in place, homeowners may avoid the costs of repairing or replacing malfunctioning systems, and municipalities may avoid the costs of having to extend sewer lines great distances when malfunctioning on-lot systems leave the municipality with no other alternatives.

4) Toxic Substances

Accidental spills of hazardous substances also pose a threat to surface as well as ground water. At present, there is no water quality monitoring for toxic chemical contamination; but the risk is potentially high.

There are many potential sources of toxic substance pollution surrounding the creek. Several major highways, Rt. 11, I- 81, and the Pennsylvania turnpike (76) as well as secondary roads are found in close proximity to the creek and its tributaries. On any given day, a large number of trucks transporting hazardous materials pass through the area. Historically a large number of spills occur in transportation related accidents.

Underground tanks and pipelines used for the storage and transport of petro-chemicals are another potential source of ground water pollution. These are probably more of a threat than surface spills since they are buried underground. Underground tanks and corroded pipelines can leak over long periods of time before damage is detected. Over time the underground plume has the opportunity to infiltrate both the soil and groundwater. Petro-chemicals are involved in 46% of Cumberland County's spills.

A number of industrial plants and warehouses are found in and around the Carlisle area. Some of these are found within the Middle Conodoguinet watershed. Manufacturers use and store a variety of chemicals on site. Warehouses in the area are temporary holding places for chemicals that are being transported from one area of the country to another.

4. Total Maximum Daily Loads (TMDLs):

After water quality problems are identified in a watershed, a planning process begins whereby the Department of Environmental Protection develops a strategy to address and correct water pollution. The developed plan can be considered water budgets for pollutants, representing the total amount of pollutants that can be assimilated by a stream without causing impairment or causing water quality standards to not be met. Total Daily Maximum Loads (TMDLs) are calculated for each pollutant type and sources of pollution to a stream.

The daily loading of nitrates and phosphorous is often calculated to determine the effect on aquatic life. Loading is a factor of the stream size or volume of water; a larger stream carries a larger nutrient load than a smaller stream. Loads of pollutants in a stream are used in calculating TMDLs for impaired streams. The Department of Environmental Protection for each stream or lake on the 303d List will develop TMDLs. TMDLs identify the amount of a pollutant that a stream or lake can assimilate without violating its water quality standards. Comparisons with pollutant loads in a similar unimpaired stream are used to determine the reductions in pollutants necessary to restore aquatic life in impaired watersheds. The load reductions necessary to restore aquatic life were calculated for the impaired tributary watersheds of the Conodoguinet Creek.

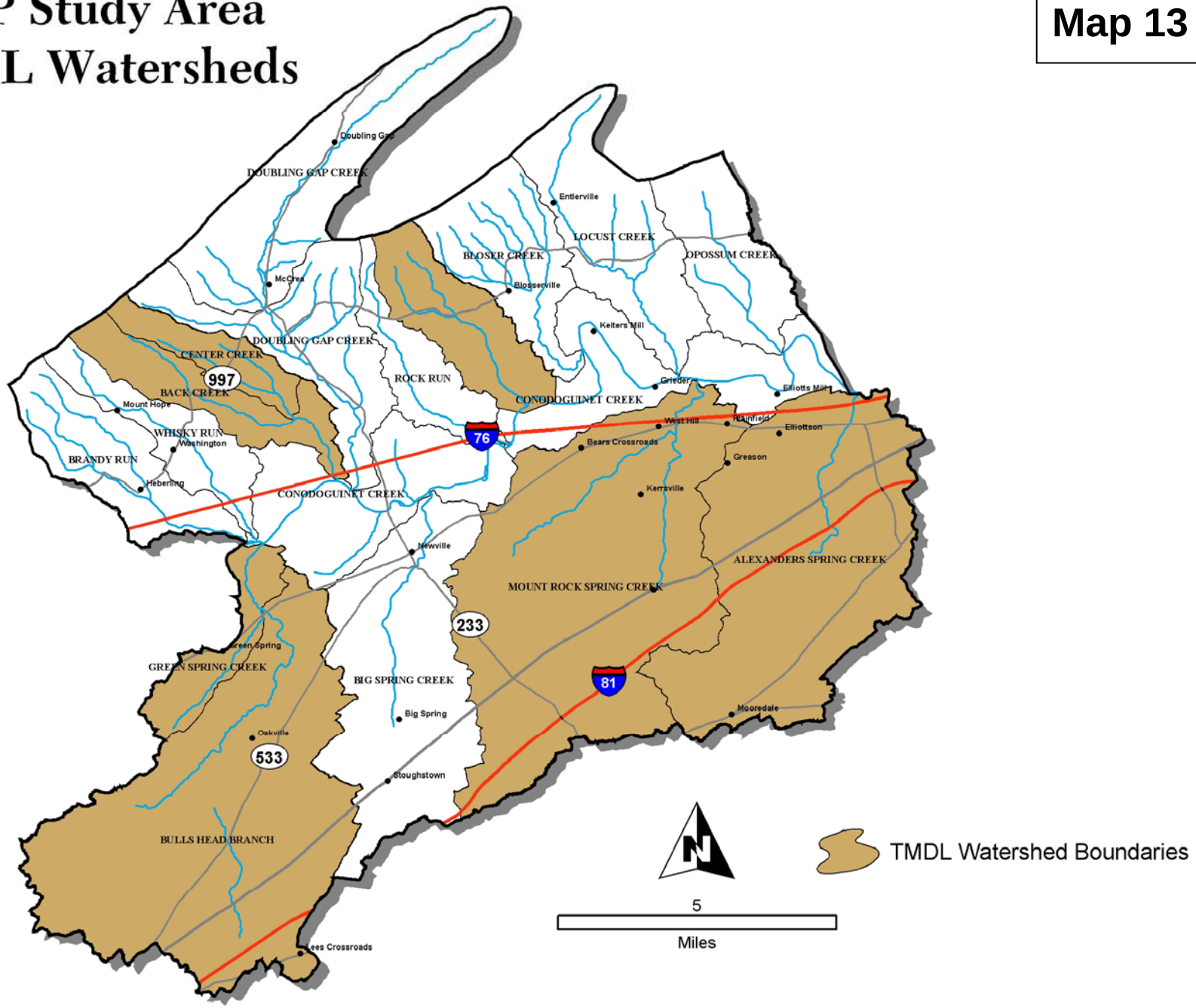
a. The TMDLs for Conodoguinet Creek Tributaries

Through the watershed assessment completed for the Conodoguinet Creek watershed, several Total Maximum Daily Loads (TMDL's) were developed for a section of the main stem Conodoguinet Creek, and for, all or a section of, six tributaries within the subbasin. The six tributaries currently with TMDL's include Alexander Spring Creek, Mount Rock Spring Creek, Back Creek, Center Creek, Green Spring Creek, and Bulls Head Branch. These TMDL's were developed for mainly for sediment and nutrient impairments noted on the Pennsylvania's 2002 Clean Water Act Section 303d list. The TMDL's for other sections of the main stem of Conodoguinet Creek and other tributaries have a targeted 2003 or later development date, after further analysis of the point source contributions to the stream. TMDL's were not developed for Big Spring Creek because the watershed contains the PA Fish and Boat Commission Big Spring Hatchery that is a contributor of nutrients and oxygen demanding substances to the stream. The impairments in Big Spring Creek will first be addressed through changes to the fish hatchery's discharge permit.

A report on the TMDL's for the Conodoguinet Creek watershed, entitled "Total Maximum Daily Load for the Conodoguinet Creek Watershed Pennsylvania" (December 2000) can be found at http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/tmdl/Conodoguinet_TMDL.pdf. For more information on the TMDL's see Appendix B and Map 13, TMDL's for Conodoguinet Creek Tributaries.

RCP Study Area
TMDL Watersheds

Map 13



Agriculture is the primary land use (61.3%) in the Conodoguinet Creek watershed. Nearly 200,000 acres are in either cropland or hay/pasture. Cropland accounts for 38.6% of land use and pasture 22.7%. Agricultural land was identified as a major source of nutrients and sediment to the Conodoguinet Creek subbasin. Agricultural runoff from cropland and pasture can often contribute increased pollutant loads to a stream when poor farm management practices allow soils rich in nutrients from fertilizers or animal waste to be washed into the stream, increasing in-stream nutrient and sediment levels. Cattle and other agricultural animals deposit manure (nutrients) on the land surface, where it is available for runoff and delivery to receiving streams. Spreading animal manure on agricultural lands also contributes to nutrient runoff. The main stem Conodoguinet Creek is subject to significant sediment runoff; the creek usually carries a heavy silt load and appears muddy after moderate to heavy rainfall.

Nutrients and sediment are the most likely pollutants causing the impairments identified in the listed segments of the Conodoguinet Creek basin. This conclusion is based on the dominant source types, the observed high sediment and nutrient loading, observations of the biological assessment teams, and similarities to other impaired waterbodies.

The biological assessment in the Conodoguinet Creek basin listed organic enrichment/low dissolved oxygen (DO) as the cause of the impairment seen in some portions of the subbasin streams. This listing was based on visual observation; no dissolved oxygen readings were used as the basis for this impairment listing. Impairment caused by organic enrichment/low DO is addressed through reduction to the phosphorus loading.

Typically in aquatic ecosystems the quantities of trace elements are plentiful; however, nitrogen and phosphorus may be in short supply. The nutrient that is in the shortest supply is called the limiting nutrient because its relative quantity affects the rate of production (growth) of aquatic biomass. If the nutrient load to a waterbody can be reduced, the available pool of nutrients that can be utilized by plants and other organisms will be reduced and, in general, the total biomass can subsequently be decreased as well. In most efforts to control eutrophication processes in waterbodies, emphasis is placed on the limiting nutrient. This is not always the case, however. For example, if nitrogen is the limiting nutrient, it still might be more efficient to control phosphorus loads if the nitrogen originates from sources that are difficult to control, such as nitrates in groundwater.

In stream systems, elevated nutrient loads (nitrogen and phosphorus) can lead to increased productivity of plants and other organisms. Aquatic plants use oxygen at night and animals that live in the stream use oxygen during the day. Excessive nutrient input can lead to elevated levels of productivity, which can subsequently lead to depressed dissolved oxygen levels when an abundance of aquatic life is drawing on a limited oxygen supply. Additional problems arise when these organisms die because the microbes that decompose this organic matter also

consume large amounts of oxygen. A second effect of nitrogen (specifically ammonia) occurs when bacteria convert ammonia-nitrogen to nitrate-nitrogen. This process, called nitrification, also results in lower dissolved oxygen levels in streams.

On-site septic systems have the potential to deliver nutrients to surface waters due to system failure and malfunction. An estimated 7.1 percent of the Conodoguinet Creek watershed population uses septic systems. Normal septic systems contribute both dissolved nitrogen and phosphorus to the groundwater. Failed septic systems contribute greater amounts of nutrients to both groundwater and surface runoff.

Agriculture and septic systems are two major sources that enrich the groundwater. Based on water quality data from the United States Geological Service (USGS), the estimated concentrations of nitrogen and phosphorus in groundwater in the Conodoguinet Creek agricultural areas were 2.7 mg/l and 0.019 mg/l, respectively, which are higher than the concentrations in the forested area (0.19 mg/l for nitrogen and 0.006 mg/l for phosphorus).

Implementation of the proposed TMDL's for tributary watersheds should reduce phosphorus and sediment loads to the main stem by 9.8 percent and 11.3 percent, respectively. These TMDL's do not directly address habitat modification, which is not a pollutant; however, reductions of sediment and nutrient loads should also benefit habitat conditions. Management practices expected to be used in reducing sediment and nutrient loads will include riparian zone management that benefits habitat conditions as well, through stream shading and stream bank protection.

The majority of the sediment and phosphorus reductions in the TMDL's are allocated to agricultural activities in the watershed. Implementation of best management practices (BMPs) in the affected subwatersheds should achieve the loading reduction goals established in the TMDL's. Substantial reductions in the amount of sediment reaching the streams can be made through the planting of riparian buffer zones, contour strips, and cover crops. These BMPs range in efficiency from 20% to 70% for sediment reduction. Implementation of BMPs aimed at sediment reduction will also assist in the reduction of phosphorus. Additional phosphorus reductions can be achieved through the installation of more effective animal waste management systems and stone ford cattle crossings. Other possibilities for attaining the desired reductions in phosphorus and sediment include stabilization of streambanks and streambank fencing. Further field evaluations will be performed in order to assess both the extent of existing BMPs, and to determine the most cost-effective and environmentally protective combination of BMPs required for meeting the sediment and nutrient reductions.

EPA Non-point Source program 319 grants and DEP Growing Greener grants for the will fund installation of agricultural best management practices in the Conodoguinet Creek watershed to control manure and other agricultural runoff, which should reduce nutrients and sediment entering the Conodoguinet Creek

5. Monitoring

The Conodoguinet Creek Watershed Association and the Alliance for Aquatic Resource Monitoring (ALLARM) at Dickinson College have been working together for several years to monitor water quality in the Conodoguinet Creek Watershed. Monitoring data collected includes water chemistry information for 1998-2002 at several sites throughout the watershed. There are seven sites located within the Middle Conodoguinet Creek: CONO 46.3 CONO 46.8, CONO 48.8, CONO 53.2, MTRK 00.1, MTRK 03.3, and MTRK 03.9. CONO sites are on the main stem Conodoguinet, and the MTRK sites are located on Mount Rock Creek.

The CCWA is currently working to develop a plan of action for monitoring within the watershed. As part of the plan development, a summary of monitoring activity was developed in Spring 2003 by ALLARM. Five out of the seven sites in the study are included in this monitoring summary. Based on the summary data, two of the five including monitoring sites are potential problem sites. CONO 48.8 had low dissolved oxygen in 1999 and 2001, an indicator of high eutrophication. MTRK 03.9 was close to nitrate violation in 1998 and 1999, which could be an indicator of high agricultural runoff.

According to the Spring 2003 summary, monitoring data for the entire Conodoguinet Creek shows the following:

- Both point source and non-point source pollution are impacting the Conodoguinet. Any mitigation and protection plans should include targeting both types of pollution sources. A number of sites show evidence of high nitrate and/or phosphate concentrations and low or high percent saturation of DO.
- Nonetheless, based on the parameters measured by CCWA from 1998-2002, the Conodoguinet Creek is generally in good health. It is recommended that we work aggressively to establish protection and growth management measures so that water quality does not degrade any further.
- The current study provides excellent baseline data with which future data can be compared to assess the effects of future land use decisions and to prevent further degradation. It must be made accessible so that it can be used in this manner.

Based on the monitoring summary done by ALLARM, recommendations for future efforts include:

- Implementing an aggressive landowner education effort.
- Working with townships and boroughs for sound land use planning and growth management to protect our freshwater resources.
- Becoming actively involved in the permit renewal process for point dischargers to strengthen river protection (there are currently over 50 permitted point dischargers in the watershed).
- Increased monitoring efforts around hot spots identified by this study.
- Implementing a tributary monitoring plan.

The plan of action, which is currently being developed by CCWA, will include several of these recommendations for future efforts within the Conodoguinet Creek watershed.

6. Water Quality Snapshots

As part of the Earth Day celebrations in the spring of 2001 and 2002, volunteers and members of the Conodoguinet Creek Watershed Association conducted a water quality snapshot on tributaries to the Conodoguinet Creek. Twenty-six tributaries were sampled near their confluences with the Conodoguinet Creek. Nine of the tributaries sampled originate as springs or flow through limestone (carbonate) rocks of the valley and 17 streams sampled originate in the shale rock of North Mountain or the mountain foothills. Grab samples were collected and taken to a central location for analysis. See Map 14, Water Quality Snapshot Monitoring Sites for the location of sites included in the snapshots.

The shale tributaries had the lowest concentrations of nitrates, ranging from 0.36 to 3.68 mg/l and an average of 1.66 mg/l. Only two of the carbonate tributaries had lower nitrate concentrations than the shale tributaries. Concentrations ranged from 3.04 to 10.85 mg/l and averaged 6.72 mg/l. Samples collected during the 1999 Citizen Volunteer Monitoring Earth Day Water Snapshot sampling throughout Pennsylvania had nitrate concentration less than 1.0 mg/l in 49% of the 414 samples and concentration less than 10 mg/l in 94% of the samples.

Phosphorus (P) concentrations measured in the Conodoguinet Creek tributaries ranged from 0 (below detection limits) to 0.05 mg/l. They were all below the 0.05 mg/l recommended upper limit established by EPA. Sources of phosphorus in streams and lakes are leaking sewer pipes, fertilizer applications, or stormwater runoff. A measurement of dissolved versus total P would determine the origin of the phosphorus: high dissolved P indicates that the P is from groundwater flow and not the soil.

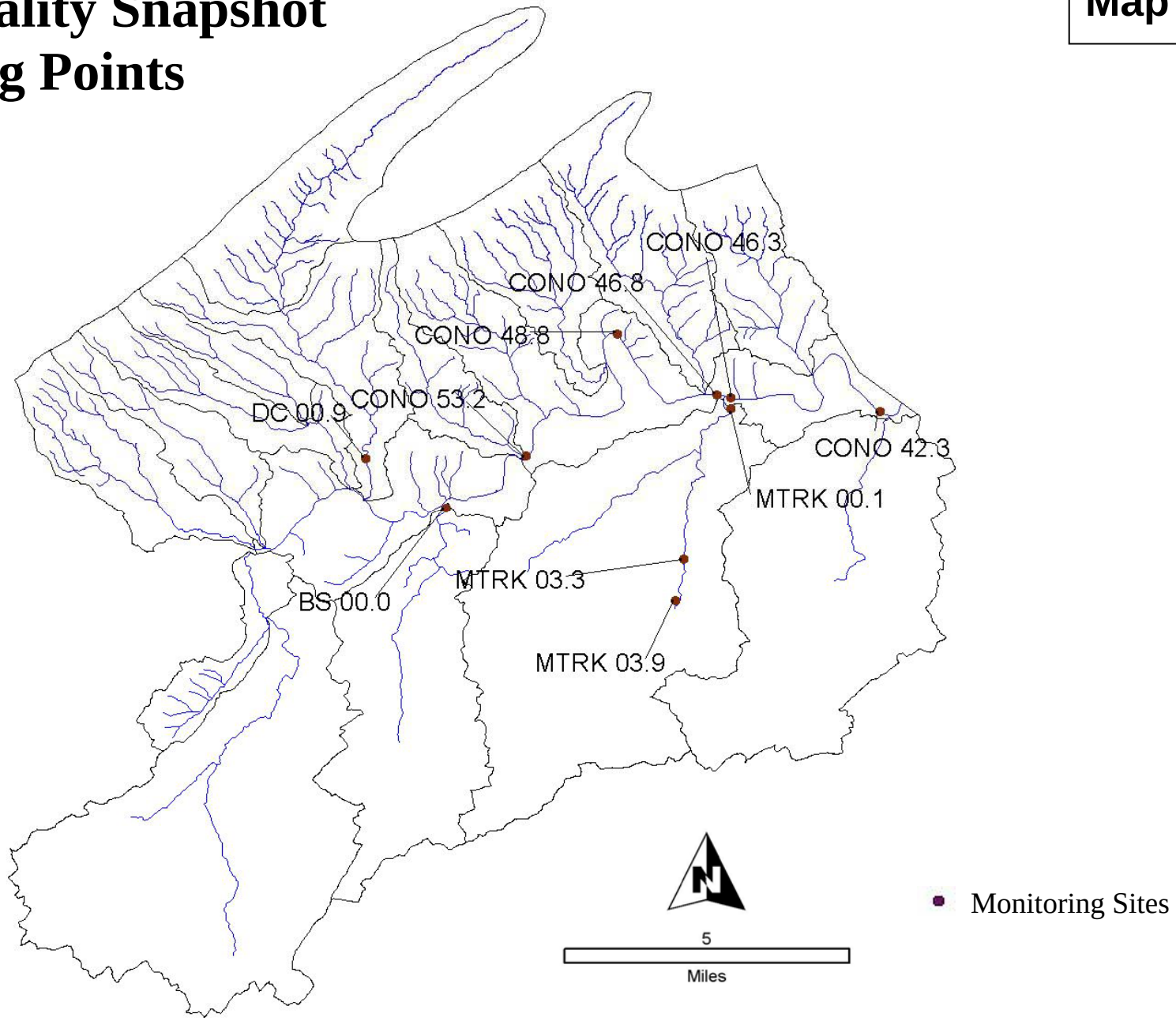
The volunteer monitors also measured pH, which is a measure of the acid/base relationship of the water. The pH scale ranges from 0 to 14, with neutral at 7. All the pH measurements were about or near neutral pH. Specific conductance (SC) was also measured. Conductance measures the ability of the water to pass an electric charge and the amount of dissolved minerals, such as calcium, sulfate, and nitrate, in the water. Primarily the bedrock of the watershed affects conductivity. The conductivity of natural waters is generally low in sandstone and high in carbonate and shale bedrock. Road salts and leaky septic systems can raise the conductivity of streams. Most of the carbonate tributaries had higher SC than the shale tributaries. Exceptions were Rowe Run and Mount Rock Spring, carbonate tributaries with relatively low SC, and Simmons Creek, Sears Run, and Holtz/Pine Run, which had the highest SC among the shale tributaries.

The water snapshot was conducted in April, after a period of normally high seasonal rainfall. Sampling during the springtime may yield higher concentrations of nutrients

due to runoff from the land surface. Sampling during the summertime would yield a more representative picture of normal base flow conditions, that is, when stream flow is maintained by groundwater discharge. Concentrations of nutrients in the stream during the summertime are more indicative of groundwater conditions.

Water Quality Snapshot
Monitoring Points

Map 14



IV. Biological Resources

The study area has a number of biological resources, including the local ecological environment and wildlife habitat.

A. Ecological Environment

Cumberland County is located west of the Susquehanna River and lies in the state's Ridge and Valley Province. The Project Area encompasses a mix of forest to the north, agriculture, small towns and suburbs. Development patterns in the county have been greatly influenced by the dominant features of the landscape itself. The Great Valley, incorporating central Cumberland County, contains the majority of the urban and intensely agricultural areas. However, Cumberland County still contains a patchwork of natural and human-dominated habitats, including cropland, pasture, young and old forests, ponds, streams, and rivers. These areas are used for hunting, fishing, hiking, birdwatching, and other activities, which make the region an attractive place to live. The same pieces of the landscape, which provide scenic and recreational opportunities, also function as habitat for a great diversity of plants and animals, including some, which are rare, threatened and endangered species. Cumberland County contains intact examples of natural communities and sites for species rare in the state or even globally rare.

Much of the recent population growth in the region has occurred through new developments and the expansion of small towns and suburbs into previously rural areas. Recent changes such as the expansion of Route 322 and the growth of suburbs in the Cumberland Valley will affect the county. As growth continues, the natural areas that comprise Cumberland County's native natural heritage can be easily lost without careful planning of growth and development. Protecting the integrity of these natural systems provides benefits to humans as well as providing for the survival of wildlife, rare and otherwise. The danger of losing rare species and habitats is more intense in a region experiencing growth as rapidly as the Cumberland County area. Wise planning can maintain open space, including natural environments and the plants and animals associated with them. A balance between growth and the conservation of scenic and natural resources can be achieved by guiding development away from the most environmentally sensitive areas.

In order to achieve such a balance and ensure protection of critical natural areas, county and municipal governments, the public, and developers must know the location and importance of these sites. This knowledge can help prevent conflicts over land use as well as help to direct protection efforts and limited conservation dollars to the most vulnerable areas.

B. Corridors/Habitat

The Ridge and Valley Province of Pennsylvania, which includes most of the state's mountains, contains the Great Valley Section in the eastern portion of the province. It is marked by a broad plain about 30 kilometers (20 miles) wide, and is regionally known as the Cumberland Valley. It is characterized by low, undulating hills cut by slow-moving watercourses. The Conodoguinet Creek is one of two major drainages of this portion of the Cumberland Valley and releases into the Susquehanna River. Bordering the Great Valley Section on the West is a forest-covered mountain ridge known at various points along its length as Blue, Kittatinny, or First Mountain. It rises some 300 meters (990 ft.) above sea level.

1. Wildlife Habitats and Corridors

The 1996 Farm Bill elevated wildlife to coequal status with USDA soil and water conservation goals. Every conservation program, plan and action should consider wildlife habitat and soil and water conservation needs. Although forests cover much of Pennsylvania and provide food and shelter for many of the state's birds and mammals, farmlands, grasslands, old fields, and wetlands also supply suitable habitats. These plant communities are scattered throughout the state and are often ephemeral in existence. For example, farmland that no longer is cultivated may soon revert to a grassland community.

In addition to the types of habitats listed below, there is also a decided need for travel lanes. These wildlife corridors are as necessary to wildlife as our highways are to us. Corridors allow for the movement (dispersion) of a variety of organisms while at the same time minimizing contact with organisms or situations that could have an adverse affect on species movement. Several examples of natural wildlife corridors include hedgerows, narrow woodlands connecting larger woodlots and forests, waterways, riparian forests/woodlands, or undisturbed strips of grasslands

a. Woodlands

Woodlands in the Project Area are generally wooded lots located on farms. Woodlands on farmlands provide unique habitats and management opportunities for wildlife. More contiguous woodlands are found abutting the Blue Mountain located on the northern side of the Cumberland Valley.

b. Agricultural Grasslands

These lands have been planted in grass and are preserved by mowing or grazing. They are completely artificial ecosystems that the Europeans created in a space of about 50 years. Shunning the value of the native warm-season grasses, colonists imported seeds of their own cool-season grasses almost immediately upon arriving. Grassland that is cut periodically is called a meadow; if it is grazed continually, it is called a pasture. Meadows may remain green through most of the summer if cut; they consist of grasses that are one to two feet high. Pastures are short-cropped, a rich green, and frequently support a population of robust weeds.

c. Relict Grasslands

Though dwarfed by surrounding forests, grasslands existed in the eastern forests when the European settlers arrived. The Native Americans recognized them as having outstanding attraction and benefit to wildlife. Components include warm season grasses, with scattered forbs and woody species. Remnants of these tall grass prairies and savannas that once dotted eastern forest regions are now mostly limited to pioneer cemeteries, wasteland pastures, roadsides, railroad beds and beech ridges in parks and nature preserves. They provide a window into the past.

d. Old Fields

An agricultural field that has not been grazed or mowed is taken over by different species of grass. Old fields and relict grasslands are filled with coarse yellow grasses and a wide assortment of shrubs and forbs. (Forbs are non-woody plants that are not a grass.) Ultimately, if undisturbed, an old field becomes a forest.

e. Succession Areas

Succession can be defined as the orderly progression of plant and animal communities over time in the absence of disturbance. Generally the progression includes old fields surrounded by a forest, which is invaded by weeds, then perennials and shrubs. Saplings and pole timber replace these, and finally a mature stand of trees develops. Different animal species take advantage of the different habitat conditions offered by each stage of succession.

f. Wetlands

Wetland communities such as small streams, swamps, marshes and bogs are interspersed throughout the Cumberland Valley. A wetland is characterized by soil that is periodically saturated or covered with water. Wetlands are the most productive and the most rare habitat type in Pennsylvania. These areas support the greatest number of wildlife species. Despite their great importance to wildlife, an alarming number of wetlands are lost each year to development

g. Riparian Zones

Riparian zones are narrow strips of land bordering streams. These areas have long been known for their importance as fish and wildlife habitats. During the hot summer months, riparian vegetation provides shade that protects aquatic life from high water temperatures. Animals depend on riparian zones for both the protective cover that the vegetation offers and for water. Riparian zones also act as natural sponges by soaking up water and lessening the effects of heavy rains and snowmelt. These areas help to control soil erosion by stabilizing stream banks. A lack of vegetation along a stream leads to high water temperature and an increase in water turbidity, which in turn results in loss of aquatic life.

h. Spring Seeps

Spring seeps occur throughout the mountainous areas in the northeastern United States. Seeps exist where water percolates through the soil and emerges from the ground on lower slopes. The surfacing of this ground water creates snow-free areas

in the winter. These areas may be the only places in woodland where wildlife, such as the wild turkey, can move and feed.

2. Habitat Disturbance

The nature, scale and frequency of disturbance are influential in the evolution and appearance of natural communities and associated rare species. Disturbance can be beneficial or destructive to the development and persistence of natural communities. Some examples of natural disturbances are flooding, fire, and deer browsing. While often regarded as a detrimental impact, both fire and small-scale flooding can be beneficial to certain communities or rare species. Floodplain forests benefit from the periodic scouring and deposition of sediments as streams overtop their banks. At the same time, streamside wetland communities hold excess water, thus reducing the scale of flooding downstream. In contrast, deer have been blamed for a number of negative impacts on Pennsylvania flora and fauna: a reduction in the amount of understory, poor regeneration of some species, decreased songbird diversity, and direct loss of rare plants.

In many cases, human disturbance has been clearly distinctive to natural habitats and species associated with them. Although necessary, farming, mining and development are disturbances that have completely eradicated some natural communities and habitats. For example, old-growth forests are all but non-existent although occasional old trees may be encountered; many wetland habitats have been filled or altered, resulting in the loss of some of the native plants and animals of these sites. Although some species, including several rare species, are aided by on-site disturbance (e.g. clearing or mowing), human disturbance is detrimental to most species. With wide-ranging human disturbance, some plant and animal species may be completely eradicated from an area because they cannot compete or survive under newly created conditions.

C. Wildlife

1. Terrestrial

a. Birds

The Conodoguinet Creek and the surrounding watershed support a diverse bird community (108 confirmed species, 32 probable, and 25 possible). Habitat variability and proximity to the Susquehanna rookery are the likely explanation for this richness. However, increased pressure from urbanization, conversion of farmland to residential and industrial area, and continued water quality limitations on aquatic diversity pose a threat to this diversity and abundance. A full list of birds that breed in and/or frequent the area during non-breeding seasons is located in Appendix F.

b. Mammals

The variety of habitats throughout the watershed provides for the ecological needs of a diverse spectrum of mammalian species. Some are more common than others.

People seldom see many because of their nocturnal behaviors. Pressure for continued development of rural areas is a real and constant threat to many of these species especially those with specific habitat needs. See Appendix G for a complete list.

c. Hunting and Trapping – Recreation and Economic Impacts

Small Game

Despite the Northeast U.S. obvious urban nature, agriculture, forest products and wildlife-associated recreation are big business in the region. Society can simultaneously derive a variety of economic, recreational, educational, ecological, aesthetic, tangible (products such as meat, fur and leather), spiritual, familial and other personal benefits from wildlife. Recreational hunting is only one of many ways society derives benefits from wildlife. While some of these benefits may be attained from other activities, such as birdwatching or photography, hunting can provide them all.

Retail purchases by Pennsylvania hunters stimulate a total of more than $500 million per year in economic activity directly related to hunting and hunting equipment. This contributes over $1 billion annually to the state's business and industrial communities. In 1996, it also accounted for the collection of Pennsylvania taxes in the amount of $163 million. This economic activity is particularly important in rural areas where most hunting occurs. Furthermore, more than 20,243 jobs throughout numerous industries in Pennsylvania are directly dependent on hunting-related expenditures. Hunting provides significant recreational opportunities for society. In 1996, Pennsylvanians spent all or parts of over 57 million days hunting, fishing and wildlife watching away from their homes.

The Project Area lies in the heart of Primary Pheasant Range, which, historically, produced legendary numbers of ringneck pheasants. Not native to this continent, the ringneck populations burgeoned during the years of farmland set-aside acres, and plummeted with the demise of those programs in the early 1970s. Wild pheasant populations in the Project Area are practically non-existent today. The cottontail rabbit has a similar history, although not nearly as drastic.

Statewide since 1983, hunter participation has declined for every species of small game, as well as wild turkey. As hunter participation has declined, so have the number of game animals harvested.

The trends for hunting and trapping furbearers are similar. The exceptions are the coyote and weasel. The weasel harvest has changed little from 1990 – 1996, while the coyote harvest has increased four-fold in that period statewide.

Big Game

In the Project Area in 1996, there were approximately 400 whitetail deer, antlered and antlerless, reported as legally harvested. This represents 28% of the reported harvest for Cumberland County, which was 1436. In that same year, there were 371

deer reported as killed on the highways in Cumberland County. An extracted 28% yields an estimate of 104 deer killed on the on the highway in the Project Area.

The deer population is well above the Pennsylvania Game Commission's management goal for Cumberland County and continues to grow. It is not known what the impact of these numbers is to the agricultural base.

2. Aquatic

a. Macro-invertebrates

Numerous studies have focused on macro-invertebrate life within the Creek, however to date, no comprehensive study has been completed. Research completed in 1994-1995 by Jeff Ericson has yielded the most extensive data, though he concentrates only on the lower 43 miles of the Creek. His collections, obtained by five kick samples from each of 18 sites, yielded between 3421 individuals (summer collection) and 7403 individuals (spring collection) representing 40 different genera (due to difficulty in identification to the species level).

Macroinvertebrate information from above mentioned study:

Yearly Averages	**Sites 1-9**	**Sites 10-13**	**Sites 14-18**
EPT	80.66	213.4	148.08
Richness	240.91	332.68	323.14
HBI	4.63	3.86	4.29

HBI (Hilsenhoff Biological Index) Values:

Biotic Index	**Water Quality**	**Degree of Organic Pollution**
0-3.5	Excellent	None apparent
3.51-4.5	Very Good	Possible/Slight
4.51-5.5	Good	Some
5.51-6.5	Fair	Fairly Significant
6.51-7.5	Fairly Poor	Significant
7.51-8.5	Poor	Very Significant
8.51-10	Very Poor	Severe

b. Fish

Many fish species are present in the Conodoguinet Creek. The creek is classified as a warm water stream, but does have some cold-water tributaries and springs leading into it, making excellent habitats for cool water fish species. The numbers of fish along the Conodoguinet Creek has been declining, however, due to silting, chemical pollution, and loss of habitat. See Appendix D for full listing of fish species.

Recreational fishing is available in many of the streams in the study area of the watershed. In the main stem, panfish and smallmouth bass are the main sport fish. Many headwater streams on Blue Mountain have native brook trout populations. Green Spring Creek and Big Spring Creek are stocked under the PFBC catchable trout program. The revitalization of Shad and their migration ability is becoming an important issue within the Conodoguinet Creek area. Shad migration is on the rise

in the watershed.

D. Vegetation

1. Invasive Species

An increasing threat to these communities and natural habitats is the introduction and spread of exotic (i.e., non-native), invasive species across the landscape. The grass carp is one such species, among a long list of plants that threaten and disrupt native species. Non-native plants such as Japanese honeysuckle (Lonicera lanonica), tree-of-heaven (Ailanthus altissima), Oriental bittersweet (Celastrus orbiculatus), and garlic mustard (Alliaria officinalis) have become commonplace in disturbed woodlands, often to the point of excluding some of the native plants. In wetlands and along streams, purple loosestrife Lythrum salicaria), Japanese knotweed (Polygonum cuspidatum), and mile-a-minute weed Polygonum nerfoliatum) are aggressive, weedy species that follow in the wake of disturbance and crowd out native species. The natural disturbances of flooding and scouring that occur along the Susquehanna River corridor, coupled with increased stormwater runoff and other human changes to drainage systems, have helped to facilitate the invasion and colonization of many exotic species.

Many existing plant communities along the middle Conodoguinet corridor include a number of exotic species. The species with the greatest impact in these communities tend to be robust herbs such as purple loosestrife and Japanese knotweed, although vines such as Japanese hops are also serious problems. Aquatic habitats of the rivers, streams, and lakes are also vulnerable to invasion by exotics. Curly pondweed (Potamogeton crispus), a native of Europe, has become the dominant plant species in some of the regions' waterways, and Asiatic clam (Corbicula fluminea) has become the most common mussel in some of the regions' streams.

Control of these problematic, non-native species is necessary for the long-term maintenance of high quality natural systems. Discouraging the use of these and other potentially weedy exotics in and around natural areas can help to prevent further encroachment. Some nurseries now carry a selection of tree, shrub and herbaceous species that are native to Pennsylvania, and these are recommended where plantings are necessary in, or adjacent to, natural areas. The Vascular Flora of Pennsylvania (1993) is a helpful reference for determining whether a plant species is native to the state or not.

2. Forest Resources

The project area is comprised of approximately 100,650 acres. About 22% of the total, 21,950 acres, is forested. The majority of this forested acreage is on the slopes of Blue Mountain, about 73% of the total 21,950 acres or 16,000 acres. For the most part, the soils throughout the project area are capable of supporting a good stand of native tree species and are generally rated high in productivity. The current condition of the forest, as it relates to buffering capabilities, is good to excellent.

These forests provide significant societal benefits; stormwater retention, wildlife habitat, scenic beauty, air purification and stream buffering. In addition, proper management will provide income for the woodland owners and employment for the logging industry. As income is derived from the forest management activities the pressure to change the land use to a form of developed activities is lessened.

a. Timber Operations

Stream margins are frequently highly productive timber sites. In any logging operation, trees should be left on both sides of a stream to provide a buffer strip 100 feet wide. Special efforts should also be made to keep logging equipment out of the stream. Haul roads and skid trails should be at least 150 feet away from the water and even farther away when logging on steep slopes.

3. Riparian Buffers

Sixteen tributaries to the Conodoguinet Creek were documented in the project area. Through a photo-interpretation of the tributaries, it was judged that 30 miles of these stream lengths are adequately buffered. Hence, over 40 miles of stream has a non-existent or inadequate buffer.

Stream Name	Length (ft)	% Adequately Buffered
Brandy Run	21,800	50
Whiskey Run	21,700	15
Back Creek	13,750	15
Center Creek	22,900	10
Doubling Gap Creek	56,250	80
Rock Creek	23,300	50
unnamed tributary	17,000	70
Bloser Creek	21,600	50
Locust Creek	25,000	65
Opossum Creek	17,500	50
Alexander Spring	20,800	15
Mt. Rock Spring	21,600	10
unnamed tributary	20,800	25
Bulls Head Branch	25,800	10
Green Spring	20,800	35
Big Spring Creek	25,000	50

The lack of adequate buffering in a significant portion of the study area presents a significant opportunity for improving water quality. It also presents an opportunity to educate the public on the value of riparian buffers. Riparian buffers are significant greenways connecting open spaces throughout the study area.

V. Cultural Resources

Cultural resources are mainly related to history and heritage and recreational.

A. Historical

1. Origins of the Name Conodoguinet

The name Conodoguinet is a corruption of the original name for the creek, which was Gunnipduckhannet. Translation of this word means "for a long way nothing but bends." It is derived from two Native words; Gu-ne-u, "long" and P'tuk-hanne, "a crooked creek." According to Donahoo (1928) the correct form of the word would be Guneptukhanne. Throughout the history of Cumberland County, the creek's name has been repeatedly altered until it acquired the current name used today. Other forms of the name include Canadagueany (Weiser 1743), Canataquamy (Weiser 1743), Canataqueany (Weiser 1748), Conedaguinet (PA council 1771), Conedagwainet (Evans, map, 1749), Conedagwinit (deed of 1949), Conedegwenet (Evans, map, 1755), Conedoguinet (Norris 1755), Conedogwainet (Penn Manor survey map 1768), Conedogwenet (Pownall, map 1776), Conedogwinit (Scull, map 1759), Conidogwanet (Lowther Manor map 1764), Connedoguinet (Pa Council 1771) and Conodoguinet (Historical map of PA 1875).

2. Early Inhabitants

From Paleolithic times to the early colonial period and up to the present day, the Conodoguinet has been an integral part of Cumberland County and its history. The fertile soils, level terrain, and the abundant and voluminous springs played an important role in the settlement of the Cumberland Valley. In the past the Conodoguinet has served as a source of water, food, power for industry, a means for transportation, and as a place of natural beauty. Today it's legacy lives on. Like so many places, current land use within the middle reaches of the Conodoguinet watershed was dictated by land use long ago. Some of the old trails that were used by indigenous peoples are now the roads and highways of Cumberland County. Many of the farms in this region have been under cultivation since the first Scotch-Irish and German immigrants settled the area in the 1700s.

The Algonquins and the Susquehannocks or Minquas were the earliest. Later, the Iroquois Confederacy comprised of Cayuga, Mohawk, Oneida, Onondaga, and the Seneca took over the lands. The Shawnee and Delaware (Lenni Lenape) were the last native peoples to inhabit the watershed. The influx of Scotch-Irish and German settlers pushed the Shawnee and Delaware westward. Some of the old trails that were used by indigenous peoples were precursors of the roads and highways of present day Cumberland County.

3. Samuel Blunston Land Licenses and Early Europeans

Lands of the Middle Conodoguinet watershed were actually some of the first lands to be settled in Cumberland County. As far back as the early 1730's this land was recognized as having rich soils for farming as well as an abundance of forests and water resources. It was these qualities that enticed many of the early Scotch-Irish

setters who crossed the Susquehanna River to settle the area. Many of the farms in the watershed have been under cultivation since the arrival of the first immigrants.

Samuel Blunston was authorized to act as the Penn family agent in granting land licenses from 1733-1737. These licenses which pre-dated deeds and warrants in Cumberland County permitted many of the early settlers to take up lands until they could be purchased from Indigenous peoples After the land purchases were complete in 1936 warrants for the lands were then issued to the occupants. During the period of time between the license and the land purchase the occupants were required to arrange and pay for a survey of the property. After which the survey was to be returned to Samuel Blunston. Those who returned the surveys then had the opportunity to purchase the land. If they failed to do so they were considered squatters and appropriate actions were taken.

By 1750, Carlisle had been formed, followed by Cumberland County (1750), and Shippensburg (1751). By 1762, the first of over 9 mills to be built along the Conodoguinet was built by John McAllister at Roxbury. Waters from the Conodoguinet and a number of its tributaries powered many businesses that became an integral part of the predominately rural communities.

In 1771, the State Assembly declared the Susquehanna and some of its tributaries, Including, the Conodoguinet, to be public highways, suitable for navigation. By 1826, the Canal Commissioners had recommended that a canal be built connecting the Susquehanna and the Potomac. A Conococheague-Conodoguinet canal would have resulted in an all-water route between Harrisburg and Washington. However, before the canal could be built, railroads made the canals obsolete. In 1831, local leaders organized the Cumberland Valley Railroad, which towards the end of the century became very prosperous.

4. Historic Sites

a. Mills

The mills of Cumberland County were the small industrial centers of their time. Creeks in the watershed powered mills and small businesses. The first mill was built in 1762 at Roxbury. The early 1800's saw the development of different types of mills for the processing of the abundant harvests secured in the area including grist, clover, plaster and chopping, rolling, oil, hemp, woolen, lumber (saw), and paper mills. Besides grain, cider, nails and wood, these mills refined diverse products such as sumac leaves that were made into tanning and dyeing materials. Distilleries were also located at a number of these sites. By 1840 the Conodoguinet Creek provided the power for some 140 plus mills throughout the county (Van Dolson). By l909, only l3 of the mills remained. Today, the industry is largely forgotten. A few of these milldams remain, including the following:

Heishman's Mill (Greider's or Dillers Mill): built in West Pennsboro Township in 1805 by Francis Diller, served as a grist and sawmill (until the 1880's when it focused

solely on grain processing). Operation ceased in the middle 1900's, but it still stands today in excellently preserved form.

Laughlin's Mill Big Spring east of Newville ca 1760 large stone mill, although the exterior eludes to the structure as being a fully restored mill it now serves as a private residence.

John Eckert Grist Mill (North Newton Township): In 1797 Bernard Speck operated a gristmill at this site. Between 1802 and 1835 the property ownership changed eight times. John Eckert built the still remaining mill in the late 1830's-early 1840's.

Schouller's Mill (Lower Mifflin Township): built in 1780 (a replacement to a burnt structure), was a grist and saw mill owned by John Schouller. The *family* owned and operated the mill for almost 140 years (1768 to 1902). The building is in very poor condition, but still stands along Creek Road.

b. Historic Homes

Some of the finest architecture found in Cumberland County graces the banks of the Conodoguinet Creek. Many of the homes situated within the boundaries of the management plan area sit within view of the creek. The following historic homes are listed by township.

Upper Mifflin Township

John Eckert House: a log house located on Creek Road was built between 1837 and 1840. A large frame barn also sits on the creek-front property.
Samuel Bowman House: also located on Creek Road and overlooking the C*onodoguinet,* was built between 1855-58. Bowman purchased the brick farmhouse from John Whistler in 1853. A nineteenth century frame barn and wagon shed are still on the property.
John Whistler House: a remarkably intact early frame house was first recorded as standing in 1850 as a tenant house on Abraham Whistler's farm. Levan Orris purchased the property in 1858. It is located along the Black Run.

Lower Mifflin Township

Unnamed three bay façade: This tin-roof house located in Newville dates back to the late 1700's. The earliest known owner, Reverend Samuel Wilson, was a minister at the First Presbyterian Church in Newville. The farm and barn has changed hands numerous times since then.
James Woodburn House: This house is located on Route 233 and overlooks the creek. It is a log structure built between 1810 and 1820 by its namesake. Peter Ahl bought the farm and owned it until 1872.

Lower Frankford Township

Samuel Buchwalter House: a good example of a log cabin constructed by 1 820's settlers, exists one-third mile north of the Conodoguinet. The home was built between 1818 and 1823, likely by its namesake.

John Mordorff House: built in 1855 a four bay brick farmhouse and bank barn by its namesake, overlooks the creek near Plainfield.

Upper Frankford Township

Christian Myers House: built circa 1820, is a two-story brick structure located close to the creek near Plainfield. Its namesake likely built it.
Jacob Bowman House: built sometime prior to 1798, is a log house retaining many original features. It is located along the creek near Plainfield.
Beniamin Gayman (Gehman) farm complex hosts a brick house built between 1861-64. It is located on Creek Road along the Creek.
Col. William Gracv House, built circa 1850, located on Creek Road inhabited by Gracy Family.

West Pennsboro Township

James MacFarlane House and stone barn sits back a lane off Creek Road facing the creek. McFarlane built it in 1798. By 1816, the property had changed hands several times—eventually to John Diller, a German Mennonite farmer.
Diller Mennonite Church is located next to Creek Road. The German Mennonites came to the area in the late 1700's and made the south side of the Conodoguinet their home. One of the first families, the Dillers purchased land in the early 1800's and held church services at their residence on the property. Eventually, the simple, brick church was built in 1868. Some of the oldest tombstones in the township are also found here.
Isaiah Graham House, a huge structure sitting between Creek Road and the Conodoguinet, consists of an original log house with two stone wing additions. The Graham family arrived from Scottish-Ireland in the late 1700's and started one of the earliest tankards. Graham, a prominent citizen, agrarian, judge, esquire, and state senator, likely built the original part of the house around1790. The additions date back to 1820.
Jacob Alter House sits south of the creek on Creek Road. The namesake arrived in the township in the early 1700's and started a flourmill and trading post where such items as coffee, sugar, and salt could be purchased. He also had a saw and clover mill and distillery on the property, which were in operation until the late 1800's. Alter and son, his heir, both served on the State Legislature. The extant house dates to circa 1800.
Lime Kiln, off Creek Road near Plainfield, built around1850, sits on the south side of Creek Road in the slope of a hill. The Bricker family owned the property during much of the 1800's, though there is no evidence that they, in fact, operated the kiln.

c. Bridges

Covered bridges were the link between the north and south sides of the Conodoguinet creek during the early days of Cumberland County. Many of the bridges were built at fords of the creek. Before any bridge was built, County officials required proof of need. The process required citizen input, meetings with county officials, and review by a committee that ultimately resulted in approval or denial from the county courts. Other factors that affected the process were the influence of

wealthy and political interests, citizen pressure and availability of moneys to build the bridges (Porter).

All of the *Conodoguinet's* wood covered bridges were of the arch-truss design of Theodore Burr: "On each side of the bridge a great arch was sandwiched between the multiple king-post arrangement, pinned to the trusses, and tied directly into the bridge abutments. Instead of strengthening the arches by the trusses, Burr's arches strengthened the trusses. Each side of the arches sprang from approximately three feet below the bottom chords and was pinned through at every intersection with the members of the trusses...Burr's roadway was level.

The latter steel bridges over the Conodoguinet were of the Parker truss design. In essence, the truss principle involved connecting the individual members of the bridge in a series of triangles. Major features are top and lower chords that resist forces caused by bending. The Parker truss had an inclined top chord.

Concrete bridges have long since replaced many of the wooden and steel bridges of days past. However these bridges are still links between the north and south sides of the creek and are traversed by many county residents in their daily commutes. The bridges and their locations are listed below in order from east to the west in the project area. Each description gives the most common name for the bridge, followed by other names the bridge has been known by. Next is its location (where available, first by the nineteenth century place names).

Watt's Bridge (Noble Bridge, Noble-Watts Bridge), at Nobles ford, McClures Gap Road-SR 4027. The original iron bridge was carried away by ice in 1881, and was replaced with a covered, wooden bridge which was in turn replaced with a covered wooden, two span, Burr arch-truss in 1890. It was razed by a fire in the mid-1960s and was eventually replaced by a concrete bridge in the 1990s.

The Havs Bridge (McDonalds Bridge, McDonald-Baker Bridge, Fishburn Bridge), at Jumpers Mill, Bakers Ford-Meadowbrook Road was constructed in 1792. The original structure was an uncovered wood bridge, which was reputedly the first major span on the Conodoguinet Creek. Replaced in 1825 by a wood covered, single span (110 feet), Burr arch-truss. It was torn down in 1962 and replaced with a concrete bridge. Before it’s demise, the Hays Bridge was believed to be the oldest surviving covered bridge in the United States.

Hertzler's Bridge (Germeyers Bridge), at Germeyers Mill, Iron Bridge Road, was built in 1896. Parker metal truss, one span.

Burgner's Bridge (Burgner’s Bridge, Hepburn Bridge, Lindseys Bridge, Forbes Bridge), near Hepburn-Burgner’s Mill Road (T457) was built in 1889 by Samuel Myers. The original three span iron bridge served the people of this area for 19 years before it was destroyed in a flood. It was replaced by the wood covered, two

span, Burr arch-truss in 1889. Within a few years, an iron bridge was built adjacent to it. Both bridges were torn down in 1959 and replaced with a concrete bridge.

Greider's Bridge (Kreider's Bridge, Heishman's Bridge), is located near Isaac Shelleberger Mill (Diller's Mill Heishman's mill), Old Mill Road-SR 4025. This bridge was constructed in 1851. It was Wood, covered, two spans, of the Burr arch-truss design. A concrete bridge replaced Greider's bridge in 1961.

Stanton's Bridge (Alters Bridge), near the Alter or Frehn Mill-T448. Built in 1855. It was wood, covered, one span, and a Burr arch-truss design. The bridge was torn down in 1961 and replaced with a concrete bridge.

Diller's Bridge at John Diller's ford-Bloserville Road-SR 4021. Built in 1829. Wood, covered, one span, Burr arch-truss. Replaced in 1913 with a concrete bridge.

Grahams Bridge (Bowman's Bridge): Bridge Road-T409, SR 4019. Built in 1856. Wood, covered, one span, Burr arch-truss. Replaced in 1961 with a concrete structure.

Jacob's Twin Bridge (Newville Bridge, Doubling Gap Road), at Jacobs Ford- SR 0233. Built in 1824. Wood, covered, one span, Burr arch-truss. A second identical bridge was built in 1879.
Replaced prior to 1933 by a steel structure.

Eckert's Bridge (Eckert's Triple Bridges), at Eckerts ford-Steelstown Road-SR 4006. Built in 1852. Wood, covered, one span, Burr arch-truss. Two additional metal bridges built adjacent, wooden bridge burned in 1936. A single span steel bridge was built in the 1970's.

d. Archeological Sites

According to the records of Reverend James Brown Scouller (1820-1899), a local historian of his day, an Indian burial ground once existed in an area of Upper Mifflin Township, in the vicinity of Brandy Run. The probable location of this burial ground can be found on the 1872 Atlas of Cumberland County. Scouller's records also indicate that an Indian village existed within the same neighborhood; and that the peninsula in the long bend of the creek, owned by Matthew Thompson, was used by the villagers to raise corn. Another site, an Indian encampment, once existed in the area where the Big Spring and Conodoguinet meet. There is also an archeological site at the Logan School on Creek Road. All sites are located on private property.

B. Recreational Resources

1. Facilities and Use

Several types of recreational facilities offering a variety of uses are located within or adjacent to the middle reaches of the Conodoguinet Creek watershed. State recreation lands include Colonel Denning State Park located in Upper Frankford and Lower Mifflin Townships (operated by DCNR), State Game Lands 169 in Upper Mifflin Township (operated by the PA State Game Commission) and Opossum Lake (59 acre lake) located in Lower Frankford Township (operated by the PA Fish and Boat Commission). Recreational activities associated with the state operated facilities include: swimming, fishing (year round), environmental education, boating, hiking, family camping, hunting, trapping, cross-country skiing, ice skating, sledding, and tobogganing. Municipal operated facilities in this region include the Newville playground and Newville Community Center and the West Pennsboro Township Park. Other public, semi-private, and private recreation facilities associated with schools, churches, and other institutions and golf courses are also in the area. The Conodoguinet Creek and Big Spring Creeks, including their numerous tributaries, are also available for a number of activities including fishing, boating and other forms of recreation.

Both public and semi-public lands make up a large part of the available recreational resource areas. Map 15 shows the State Forests, State Parks, Municipal Parks, Golf Courses, Fish & Boat Commission facilities, and the Cumberland Valley Rail Trail that are located within the study area.

A list of recreational facilities and associated uses is in Table 6, Municipal Recreation Facilities. Cumberland County has a total recreation acreage area of 1824.85 acres.

Table 6, Municipal Recreation Facilities

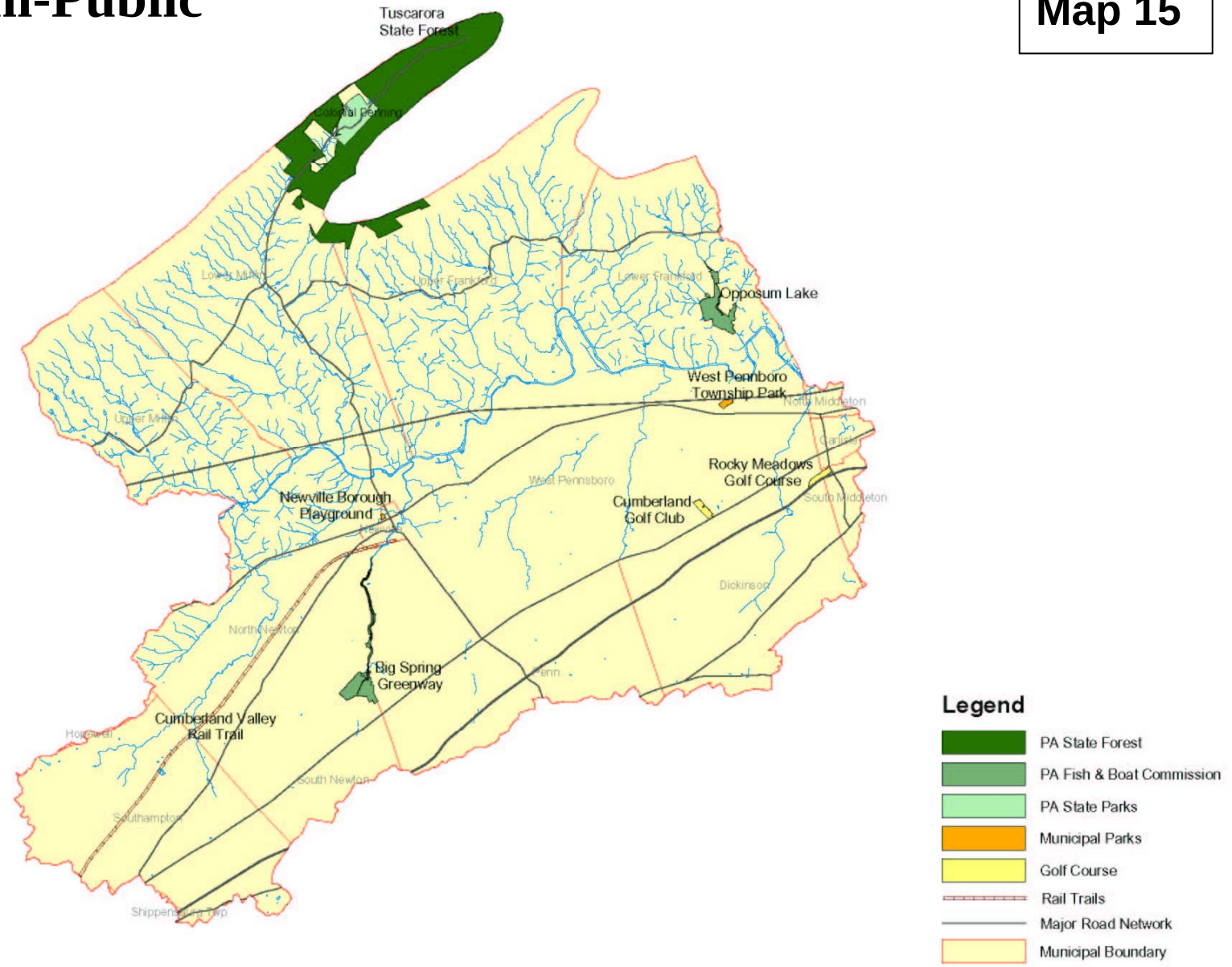
MUNICIPAL RECREATIONAL FACILITIES																			
	Location Number	Baseball Field	Softball Field	Soccer Field	Basketball Court	Tennis Court	Playground	Multipurpose Field	Swimming Pool	Gymnasium	Hiking	Biking	Volleyball Court	Picnicking	Pavilion	Fishing	Golf	Other	Undeveloped	Area (acres)
Dickinson Township																				20
Barnitz Mill at Stuart Park	21										X	X		X	X	X		X	X	20
Newville Borough																				**2**
Newville Playground	71	X	X	X	X	X	X			X			X	X	X					2
Newville Area Community Center	72				X					X			X					X		--
North Middleton Township																				**40**
Creekview Park	73	X					X				X			X	X	X				10
North Middleton Park	74	X			X		X						X	X	X	X				15
Village Park	75	X					X						X	X	X					15
Southampton Township																				**40**
Southampton Township	90													X					X	40
South Middleton Township																				**154.33**
South Middleton Township Park	91	X	X	X	X	X	X						X	X	X	X				40
Holly Woodcrafters Ballfields	92	X																		6
Iron Furnace Park	93										X				X	X				10

Spring Meadows Park	94	X						X			X			X	X				X	90
Indian Hills Park	95	X																		8.33
West Pennsboro Township																				**16**
West Pennsboro Township Park	107	X	X	X	X	X	X								X					16
Study Area Total																				544.66

(Source: Tri-County Regional Planning Commission; Municipal Recreation Facilities Survey, November 1996; Municipal Recreation Facilities Survey Update, February 2002.)

Public and Semi-Public Lands

Map 15



2. Greenways

Greenways offer an important functional link between recreation systems. Connecting community places, such as parks, schools and nature areas, to the regional greenways and greenway links is done with functional links. These may follow natural features but in many cases trails must be created. There are existing greenways within the study area that are not identified as such; streambank fencing areas, agriculture land preservation areas, natural and manmade wetland areas, and areas that are already recognized as greenways/open space; Game Lands, State Parks and State Forests. The first serve almost no public recreational function but are primarily wildlife protection/propagation/viewing areas and areas to protect water resources. As public awareness of these functions increase there is a significant opportunity to develop more of the essentially private greenways. The second while serving some of the functions of the first group also serve as significant public recreational areas. These areas are perpetually protected and probably will not increase in size. It is important that a process is developed to publicize the benefits of greenways, distribute information about their creation and identified areas that are particularly important to include in a greenways system

a. Greenways in Cumberland County and Middle Conodoguinet Watershed

The Cumberland County Planning Commission completed a Cumberland Countywide Greenway Study in April 2000. According to the study, greenways are:

- Trails that connect parks, nature and communities
- Corridors of green space that protect wildlife
- Scenic views of our ridge tops and valleys
- Public access to rivers and streams
- Wide open spaces

The Cumberland Countywide Greenway Study identifies three regional greenway corridors totally or partially within the Rivers Conservation Plan area, the Conodoguinet Creek, the Cumberland Valley Rails to Trails corridor and Big Spring/Doubling Gap Run. These connect areas in Cumberland County with areas outside the county.

The regional greenways do not complete a greenway system. Additional greenways must be identified which will extend greenways along secondary corridors, interconnecting greenways and “loops” that tie major greenways together. Within the study area, there is one identified “greenway link” along Bore Mill Run. Table 7 lists further details about the identified greenways in the study area.

Table 7, Regional Greenway Corridor Description

Regional Greenway Corridor Description				
Regional Greenway	**Approx. Length (mi.)**	**Municipalities**	**Key Features**	**Other Planning/ Development Initiatives**
Conodoguinet Creek				
Laughlin Run to Carlisle	25.26	Hopewell, Upper Frankford, North Newton, Lower Frankford, West Pennsboro, Upper Mifflin, Lower Mifflin, North Middleton	State Game Lands 169, Doubling Gap, Opossum Lake	
Carlisle to Trindle Spring Run	3.54	North Middleton, Middlesex	North Middleton Park, Cave Hill Nature Center	Middle Conodoguinet Creek Watershed Study
Trindle Spring Run to Susquehanna River	24.87	Middlesex, Silver Spring, Hampden, East Pennsboro, Camp Hill, Wormleysburg	Carlisle County Club, Silver Spring Golf Course, Cumberland Perry Vo-Tech, Armitage Golf Club, Adams Ricci Park	
Cumberland Valley Trail				
Shippensburg to Newville	7.56	Shippensburg Boro., Shippensburg Twp., Southampton, North Newton, Newville	Shippensburg Twp. Park, Shippensburg University, Newville Community Center	Cumberland Valley Trail Master Plan
Newville to Carlisle	8.56	Newville, West Pennsboro, Carlisle	Big Spring High School, Big Spring Middle School	
Big Spring Creek/Doubling Gap Creek				
Big Spring Creek	3.36	North Newton, West Pennsboro, Newville, West Pennsboro	Oak Flat Elementary, Big Spring Culture Station	
Doubling Gap Creek	5.11	Lower Mifflin	Colonel Denning State Park, Tuscarora State Forest	
SOURCE: Cumberland Countywide Greenway Study (2000)				

b. Greenway Benefits

The benefits associated with greenways include not only recreational, but also economic, social, transportation, and ecological. The benefits in urban and suburban areas are different from those in rural areas. In urban areas many of the benefits are associated with public use of those areas. In the more rural areas public use is less important. Since much of our area is rural and semi-rural the benefits listed below are focused on those areas.

Economic Benefits

- Create tourist destinations which generates expenditures on food, services and lodging
- Reduce financial loss from flooding by providing buffer areas along stream and river corridors.

Social Benefits

- Provide access to historically and culturally significant features in our community
- Help to preserve the character and aesthetic appeal of a place or landscape
- Provide significant new public places which can help to connect people and communities
- Heighten sensitivity to the natural environment by providing for interaction between people and nature

Transportation Benefits

- Provide safe alternative transportation routes for pedestrians and bicyclists
- Provide emergency access via trails to undeveloped areas

Recreational Benefits

- Provide areas to jog, walk, bike, ride horses and canoe
- Serve as sites for passive pursuits such as picnicking, fishing and enjoying nature
- Connect existing and planned trails
- Provide landscapes for environmental education

Ecological Benefits

- Serve as a filtering zone, wetlands absorb pollutants and nutrients and slow surface runoff
- Preserve and protect vital wildlife, plant and aquatic habitats
- Improve air quality and reduce noise
- Provide corridors for wildlife migration and movement
- Reduce stormwater damage and promote flood mitigation within protected floodplains
- Connected fragmented landscapes
- Store and convey flood waters

VI. Community Input - Issues, Concerns, Constraints, and Opportunities

A. Public Participation

Two public meetings were held during the plan process. The first was held to kick-off the plan and generally spread the word that the plan was underway. The Advisory and Technical Committee was created after the first meeting. In March of 2001, a letter was sent to the municipalities explaining the purpose of the plan and asking for further input on comments received at first public meetings. Two of the townships responded. In accordance with the plan process, the second public meeting was held as an informational review and input meeting on the plan process and the plan's draft goals and recommended actions. Another piece of the public participation was a community survey, which was completed in 2001.

1. Meeting 1

The first meeting was held on October 12, 2000 and 35 people attended. Goals of the project were presented at the meeting. The public was invited to provide input into defining the value of natural resources and threats/concerns about the watershed's health.

Priority issues were identified at this meeting as follows:

- Preservation of prime aquifer recharge areas and preventing groundwater depletion
- Loss of fish and wildlife habitats
- Runoff from agricultural residential and commercial sources (includes point and non-point sources of pollution, lack of stream0-side fencing, preservation and/or development of riparian buffers
- Need for public education concerning natural resources and environmental pollution
- Preservation of prime agricultural lands and family farms
- Sprawl (continual development pressures large and small)
- Impact of sprawl on natural resources (surface water quality and quantity, groundwater quality and quantity, sinkhole development in limestone areas, air quality
- Landfills
- Lack of zoning
- Overtaxed sewage treatment plants, sewage sludge, malfunctioning on site septic systems, and lack of on site septic systems
- Road buffers and use of salt on roads
- Township and/or DEP ordinances, and dealing with issues across municipal boundaries.

2. Meeting 2

The second meeting, entitled "Conodoguinet Creek Watershed Forum", was held on September 29, 2001 and 34 people attended. During the meeting, a presentation was given regarding the plan process, review of the first public meeting, issues were

identified, and recommended actions were discussed in small groups, and the forum was evaluated.

In the small group breakout sessions, participants were asked the following questions:

i. *What is your general reaction to the information & priority issues presented at today's forum?*
   1. *Informative?*
   2. *Agree/disagree with priority issues and goals?*
   3. *Other concerns to bring to the table?*

ii. *Can you see ways in which your local government, community, or organizations can implement any of the recommendations listed under the top 6 priority issues?*

iii. *What are the top 3-5 issues/ideas to communicate back to the large group?*

The meeting attendance list, small group breakout results, the forum evaluation, and community survey summaries are located in Appendix I.

3. Meeting 3

The third meeting was held on February 7th, 2004, a Saturday morning meeting with breakfast included. It was held at the Big Spring High School Cafeteria and 32 people attended. Presentations were given by the Conodoguinet Creek Watershed Association members, including a general overview of the Conodoguinet Creek, the Rivers Conservation Plan process, and Plan findings. After the presentation, the audience was divided into three groups to discuss the management action plan items. A number of comments and additions were made to the action plan. At the end of the meeting, the whole group got back together to hear another presentation on Environmental Advisory Councils by the Pennsylvania Environmental Council.

A survey was handed out to gather additional input from meeting participants. The survey included a copy of the management action matrix with a request to review the issues and recommendations, add new projects, and hand it in at the end of the meeting. Specific questions on the survey were: are there general ideas missing from the recommendations; do you disagree with any of the issues or recommendations; and, are there specific land areas of concern that we can focus on for future watershed conservation and protection projects. All comments from the break-out groups and surveys were incorporated in the text and management option matrix of the Plan.

VII. Management Options and Recommendations

Based upon available resources identified through the planning process, several management options and recommendations have been developed to address the various issues, concerns, constraints, and opportunities within the Middle Conodoguinet Creek corridor. Recommendations include resource protection, land use issues, and habitat issues. Implementation of these recommendations will help restore, maintain, and enhance the Middle Conodoguinet Creek watershed. There are many agencies and organizations immediately available to assist in the Middle Conodoguinet Creek watershed with implementation of these recommendations. It is generally recommended that the Conodoguinet Creek Watershed Association, whenever possible attempt to identify and coordinate the many parallel efforts by various governments and other organizations doing work within the watershed. See Appendix B for a list of partners and programs. Table 8, at the end of this section provides a summary of the recommended action items.

A. Resource Protection

Several resources were recognized as areas that need additional protection, in terms of both point and non-point sources of pollution. Stormwater runoff, sinkholes, and sewage treatment plants/septic systems were identified in conjunction with use of best management practices and education regarding water quality issues.

General recommendations include overall reduction of pollution sources; such as industrial stormwater violators, high nitrogen and phosphorus permitted sources, and on-lot septic systems.

1. Agricultural Area Stormwater Runoff

There are several action items that can help control stormwater runoff from agriculture, commercial, and residential areas, including the following:

- Encourage maintenance of riparian buffers;
- Encourage municipalities to maintain grassy roadside buffers;
- Encourage Agricultural Best Management Practices;
- Encourage proper fertilization practices;
- Insure adequate waste product (manure) detention basins;
- Develop and enforce Nutrient Management Plans;
- Assess Sewage Sludge impact on watershed;
- Educate about best management practices (BMPs);
- Map sludge application sites and monitor application programs; and,
- Identify areas suitable for siting of intensive livestock operations.

2. Commercial/Residential Stormwater Runoff

Action items include implementation and enforcement of stormwater management plans, including requiring detention basins for commercial areas. Each municipality should adopt policies that require low discharge/high recharge Best Management Practices. In addition, there is a need to implement county stormwater management, inventory and assess impact of runoff from roadways and golf

courses, impact of holding areas, work with DEP on regulated stormwater practices, and identify quarry locations within the watershed.

3. Sinkholes and Karst Environments

Since an inventory of sinkholes has already been made, education should be the main priority. Information on sinkhole locations and background information on sinkholes can be found on the DCNR website at www.dcnr.state.pa.us, under the Topographic and Geologic Survey. Booklet number Educational Series 11, "Sinkholes in Pennsylvania" is especially helpful for understanding sinkholes.

Given that run-off from hazardous materials spills moves quickly within karst environments, karst watersheds should be mapped before accidental spills using groundwater-tracing dyes that link recharge points to spring outflows. Dye tracing tests can be used to delineate general watershed boundaries for each spring and maps can be developed showing the potential affected areas. Emergency response crews should use these maps to determine where their efforts should be concentrated during spill cleanup.

4. Malfunctioning Sewage Treatment Plants/Septic Systems

Malfunctioning sewage treatment plants should be monitored for compliance with treatment plant discharge limits. Education and promotion of funding for system repair should be targeted to on-lot septic problems. A process for monitoring small systems should be developed to more efficiently identify malfunctioning systems, and confirm corrections to failing systems. An educational program should be developed for municipalities and residents targeted on the watershed impacts of malfunctioning septic systems. Municipalities need to take action by requiring proper maintenance of septic systems. Creek should be monitored for signs of failing systems.

B. Land Use Issues

Watershed-based zoning/planning is a land use planning process that uses subwatershed boundaries as the basis for future land use decisions. It involves defining existing watershed conditions, measuring current and potential future levels of development, classifying subwatersheds based on the amount of future development, and modifying zoning and/or comprehensive plans to shift the location and density of future development to the appropriate subwatersheds. In situations where subwatershed boundaries cross municipal boundaries, municipalities are encouraged to take advantage of the new provisions in the Municipalities Planning code that permits them to band together to provide sites for development activities.

1. Aquifer Recharge Preservation

The most critical aquifer areas in the Middle Conodoguinet Creek watershed are in our limestone valleys. Our spring creeks are a great resource, but their waters have been affected by excess nutrients and their flows have been diminished. Protection of our limestone aquifers should be a major goal for the Middle Conodoguinet Creek watershed. See table 8 for more details. Replenishment of aquifers is critical so

that we do not run out of water. Impervious surfaces, like pavement prevents precipitation from infiltrating into groundwater via the porosity of the underlying karst limestone structure. Prolonged droughts and pumping of wells may lower the water table and diminish springs and wells. Sinkholes and wetlands should be inventoried as part of the aquifer recharge/groundwater protection system.

2. Prime Agricultural Land Preservation

The Cumberland County agricultural land preservation programs have proven to be very attractive to a large number of landowners, thus creating long waiting lists. Cumberland County currently has a backlog of approximately 80 applications that involve 10,000 acres of land. Regardless of the structure of any agreement, there is a need for an additional source of funding. Out of economic necessity, some owners will be unable to wait for funding to become available and will sell or convert their land to nonagricultural uses. Recommendations include helping to secure funding for agricultural land preservation. The Plan also recommends working with farmers, developers, municipalities, legislators, and residents on protection of agricultural land. Farmland preservation is encouraged to the north side of the Conodoguinet Creek where it is better suited. Awareness programs should be developed to help educate about stream buffers, easements, and how to protect these areas.

3. Development Pressures/Small Scattered Developments

Development pressure exists throughout the Middle Conodoguinet Watershed. This development should be focused in areas with existing public water and sewer and should be encouraged as infill development in already developed areas. Local ordinances and easements should be promoted and sustained to protect sensitive areas. New development, including warehouses, should be monitored to assure need for the new development and for compliance with watershed regulations. An educational program should be created to promote sound development practices within the watershed. Sensitive areas along the creek should be mapped and used as a guide for land development. Developers and engineers/surveyors need to be educated about conservation subdivision design.

4. Landfills

New landfills should be placed in geologically stable areas. Compliance to regulations should be closely monitored at all existing landfills. Actions should include encouragement of legislation that gives local control over landfill locations and operations. Historic landfill sites, such as the one in North Middleton Township should be monitored. The Watershed Association should work with the Solid Waste Authority of Cumberland County, PA CleanWays Chapter, municipalities, and others on identifying problem dumping areas, cleaning up these areas, and developing an educational program for residents. The Association should also work with municipalities on their annual cleanups.

5. Lack of Zoning/Land Use Planning

Cumberland County is encouraged to complete a study for Conodoguinet Creek for stormwater management and land use planning practices. It is recommended that

municipalities be encouraged to do joint planning and zoning, as well as, consistent planning between municipalities. Main goals of this would be to protect areas identified in the Cumberland County Greenways Plan and the Natural Resources Inventory, limit development in stream/riparian corridors, and in general protect sensitive areas. Increased education for municipal officials and the public should be developed on zoning/development issues. The Plan recommends working with municipalities on these recommendations, especially in ways that make watershed issues relevant to them. Enacting environmental advisory councils (EACs) is a recommendation on the individual or multi-municipal basis to help implement the action items in the plan and to be a liaison group between the watershed association and the local governments.

C. Loss of Fish and Wildlife Habitat and Lack of Stream Corridor Protection

There are a number of topics and recommended actions to improve and maintain sufficient and suitable habitat for the flora and fauna of the Conodoguinet watershed. Restoration of riparian corridors through implementation of BMPs, limitation of development in riparian corridors, and implementation of stream bank fencing programs will help to protect habitat. Problem areas within the stream corridor should be identified for streamside stabilization and streamside habitat areas, especially in areas of sensitive species. Incorporation of greenways, protected linear corridors is encourage were suitable to help protect stream corridors and habitat. Educational programs geared to landowners will help to increase awareness of appropriate practices within the watershed, including information on permits/regulations regarding activity in the stream corridor.

1. Forest Management

Stream margins are attractive timber sites. In a proper logging operation, some trees and other plants are left on both sides of a stream to provide a buffer strip 100 feet wide. Logging equipment must never enter the stream. Haul roads and skid trails requiring grading should be at least 150 feet away from the water and even farther away when logging on steep slopes.

To maximize the variety of animals in the woodland, create as many different stages of succession as possible. This is accomplished through timber harvests, fuel woodcuttings, timber stand improvement cuts, mowing, and plowing.

2. Field Borders

One of the most popular woodland management practices here is establishing field borders, a transition zone between field and forest. Field borders are strips of perennial vegetation at the edge of a field introduced by planting or converting from trees to herbaceous vegetation and shrubs. It is one of the most effective ways of increasing an area's potential for both wildlife diversity and numbers. A well-designed and maintained field border should provide a series of successively higher layers of vegetation in the transition zone between the field and the forest stand. The greater the number of distinct layers of vegetation represented in a field border,

the more suitable an area is for supporting diverse wildlife populations. Wildlife food-producing shrubs should be retained.

3. Agricultural Lands

Agricultural lands account for the primary land use in the Cumberland Valley, and directly impacts the vegetative types that exist. These lands also determine what kind of wildlife habitat, and which species will be found there. Conservation practices must be carefully developed and evaluated so that wildlife habitat will become an integral component of the farm without sacrificing farm production.

a. Stripcropping, Contouring

Edges created by stripcropping offer attractive feeding and nesting sites and work best if a minimum number of fencerows, hedgerows, stonewalls, and other obstructions are removed. These vital travel and cover lanes contribute to greater use of cultivated acreage by farm wildlife species. Planting hay or food-bearing shrubs in field corners and where equipment use is restricted will provide additional wildlife food and cover. Areas maintained in sod provide nesting cover and enhance wildlife production, especially if mowing is delayed until July.

b. Conservation Tillage

Conservation tillage generally has a positive impact on wildlife. Using crop residues to protect cultivated fields during critical erosion periods provides food and cover for wildlife. Waste grains left on the surface with crop residues provide extensive feeding areas for wildlife during migration periods and over the winter months. Chopping or shredding cornstalks after harvest does ensure soil protection but it reduces the value of the land to wildlife. Crop fields left undisturbed after harvesting provide far better habitat. In addition to increased crop yields, research found substantially greater diversity and density of birds nesting in no-till row crop fields, and nest success was comparable to idle areas such as fencerows. Other studies indicate earthworm populations, which are vital to soil regeneration, tend to be vastly higher in no-till fields. Although most of the insecticides and herbicides in use today are short-lived chemicals that only persist in the environment for hours or days, increased pesticide use associated with no-till methods can impact wildlife negatively. Every farmer should seek help in establishing an integrated pest management system on his farm.

c. Grasslands

Grasslands, a common feature of the Pennsylvania landscape, are distributed as broad lowland plains in the Great Valley Section. Some grasslands are, in fact, old-field communities undergoing various stages of succession, reverting back to a forest community. Pastures and hay-lands should be managed to support both livestock and wildlife. This requires planning concerning vegetation types and uses. Because of growth characteristics of cool season grasses, they become dormant during the hot, dry summer - creating a slump in forage quality and quantity. Warm season species grow primarily in the warm part of the summer, and they thrive in hot temperatures. By using a combination of perennial cool and warm season grasses,

farmers can rotate cattle on nutritious forage throughout the growing season. The clumpy growth form of these tall densely stemmed stands also makes these grasses attractive nesting and cover sites for wildlife species. Seasonal rotations of grazing or hay production allow wildlife to take advantage of warm season grasses for nesting and cover. Further, the later haying date for warm season grasses fits better into farmers' schedules, as early summer is typically less busy than mid or late spring. Warm season grass haying permits cutting at a time when forage quality is highest.

d. Corridors

Wherever practical, farmers should develop a system of wildlife travel lanes. These are narrow strips of cover connecting two separate clumps of cover or connecting the roosting or nesting cover with the feeding ground. They consist of brushy fence lines, strips of hay or grass and gullies of stream banks where there is a growth of shrubs, vines and weeds. A few feet around the outside edges of the hay or grain fields left uncut serve as good travel lanes and provide food during fall, winter and spring.

e. Farm Ponds

During the past 50 years, farmers and rural landowners built scores of small ponds to aid in water management and to provide a water supply that would not normally be available on the farm. Properly constructed and well-maintained farm ponds provide habitat for fish and associated aquatic organisms. Land surrounding the ponds can be developed into excellent wildlife habitat. Fruit-producing wildlife shrubs and conifers can be planted, and if livestock are kept away from the pond the resulting brushy vegetation will provide nesting cover. Pond islands offer protection from land predators and are preferred by nesting waterfowl. Nesting devices can be installed for a variety of animals.

f. Delayed Haymaking

Studies show that the “normal mowing schedule” destroys 90% of ringneck pheasant nests; therefore delayed haymaking is encouraged when practical. When delayed until after June 20, 34% of ringneck pheasant nests were successful. If delayed until after June 27, success might increase to 70 – 80%. This is equally important for bobolink, eastern meadowlark, upland sandpiper, grasshopper and savanna sparrows, and bobwhite quail populations.

g. Streambank Fencing

As livestock numbers increase, and operations become increasingly concentrated, nearby natural areas are often negatively effected. Runoff from cultivated fields, pastures and feedlots pollutes surface water by washing soil, fertilizers, and pesticides into nearby streams. When livestock trample stream banks, the soil is left unprotected and may collapse. Much of Pennsylvania’s water pollution is sediment that comes from soil erosion along stream banks that are grazed. One of the best ways for a farmer to prevent erosion and loss of productive land is to limit livestock access to stream banks. This also reduces contact with waterborne bacteria, and is

the first step in developing a more productive pasture management system. Streambank fencing is a low-cost, low-maintenance management tool readily available to any farmer. Additional benefits include food, cover, and nesting sites for birds and small mammals. Over 80 kinds of birds use streamside vegetation for summer feeding or nesting. It also improves fish habitat by enhancing water quality, providing protective cover, and increasing food for fish. Wildflowers and shrubs add shape and color, increasing the beauty of the farm landscape. Significant watercourses of the Project Area now have about 14,100' of streambank fencing on 9 farms. There is a probable need of an additional 35,250' on 23 farms.

4. Subdivision Design

Subdivision design should incorporate stream bank protection and wildlife travel corridors in the initial development of the development plan layout. A conservation concept plan should be part of the initial subdivision plan to preserve elements such as wildlife travel corridors as conservation areas, thereby excluding potential development in critical areas. An added benefit is that these wildlife corridors reduce the human/wildlife conflicts on highways and in suburban settings.

5. Wetlands

Despite their great importance to aquifer recharge and wildlife habitat, an alarming number of wetlands are lost each year to development. Wetlands should be restored, preserved or enhanced to protect the many species of waterfowl, furbearers, shorebirds, and songbirds that thrive in these areas.

6. Spring Seeps

Existing spring seeps should be protected, and all valuable mast-producing trees and shrubs in the vicinity of seeps should be retained. Encouragement of herbaceous vegetation around seeps and the planting of food shrubs or evergreen cover are desirable.

7. Non-native Flora and Fauna

Control of problematic, non-native species is necessary for the long-term maintenance of high quality natural systems. Discouraging the use of these and other potentially weedy exotics in and around natural areas can help to prevent further encroachment. Best control is through encouragement of growth of desirable species. Some nurseries now carry a selection of tree, shrub and herbaceous species that are native to Pennsylvania, and these are recommended where plantings are necessary in, or adjacent to, natural areas. The Vascular Flora of Pennsylvania (1993) is a helpful reference for determining whether a plant species is native to the state or not.

D. Enhancement through Public Education

Engage and educate individuals, communities, schools, and governments through outreach and education efforts associated with the other identified recommended actions. Educational programs should be targeted to all levels of the community and be distributed through websites, mailings, newsletters, workshops and individual personal

contacts. Identifying interest in the Builders for the Bay program, a signage projects, and creek outings are also recommended.

1. Builders for the Bay Program

Promote municipal and county government participation in the Builders for the Bay Program. The program, formed under the leadership of the Alliance for the Chesapeake Bay, the Center for Watershed Protection, and the National Association of Home Builders, is aimed at reducing the environmental effects of residential and commercial development in the Chesapeake Bay Watershed. At this time, the Builders for the Bay Program is seeking local governments for participation in the program over the next two years.

2. School Outreach

Work with school district on programs involving all aspects of watershed planning. Curriculum could include nature, biology, culture, recreation, and other topics. School groups could partner with the watershed association and other groups on various projects throughout the watershed. Development of a grant program to enhance school involvement is a potential action.

3. Signage for Identification of Creek at Road Overpasses

A signage project could be completed for the corridor in coordination with various watershed partners. Signage and wayfinding projects would increase knowledge of the Conodoguinet Creek's location and access points.

4. Creek Outings

Outings and gatherings on the Creek and its watershed should be encouraged, as participation in events increases the public's knowledge, appreciation and adoption of the Creek.

Table 8. Management and Recommendation Actions			
ISSUE	RECOMMENDED ACTION	ACTION ORGANIZATIONS	PRIORITY
Resource Protection Issues			
Agricultural Area Stormwater Runoff	1. Encourage proper fertilization practices	1. Conservation District 1. PSU Cooperative Extension 1. Farm Bureau	1. M
	2. Encourage Townships to maintain grassy roadside buffers	2. Municipal Governments 2. Watershed Association	2. L
	3. Encourage agricultural BMPs	3. Conservation District 3. Farm Service Agency 3. PSU Cooperative Extension	3. H
	4. Encourage maintenance of riparian buffers	4. Farm Bureau 4. Conservation District 4. PA Game Commission	4. M
	5. Identify optimum locations within watershed for large scale agricultural operations locations and ensure manure management plans are implemented appropriately	5. Farm Bureau 5. NRCS 5. Conservation District 5. Watershed Association 5. Farmers	5. M
	6. Implement heavy use BMPs	6. Farmers	6. H
	7. Identify sources of funding for BMP implementation	7. Farm Service Agency 7. Conservation District 7. NRCS	7. H
	8. Develop and enforce Nutrient Management Plans	8. Conservation District 8. Farmers 8. NRCS 8. Farm Bureau	8. M
	9. Map and assess sludge application sites permitted by DEP within one mile of creek; educate on the impact of Sewage Sludge; look at impact on creek specifically Route 641 area, hold	9. Conservation District 9. Farm Bureau 9. PA DEP 9. Municipal Governments	9. M

	informational workshops for residents and municipalities, review regulations, work with municipalities on this issue 10. Coordinate education and information about BMPs to farmer organizations	9. Farmers 10. PA Farm Bureau 10. Grange	 10. M
Commercial/Residential/ Industrial Stormwater Runoff	1. Develop and enforce stormwater management plans; implement county stormwater plan 2. Require on site stormwater detention basins for commercial sites 3. Adopt ordinances that require low discharge/high recharge BMPs 4. Assess impact of runoff from PA Turnpike, I-76 5. Inventory and assess impact of holding areas throughout watershed, look at West Nile threat (Frytown Road, Potato Road) 6. Inventory and assess runoff from golf courses within the watershed 7. Identify and map quarry location and activity; monitor impact on watershed 8. Correct flooding problem on Creek Road (near Deihl's Deli), recurring flood problem at dip in the road	1. Municipal Governments 1. County Government 2. Municipal Governments 3. Municipal Governments 4. PennDOT 5. Municipal Governments 5. Conservation District 5. PA DEP 6. Conservation District 6. PA DEP 7. Watershed Association 7. Municipal Governments 7. Conservation District 7. PA DEP 8. PennDOT 8. Municipal Governments 8. Conservation District	1. H 2. M 3. M 4. M 5. M 6. L 7. M 8. M
Sinkholes	1. Inventory major sinkhole areas 2. Educate farmers on nutrient/herbicide loss through sinkholes 3. Educate public on potential problems	1. County Planning Commission 1. USGS 2. PSU Cooperative Extension 2. Conservation District 2. Farm Bureau 3. Conservation District	1. M 2. H 3. M

	associated with using sinkholes as refuse disposal sites	3. Watershed Association	
	4. Outreach and education to community groups and municipalities on standards regarding sinkholes, especially on sinkhole development and stormwater management to prevent sinkhole problems	4. PA DEP 4. Watershed Association 4. Municipal Governments 4. Conservation District	4. M
Malfunctioning Sewage Treatment Plants/Septic Systems	1. Monitor compliance with treatment plant discharge limits	1. PA DEP 1. Watershed Association	1. H
	2. Educate public (municipalities and residents) on impact of malfunctioning septic systems, through newsletters and letter mailing	2. Municipal Governments 2. PSU Cooperative Extension	2. L
	3. Promotion of funding sources for individual septic system repair	3. Municipal Governments 3. Watershed Association	3. M
	4. Develop process for monitoring discharge from “package” systems	4. PA DEP 4. Municipal Governments	4. M
	5. Educate public on alternative systems for individual lots and small communities	5. County Planning Commission 5. PA DEP 5. Watershed Association	5. L
	6. Develop and enforce Act 537 Plans	6. Municipal Governments	6. H
	7. Encourage proper pumping and maintenance of septic systems	7. PA DEP 7. Watershed Association 7. Municipal Governments	7. M
	8. Inventory municipal ordinances and enforcement for pumping and maintenance of septic systems	8. Watershed Association 8. Municipality 8. PA DEP	8. M
	9. Adopt municipal ordinances requiring regular pumping and maintenance of septic systems, every 3-4 years; work with sewage enforcement officers on ordinance enforcement	9. Municipal Governments 9. Watershed Association 9. PA DEP	9. M
	10. Develop creek monitoring program to look for signs of malfunctioning systems and report to	10. Watershed Association 10. Conservation District	10. M

	municipalities	10. Municipal Governments 10. PA DEP	
Water Withdrawals	1. Monitor and assess the impact of water withdrawals from the creek, both public and private entities	1. PA DEP 1. Municipal Governments 1. Conservation District	1. L
Land Use Issues			
Aquifer Recharge Area Preservation	1. Identify prime recharge areas and provide protection; enact ordinances to protect these areas	1. County Commissioners 1. USGS	1. H
	2. Direct development away from recharge areas	2. County Planning Commission 2. Municipal Governments	2. M
	3. Encourage donation of development rights in prime recharge areas	3. Watershed Association 3. Land Trusts 3. Farm Bureau	3. M
	4. Limit creation of impervious surfaces in recharge areas	4. Municipal Governments	4. H
	5. Identify point and non-point pollution sources	5. PA DEP	5. M
	6. Develop management strategies to reduce pollutant levels	6. PA DEP 6. Conservation District	6. M
	7. Encourage proper forest management	7. Bureau of Forestry 7. Conservation District	7. M
	8. Develop educational fact sheet on do's and don'ts of protecting groundwater within the watershed	8. Watershed Association 8. Capital Region RC&D	8. M
	9. Assess quantity of water withdrawals from watershed, especially by golf course and municipal water systems	9. Conservation District	9. L
	10. Inventory and map specific sinkholes and wetlands as they relate to aquifer recharge areas, utilize DEP and NWI mapping, land use	10. PA DEP 10. Municipal Governments 10. County Planning	10. M

	maps, township maps, existing development maps to complete inventory	Commission 10. Conservation District	
Prime Agricultural Land Preservation	1. Develop additional funding sources for existing program	1. County Commissioners 1. Land Trusts 1. Watershed Association	1. H
	2. Develop transfer of development rights program; work with South Middleton Township on this	2. County Commissioners 2. Municipal Governments	2. M
	3. Encourage donation of development rights	3. Land Trusts 3. Watershed Association 3. County Commissioners	3. M
	4. Encourage multi township planning and zoning	4. County Planning Commission 4. Watershed Association	4. H
	5. Adopt, maintain, and where appropriate, strengthen agricultural zoning; work with farmers to determine acceptable agricultural zoning	5. Municipal Governments	5. M
	6. Require developers to provide infrastructure required to service new developments	6. Municipal Governments 6. County Commissioners	6. H
	7. Support revisions to tax code to reduce dependence on real estate tax	7. Watershed Association 7. Farm Bureau	7. H
	8. Develop educational program on the benefits and opportunities of agricultural preservation	8. Watershed Association 8. Conservation District 8. Farm Service Agency 8. PSU Cooperative Extension 8. Farmers	8. M
	9. Focus agricultural preservation easements and activities to the north side of the Conodoguinet Creek	9. Municipal Governments 9. County Planning Commission 9. County Conservation District 9. Farmers	9. H
	10. Utilize multi-municipal planning as a way to help preserve agricultural land	10. Municipal Governments 10. County Planning	10. M

		Commission 10. DCED	
	11. Petition state representatives to support of agriculture preservation and other issues	11. Watershed Association	11. L
	12. Work with landowners along stream on education and implementation of conservation techniques, include information on conservation easements and buffers to protect stream corridor	12. Watershed Association 12. Conservation District 12. Heritage Conservancy 12. Municipal Governments	12. H
	13. Work to educate and promote small farms; examine “right to farm” for small farms, and encourage BMPs on small farms	13. Conservation District 13. Farmers 13. PSU Cooperative Extension	13. M
Development Pressures/Small Scattered Developments	1. Focus development in areas with public water and sewer	1. Municipal Governments 1. County Planning Commission	1. H
	2. Promote local ordinances/easements that protect sensitive areas	2. Watershed Association 2. Municipal Governments	2. M
	3. Encourage fill in of open sections in already developed areas	3. Municipal Governments 3. County Planning Commission	3. H
	4. Develop educational materials and distribute to developers within the watershed	4. Municipal Governments 4. County Planning Commission 4. Watershed Association	4. M
	5. Review new warehouse development; assure compliance, encourage reuse of existing space, and assure the need for the new development	5. County Planning Commission 5. Watershed Association 5. Municipal Governments	5. H
	6. Study air quality issues and impact on the watershed relative to the trucking industry, Route 81 corridor, and emissions regulations	6. PA DEP	6. L
	7. Map sensitive areas along creek or coordinate use of existing mapping of sensitive areas along the stream; use this information to make better	7. County Planning Commission 7. Conservation District	7. M

	land use decisions within the watershed 8. Educate developers and engineers/surveyors about conservation subdivision design	7. PA DEP 7. Watershed Association 8. County Planning Commission 8. Natural Lands Trust	 8. M
Landfills/Solid Waste Management	1. Site landfills in geologically stable areas 2. Monitor compliance with compaction and discharge limits 3. Encourage legislation that gives local control over landfill locations 4. Assess impacts from historic landfill in North Middleton Township 5. Work with Solid Waste Authority of Cumberland County on education and outreach, evaluate drop-off centers locations and adequacy of curbside pickup programs 6. Identify/map illegal dumps and encourage cleanup and education on illegal dumping 7. Complete municipal inventories of debris in creek (i.e. Middlesex Township example, near bridges); develop cleanup program for litter left near camping and picnic areas along creek 8. Send information to new residents on waste disposal, illegal dumping, watershed, and what they can/can't do in the creek (i.e. tree falls/stream banks)	1. PA DEP 2. PA DEP 2. Watershed Association 3. Municipal Governments 3. Watershed Association 3. Farm Bureau 4. PA DEP 4. Municipal Governments 5. Watershed Association 5. Solid Waste Authority of Cumberland County 6. Solid Waste Authority of Cumberland County 6. County PA CleanWays Chapter 6. County Conservation District 7. Solid Waste Authority of Cumberland County 7. County PA CleanWays Chapter County 7. Municipal Governments 8. Solid Waste Authority of Cumberland County 8. County PA CleanWays Chapter 8. Watershed Association	1. H 2. H 3. L 4. L 5. L 6. M 7. L 8. M

	9. Identify municipalities that hold regular cleanups and work with them to advertise through newsletters and getting information to residents (Lower Frankford Township example opportunity to get information out jointly with the watershed association; West Pennsboro does annual cleanup)	8. Capital Region RC&D 9. Watershed Association 9. Municipal Governments	9. M
Lack of Zoning/Land Use Planning	1. Encourage townships to engage in joint planning/zoning efforts (integrate plan with current multi-municipal planning effort underway, eight municipalities in eastern part of watershed)	1. Watershed Association 1. County Planning Commission	1. H
	2. Protect areas identified in Cumberland County Greenways Plan	2. Municipal Governments 2. County Commissioners	2. M
	3. Limit development in stream/riparian corridors	3. Municipal Governments	3. H
	4. Encourage zoning that protects sensitive areas identified in County Natural Resources Inventory (i.e. buffers, open space, stormwater, etc.); implement zoning in every municipality	4. Watershed Association 4. County Planning Commission 4. Conservation District	4. M
	5. Increase educational programs on zoning/development issues	5. PSU Cooperative Extension 5. Conservation District 5. County Planning Commission	5. M
	6. Provide copy of this Conservation Plan to all municipalities for integration into local planning practices; present the Conservation Plan to each municipality targeting supervisors and planning commissions	6. Watershed Association 6. County Planning Commission	6. H
	7. Encourage consistency in planning between municipalities within the watershed	7. County Planning Commission 7. Municipal Governments	7. M
	8. Develop and implement zoning ordinances in municipalities that currently do not have zoning	8. County Planning Commission	8. L

	9. Encourage implementation of model conservation type development ordinances; current project in Middlesex Township as example of model development	8. Municipal Governments 9. County Planning Commission 9. Municipal Governments	9. M
	10. Work with and engage the municipalities by making watershed issues relevant to them	10. Municipal Governments 10. Conservation District	10. H
	11. Implement Environmental Advisory Councils on an individual or multi-municipal basis as a means to implement Conservation Plan and to develop partnership between municipalities and watershed association	11. Municipal Governments 11. Watershed Association 11. Pennsylvania Environmental Council	11. M
	12. Encourage Cumberland County to do a detailed study of Conodoguinet Creek for stormwater management and land use planning methods	12. County Planning Commission 12. PA DEP 12. DCED 12. Municipal Governments	12. L
Habitat Issues			
Loss of Fish and Wildlife Habitat	1. Restore degraded riparian corridors	1. PA Game Commission 1. Conservation District 1. FSA 1. Landowners	1. M
	2. Limit development in riparian corridors	2. Municipality	2. H
	3. Implementation of existing greenways plan	3. County Commissioners 3. Municipality	3. M
	4. Encourage enrollment in CREP program	4. Conservation District 4. FSA 4. PA Game Commission	4. M
	5. Education and workshops to landowners on a series of topics within the corridor: sound planting and other practices, riparian buffers, shad	5. PA Game Commission 5. Conservation District 5. Watershed Association	5. M

	restoration activities, CREP program, Heishman's Mill Bypass Project	5. PA Fish and Boat Commission	
	6. Publicize Water Quality Management Data in educational/awareness format, history of stream water quality over time, location in stream	6. PA DEP 6. Conservation District 6. Watershed Association	6. M
	7. Identify project areas for the construction of streamside stabilization and streamside fish habitat areas	7. Conservation District 7. PA Fish and Boat Commission	7. M
	8. Cooperate with PA Game Commission and PA Fish and Boat Commission to identify and encourage protection of greenways of regional significance for the benefit of fish and wildlife protection; Greenways allow safe movement of fish and wildlife along stream corridors	8. PA Game Commission 8. PA Fish and Boat Commission 8. DCNR 8. Conservation District	8. M
Lack of Stream Corridor Protection	1. Publicize subsidized stream bank fencing programs	1. PA Game Commission 1. Conservation District 1. Watershed Association 1. FSA 1. NRCS	1. M
	2. Find additional sources for funding steam bank fencing programs	2. PA Game Commission 2. Watershed Association 2. FSA	2. M
	3. Map degraded riparian buffers	3. Bureau of Forestry 3. PA Game Commission 3. Conservation District	3. M
	4. Publicize benefits of riparian corridor protection and restoration	4. PA Game Commission 4. Conservation District 4. Farm Bureau 4. Bureau of Forestry	4. H
	5. Protect corridor and habitat through sound practices in forest management, field borders, agricultural lands, subdivision designs, wetlands, spring seeps, and non-native flora and fauna	5. Conservation District 5. Farm Bureau 5. Watershed Association 5. County Planning	5. M

	6. Educate public about permitting regulations for streambank and streambed activity; particularly in terms of maintenance of banks and removal of debris (such as trees, etc.) 7. Enhance stream corridor protection through development of debris and sewage monitoring/clean up programs	Commission 6. PA DEP 6. Conservation District 6. Watershed Association 7. Conservation District 7. PA DEP 7. Watershed Association 7. Municipal Governments	6. H 7. M
Education			
We All Live Downstream	1. Develop and implement educational programs to all levels of the community; should include interconnection concepts of the watershed approach; enhance all levels of communication between the many entities working within the watershed; work to identify sources of funding for development of educational programs 2. Work with local school districts on involving students through activities and curriculum 3. Develop educational materials on stream cleanups, riparian buffers, easements and tax benefits, lawn fertilizer nutrients, invasive species, etc. 4. Develop education materials and programs in several venues: website, mailing, municipal newsletters, municipal forums, and individual personal contact	1. Watershed Association 1. Conservation District 1. County Planning Commission 1. Municipal Governments 1. Local Social Organizations 2. Watershed Association 2. School District 3. Watershed Association 3. Conservation District 3. County Planning Commission 3. Municipal Governments 3. Local Social Organizations 4. Watershed Association 4. Conservation District 4. County Planning Commission 4. Municipal Governments 4. Local Social Organizations	1. H 2. H 3. M 4. M

	5. Identify interest in participating in the Builders for the Bay program	5. Alliance for the Chesapeake Bay 5. Watershed Association 5. Municipal Governments	5. L
	6. Complete a signage and wayfinding project to increase knowledge of the location of the Conodoguinet Creek's and its access points	6. Watershed Association 6. Susquehanna River Basin Commission 6. Conservation District	6. H
	7. Organize outings and gatherings on the Creek and its watershed to help increase the public's knowledge, appreciation and adoption of the Creek	7. Watershed Association 7. Municipal Governments 7. Conservation District 7. County Planning Commission 7. Local Social Organizations 7. Local Businesses and Industries	7. H

Appendix A - Stakeholders/Partners and Affiliated Programs

Builders for the Bay Program
This program helps promote municipal and county government participation. The program, formed under the leadership of the Alliance for the Chesapeake Bay, the Center for Watershed Protection, and the National Association of Home Builders, is aimed at reducing the environmental effects of residential and commercial development in the Chesapeake Bay Watershed. For more information, contact the Center for Watershed Protection at 410-461-8323. Or visit the website at http://www.cwp.org/builders_for_bay.htm.

Chesapeake Bay Foundation
The Initiative's goal is to implement restoration projects that provide wildlife habitat, improve water quality, and enhance the quality of life for all of the Bay's residents. Telephone: 717-733-0301. Program biologists help identify restoration sites, survey and design projects, contact contractors, supervise construction, and work to ensure the project meets the landowner's objectives. The Initiative can assist landowners with wetland restoration, riparian buffers, streambank fencing and upland plantings.

Conservation Reserve Enhancement Program (CREP)
This program is a new federal/state partnership with a goal of enrolling 100,000 acres of highly erodible cropland and marginal pastureland in conservation cover plantings. The program is entirely voluntary and its goals are to improve water quality, reduce soil erosion, improve wildlife habitat, and increase farm income on marginal farmland. CREP pays rental rates for lands placed in conservation cover. Telephone: 717-249-3924.

Cumberland County Conservation District
The Conservation District is a great resource of information on the watershed and its resources. The office can be reached at 43 Brookwood Avenue, Suite 4, Carlisle, PA 17013-9172, 717-240-7812, Fax 717-240-7813, conserve@pa.net. Their website is http://www.cumberlandcd.com/.

Cumberland County Planning Commission
The Planning Commission is a resource of information on planning, greenways, municipalities, and other topics. They can be reached at 18 North Hanover Street, Carlisle, PA, 17013, 717-240-6171, x6377; West Shore Area at 717-697-0371, x6171, x6377; Shippensburg Area at 717-532-7286, x6171, x6377; Fax 717-240-6517. Their website is www.ccpa.net/planning.

Cumberland County Solid Waste Authority
The Solid Waste Authority is a resource for household, hazardous, and other waste produced in Cumberland County. The office can be reached at 1 Courthouse Square, Carlisle, PA, 717-240-6489, www.ccpa.net/solidwaste/.

Forest Stewardship Program

Through this program, landowners can get advice on managing their woodlands for both wildlife and timber. The Pennsylvania Department of Conservation and Natural Resources (DCNR), and the U.S. Department of Agriculture (USDA) direct the program. Landowners sign on for 10 years, during which time they receive advice from expert foresters on how best to manage their woodlands, depending on the landowner's goals.

Partners for Wildlife, US Fish and Wildlife Service

This is a cooperative effort between a number of agencies that's primarily handled by the U.S. Fish & Wildlife Service. It's designed to restore historic wetlands on agricultural properties – those that may have been drained, ditched or tiled. The cost of restoring the wetlands is cost-shared by USFWS, and the service provides equipment and personnel to participate in all phases of the program. In Pennsylvania, priority is given to farms enrolled in a Game Commission cooperative access program. Telephone: 814-234-4090.

Center for Watershed Protection

To balance the need for growth while promoting watershed protection, the Center for Watershed Protection (www.cwp.org) has established an innovative approach to planning based on the natural borders that separate watersheds. The underlying theme of their approach is that watershed planning is a process in which communities can make better choices about future growth. Five types of land may need to be conserved in a watershed: Critical habitats, Aquatic corridors, Hydrologic reserve areas, Water hazards, and Cultural areas.

A watershed manager must choose which of these natural and cultural areas must be conserved in a subwatershed in order to sustain the integrity of its aquatic and terrestrial ecosystems, and to maintain desired human uses from its waters. While land conservation is most important in sensitive watersheds, it is also a critical tool for other types of resources. Each subwatershed should have its own land conservation strategy based on its management category, inventory of conservation areas, and land ownership patterns. The five conservation areas are not always differentiable. Some of the natural areas may overlap among the conservation areas. For example, a freshwater wetland may serve as a critical habitat, be part of the aquatic corridor, and also comprise part of the hydrologic reserve areas. However, the bulk of the most critical areas are covered in at least one of these five categories.

Critical habitat: Critical habitats can be defined as the essential spaces for plant and animal communities or populations. Examples of critical habitats include tidal wetlands, freshwater wetlands, large forest clumps, springs, spawning areas in streams, habitat for rare or endangered species, potential restoration areas, native vegetation areas, and coves.
Aquatic Corridor: The aquatic corridor is the area where land and water meet. This can include floodplains, stream channels, springs and seeps, small estuarine coves, littoral areas, stream crossings, shorelines, riparian forest, caves, and sinkholes.
Hydrologic Reserve: Hydrologic reserves are any undeveloped areas responsible for maintaining the predevelopment hydrologic response of a watershed. The three most common land uses are crops,

forest, and pasture. From a hydrologic standpoint, forest is the most desirable land use followed by pasture, then crops.
Water Pollution Hazard: This conservation area is defined as any land use or activity that is expected to create a relatively high risk of potential water pollution. Examples of water pollution hazards may include septic systems, landfills, hazardous waste generators, above or below ground tanks, land application sites, impervious cover, stormwater "hotspots", and road and salt storage areas. One way to avoid possible contamination to waterways is to locate such facilities at a designated distance away from the waterbody in order to decrease the chance of contamination.
Cultural Areas: Cultural areas provide a sense of place in the landscape and are important habitats for people. Examples of conservation areas include historic or archeological sites, trails, parkland, scenic views, water access, bridges, and recreational areas.

Land Conservation Techniques

Numerous techniques can be used to conserve land, which provide a continuum ranging from absolute protection to very limited protection. One of these techniques involves buying the land or the use of conservation easements. Conservation easements retain the original owner but pass part of the interest of the property to someone else and prevent the property from being developed. The third technique is to regulate land alteration. A law, which restricts development on an area designated as a wetland, is a good example of land alteration regulation. Another technique deals with hazard regulations which dictate where potential water pollution hazards can be placed in relation to waterbodies. The fifth technique, open space development, is the use of designs, which incorporate open areas into a development site. These areas can be used for either passive or active recreational activity or preserved as naturally vegetated land. Since it is neither practical nor feasible to regulate everyone and everything, landowner and public sector stewardship are both important techniques to the conservation of land.

Key Land Conservation Choices for the Watershed Manager

When applying the land conservation tool, a watershed manager must make some careful choices about the mix of conservation areas to protect and what techniques to employ. Given the large areas that need to be conserved within some subwatersheds, many different conservation techniques need to be applied to cover the patchwork of public and private lands across a subwatershed. Some of the land conservation choices a watershed manager often has to make include the following:

- What fraction of my subwatershed needs to be conserved?
- What are the highest priorities for land conservation in my subwatershed?
- Who will manage these conservation areas over the long-term?
- What incentives can be used to promote stewardship of private lands?
- Is a land trust available to accept and manage conservation areas, or does one need to be created?
- What are the most appropriate techniques to conserve land in the watershed?

At what scale and by what method should conservation areas be delineated?

Cooperative Farm Game Program/Pennsylvania Game Commission

Cooperative Farm Game Program, Pennsylvania Game Commission
Aimed at providing public access to hunting on privately controlled lands, this program depends upon safeguarding the right of every landowner to a peaceful existence and protection of his land, crop and livestock. Another objective includes incentives promoting better small game hunting through development of good land use practices that produce improved small game habitat. The Project Area is in the heart of Farm Game Project #153. There are 593 farms enrolled accounting for 64,668 acres available for hunting and habitat enhancement, some of which may be eligible as project work for the Commission's Food and Cover Corps. Examples are border edge cutting and warm season grass plantings. Telephone: 814-643-1831, or 877-877-9107.

Appendix B – 2002 303(d) List for the Middle Conodoguinet Creek
07B is entire Conodoguinet Watershed

[Source is PA Department of Environmental Protection information for the **State Water Plan:07B** website at http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/303d-Report.htm#2002_List.

Section 1, Part A
Aquatic Life Use, 303(d) Impaired Streams and Rivers

Data Source	Source	Cause	Priority	Year Listed	Targeted for TMDL
Named Streams: 07B - Big Spring Creek					
Segment ID: 970703-1100-JLR Miles Assessed: 3.5					
Surface Water Assessment	Other	Organic Enrichment/Low D.O.	Medium	1998	
Surface Water Assessment	Other	Siltation	Medium	1998	
Named Streams: 07B - Bulls Head Branch, Green Spring Creek					
Segment ID: 970804-0950-JLR Miles Assessed: 13					
Surface Water Assessment	Agriculture	Pesticides	High	1998	
Named Streams: 07B - Conodoguinet Creek					
Segment ID: 20010524-1435-JLR Miles Assessed: 1.7					
Surface Water Assessment	Agriculture	Nutrients	Medium	2002	
Segment ID: 6450 Miles Assessed: 58.6					
Surface Water Monitoring Program	Agriculture	Nutrients	Medium	1996	2003
Segment ID: 6452 Miles Assessed: 11.9					
Surface Water Monitoring Program	Other	Nutrients	Medium	1996	2003
Surface Water Monitoring Program	Agriculture	Nutrients	Medium	1996	2003
Segment ID: 7043 Miles Assessed: 0.9					
Surface Water Monitoring Program	Agriculture	Suspended Solids	Medium	1998	
Segment ID: 970729-1605-JLR Miles Assessed: 7.8					
Surface Water Assessment	Habitat Modification	Flow Alterations	Low	1998	
Segment ID: 970805-1510-JLR Miles Assessed: 3.2					
Surface Water Assessment	Source Unknown	Cause Unknown	Low	1998	
Named Streams: 07B - Whisky Run					
Segment ID: 970731-1125-JLR Miles Assessed: 5					
Surface Water Assessment	Source Unknown	Cause Unknown	Low	1998	

Section 1, Part B
Aquatic Life Use, 303(d) List of Streams and Source of Impairments with Approved TMDLs

Data Source	Source	Cause	Year Listed	Year TMDL Completed	Stream Level
Named Streams: 07B - Conodoguinet Creek		**Stream Code: 10290**			**3**
		Segment ID: 970729-1605-JLR			
		Miles Assessed: 7.8			
Surface Water Assessment Program	Construction	Siltation	1998	2001	
Surface Water Assessment Program	Agriculture	Siltation	1998	2001	
Named Streams: 07B - Alexanders Spring Creek		**Stream Code: 10302**			**3**
		Segment ID: 970917-0910-JLR			
		Miles Assessed: 3.8			
Surface Water Assessment Program	Agriculture	Siltation	1998	2001	
Surface Water Assessment Program	Construction	Siltation	1998	2001	
Named Streams: 07B - Mount Rock Spring Creek		**Stream Code: 10319**			**3**
		Segment ID: 6457			
		Miles Assessed: 1.4			
Surface Water Monitoring Program	Agriculture	Nutrients	1996	2001	
		Segment ID: 970811-0925-JLR			
		Miles Assessed: 7.2			
Surface Water Assessment Program	Construction	Siltation	1998	2001	
Surface Water Assessment Program	Agriculture	Siltation	1998	2001	
Named Streams: 07B - Back Creek, Center Creek		**Stream Code: 10417**			**3**
		Segment ID: 970617-1250-JLR			
		Miles Assessed: 7.9			
Surface Water Assessment Program	Agriculture	Organic Enrichment/Low D.O.	1998	2001	
Surface Water Assessment Program	Agriculture	Siltation	1998	2001	
Named Streams: 07B - Green Spring Creek		**Stream Code: 10430**			**3**
		Segment ID: 6459			
		Miles Assessed: 4.3			
Surface Water Monitoring Program	Agriculture	Nutrients	1996	2001	
Named Streams: 07B - Bulls Head Branch, Green Spring Creek		**Stream Code: 10431**			**4**
		Segment ID: 970804-0950-JLR			
		Miles Assessed: 13			
Surface Water Assessment Program	Agriculture	Siltation	1998	2001	
Surface Water Assessment Program	Other	Organic Enrichment/Low D.O.	1998	2001	

How Records Appearing for the First Time on the 1998 303(d) are Listed in 2002 303(d)

10302 - Alexanders Spring Creek

1998 SegmentID: 970917-0910-JLR 2002 Segment ID: 970917-0910-JLR
Approved TMDL.

10417 - Back Creek

1998 SegmentID: 970617-1250-JLR 2002 Segment ID: 970617-1250-JLR
Approved TMDL.

10378 - Big Spring Creek

1998 SegmentID: 970703-1100-JLR 2002 Segment ID: 970703-1100-JLR
No change

10430 - Bulls Head Branch

1998 SegmentID: 970804-0950-JLR 2002 Segment ID: 970804-0950-JLR
Approved TMDL.

10419 - Center Creek

1998 SegmentID: 970617-1250-JLR 2002 Segment ID: 970617-1250-JLR
Approved TMDL.

10194 - Conodoguinet Creek

1998 SegmentID: 970529-0835-JLR 2002 Segment ID: 970529-0835-JLR
Now listed under Sears Run. 1998 list was in error.

10194 - Conodoguinet Creek

1998 SegmentID: 970805-1510-JLR 2002 Segment ID: 970805-1510-JLR
No Change

10194 - Conodoguinet Creek

1998 SegmentID: 970729-1605-JLR 2002 Segment ID: 970729-1605-JLR
Approved TMDL.

10194 - Conodoguinet Creek (Unt)

1998 SegmentID: 7043 2002 Segment ID: 7043
No Change

10430 - Green Spring Creek

1998 SegmentID: 970804-0950-JLR 2002 Segment ID: 970804-0950-JLR
Approved TMDL.

10319 - Mount Rock Spring Creek

1998 SegmentID: 970811-0925-JLR 2002 Segment ID: 970811-0925-JLR
Approved TMDL.

10439 - Whisky Run

1998 SegmentID: 970731-1125-JLR 2002 Segment ID: 970731-1125-JLR
No Change

Appendix C – Fish of the Conodoguinet Creek and its Tributaries
**List compiled by Dr. Fred Howard, Biology Professor, Shippensburg University

White Sucker	*Catostomus commersoni*
Hog Sucker	*Hypentelium nigricans*
Redbreast Sunfish	*Lepomis auritus*
Rock Bass	*Ambloplites rupestis*
Green Sunfish	*Lepomis cyanellus*
Bluegill	*Lepomis macrochirus*
Smallmouth Bass	*Micropterus dolomieui*
Largemouth Bass	*Micropterus salmoides*
White Crappie	*Pomoxis annularis*
Potomac Sculpin	*Cottus girardi*
Mottled Sculpin	*Cottus bairdi*
Blacknose Dace	*Rhynichthys atratulus*
Longnose Dace	*Rhynichthys cataretae*
Goldfish	*Carassius auratus*
Silverjaw Minnow	*Ericymba buccata*
Cutlips Minnow	*Exoglossum maxillingua*
River Chub	*Nocomis micnopogon*
Spotfin Shiner	*Notropis spilopterus*
Common Shiner	*Notropis cornutus*
Swallowtail Shiner	*Notropis procne*
Comely Shiner	*Notropis amoenus*
Satinfin Shiner	*Notropis analostanus*
Spotted Shiner	*Notropis hudsonius*
Rosqface Shiner	*Notropis rubellus*
Golden Sniner	*Notemigonus crysoleucas*
Bluntnose Shiner	*Pimephales notatas*
Creek Chub	*Semotilus atromaculatus*
Allegheny Pearl Dace	*Semotilus margarita*
Carp	*Cyprinus carpio*
Banded Killifish	*Fundulus diaphanus*
Four-spined Stickleback	*Apeltes quadrocus*
Northern Brown Bullhead	*Ictalurus nebulosus*
Margined Madtom	*Noturus insignis*
Yellow Bullhead	*Ictalurus natalis*
Johnny Darter	*Etheostoma nigrum*
Fantail Darter	*Etheostoma flabellare*
Rainbow Trout	*Salmo gairdneri*
Brown Trout	*Salmo trutta*
Brook Trout	*Salvelinus fontinalis*
Chain Pickerel	*Esox niger*

Appendix D – Amphibians and Reptiles of the Conodoguinet Watershed

American Toad	*Bufo americanus*
Fowlers Toad	*Bufo woodhousei*
Bullfrog	*Rana catesbeiana*
Green Frog	*Rana clamitans*
Pickerel Frog	*Rana palustris*
Spring Peeper	*Hyla crucifer*
Wood Frog	*Rana sylvatica*
Dusky Salamander	*Desmognathus fuscus*
Longtail Salamander	*Eurycea longicauda*
Red-backed Salamander	*Plethodon cinereus*
Red Salamander	*Pseudotriton ruber*
Red Spotted Newt	*Notophthalmus viridescens*
Slimy Salamander	*Plethodon glutinosus*
Spring Salamander	*Gyrinophilus porphyriticus*
Two-lined Salamander	*Eurycea bislineata*
Five-lined Skink	*Eumeces fasciatus*
Fence Lizard*	*Sceloporus undulatus*
Black Racer Snake	*Coluber constrictor*
Black Rat Snake	*Elaphe obsoleta*
Copperhead	*Agkistrodon contortrix*
Decay Snake	
Garter Snake	*Thamnophis sirtalis*
Milk Snake	*Lampropeltis triangulum*
Northern Watersnake	*Nerodia sipedon*
Queen Snake	*Regina septemvittata*
Rattlesnake+	*Crotalus horridus*
Red Bellied Snake	*Storerra occipitomaculata*
Ribbon Snake	*Thamnophis sauritus*
Ringneck Snake	*Diadophis punctatus*
Worm Snake	*Carphophis amoenus*
Eastern Box Turtle	*Terrapene Carolina*
Map Turtle	*Graptemys geographica*
Painted Turtle	*Chrysemys picta*
Red Earred Sliders*	*Chrysemys scripta*
Snapping Turtle	*Chelydra serpentina*
Softshell Turtle*	*Trionyx ferox*
Spotted Turtle	*Clemmys guttata*
Stinkpot Turtle	*Sternotherus odoratus*
Wood Turtle	*Clemmys insculpta*

*Likely a release
+Probable, but never seen

Appendix E – Birds of the Conodoguinet Watershed

Pie-billed grebe	*Podilymbus podiceps*
American Bittern	*Botaurus lentiginosus*
Canada Goose	*Branta canadensis*
American Black Duck	*Anas rubripes*
Gadwall	*Anas strepera*
Mallard	*Anas platyrynchos*
Wood Duck	*Aix sponsa*
Blue Winged Teal	*Anas discors*
Redhead	*Aythya americana*
Ring Necked Duck	*Aythya collaris*
Lesser or Greater Scaups	*Aythya affinis & marila*
Common Goldeneye	*Bucephala clangula*
Hooded Merganser	*Laphodytes cucullatus*
Common Merganser	*Mergus merganser*
American Coot	*Fulica americana*
Herring Gull	*Larus argentatus*
Ring Billed Gull	*Larus delawarenis*
Great Blue Heron	*Ardea herodias*
Little Blue Heron	*Egretta caerulea*
Great Egret	*Casmerodius albus*
Black-crowned Night Heron	*Nycticorax nycticorax*
Yellow-crowned Night Heron	*Nyctanassa violacea*
Green Heron	*Butorides striatus*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Killdeer	*Charadrius vociferus*
American Woodcock	*Philohela minor*
Lesser Yellowlegs	*Tringa flavipes*
Spotted Sandpiper	*Actitis macularia*
Upland Sandpiper	*Bartramia longicanda*
Wild Turkey	*Meleagris gallopavo*
Ruffed Grouse	*Bonasa umbellus*
Ring-Necked Pheasant	*Phasianus colchicus*
Northern Bobwhite	*Colinus virginianus*
Sharp-Skinned Hawk	*Accipiter striatus*
Coopers Hawk	*Accipiter cooperii*
Northern Harrier	*Circus cyaneus*
Black Vulture	*Coragyps atratus*
Red-Tailed Hawk	*Buteo jamaicensis*
Red-Shouldered Hawk	*Buteo lineatus*
Broad-winged Hawk	*Buteo platypterus*
Bald Eagle	*Haliaeetus leucocephalus*
Osprey	*Pandion haliaetus*
Turkey Vulture	*Cathartes aura*

Black Vulture	*Coragyps atratus*
American Kestrel	*Falco sparverius*
Eastern Screech Owl	*Otus asio*
Long-Eared Owl	*Asio otus*
Great Horned Owl	*Bubo virginianus*
Barn Owl	*Tyto alba*
Northern Saw-whet Owl	*Aegolius acadicus*
Mourning Dove	*Zenaida macroura*
Rock Dove	*Columba livia*
Yellow-billed Cuckoo	*Coccyzus americanus*
Black-billed Cuckoo	*Coccyzus erthropthalmus*
Common Nighthawk	*Chordeiles minor*
Whip-poor-will	*Caprimulgus vociferus*
Ruby Throated Hummingbird	*Archilochus colubris*
Belted Kingfisher	*Megaceryle alcyon*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Pileated Woodpecker	*Dryocopus pileatus*
Common Flicker	*Colaptes auratus*
Red Bellied Woodpecker	*Melanerpes carolinus*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
Eastern Kingbird	*Tyrannus tyrannus*
Great Crested Flycatcher	*Myiarchus crinitus*
Eastern Phoebe	*Sayornis phoebe*
Eastern Wood-Pewee	*Contopus virens*
Acadian Flycatcher	*Empidonax virescens*
Willow Flycatcher	*Empinodax traillii*
Horned Lark	*Eremophila alpestris*
Purple Martin	*Progne subis*
Barn Swallow	*Hirundo rustica*
Tree Swallow	*Iridoprocne bicolor*
Rough-Winged Swallow	*Stelgidopteryx ruficollis*
Chimney Swift	*Chaetura pelagica*
Bank Swallow	*Riparia riparia*
American Crow	*Corvus brachyrhynchos*
Blue Jay	*Cyanocitta cristata*
Black-Capped Chickadee	*Parus atricapillus*
Carolina Chickadee	*Parus carolinensis*
Tufted Titmouse	*Parus bicolor*
White Breasted Nuthatch	*Sitta carolinensis*
Carolina Wren	*Thryothorus ludovicianus*
House Wren	*Troglodytes aedon*
Brown Thrasher	*Toxostoma rufum*
Gray Catbird	*Dumetella carolinensis*
Mockingbird	*Mimus polyglottos*

Eastern Bluebird	*Sialia sialis*
American Robin	*Turdus migratorius*
Wood Thrush	*Hylocichla mustelina*
Cedar Waxwing	*Bombycilla cedrorum*
Red-eyed Vireo	*Vireo olivaceus*
Black-and-White Warbler	*Mniotilta varia*
Yellow Warbler	*Dendroica petechia*
Common Yellowthroat	*Geothlypis trichas*
Ovenbird	*Seiurus aurocapillus*
Red-Winged Blackbird	*Agelaius phoeniceus*
Brown Headed Cowbird	*Molothrus ater*
Common Grackle	*Quiscalus quiscula*
Eastern Meadowlark	*Sturnella magna*
European Starling	*Sturnus vulgaris*
Orchard Oriole	*Icterus spurius*
Baltimore Oriole	*Icterus galbula*
House Sparrow	*Passer domesticus*
Dark Eyed Junco	*Junco hyemalis*
Cardinal	*Cardinalis cardinalis*
House Finch	*Carpodacus mexicanus*
Purple Finch	*Carpodacus purpureus*
American Goldfinch	*Carduelis tristis*
Indigo Bunting	*Passerina cyanea*
Chipping Sparrow	*Spizella passerina*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammodramus savannarum*
Song Sparrow	*Melospiza melodia*

Appendix F – Mammals of the Conodoguinet Watershed

Masked Shrew	*Sorex cinereus*
Smokey Shrew	*Sorex fumeus*
Northern Short-tailed Shrew	*Blarina brevicauda*
Least Shrew	*Cryptotis parva*
Hairy-tailed Mole	*Parascalops brewerii*
Eastern Mole	*Scalopus aquaticus*
Star-nosed Mole	*Condylura cristata*
Little Brown Bat	*Myotis lucifigus*
Eastern Pipistrelle	*Pipistrtllus subflavus*
Big Brown Bat	*Eptesicus fuscus*
Red Bat	*Lasiurus borealis*
Hoary Bat	*Lasiurus cineareus*
Eastern Cottontail	Sylvilagus floridanus
Eastern Chipmunk	*Tamius striatus*
Woodchuck	*Marmota monax*
Gray Squirrel	*Sciurus carolinensus*
Fox Squirrel	*Sciurus niger*
Red Squirrel	*Tamiasciurus hudsonicus*
Southern Flying Squirrel	*Glaucomys volans*
Beaver	*Castor canidensis*
White-footed mouse	*Peromyscus leucopus*
Eastern Woodrat	*Neotoma magister*
Southern Red-backed Vole	*Clethryonomys gapperi*
Meadow Vole	*Microtis pennsylvanicus*
Woodland Vole	*Microtis pinetorum*
Muskrat	*Ondatra zibethicus*
Norway Rat	*Rattus norvegicus*
House Mouse	*Mus musculatus*
Meadow Jumping Mouse	*Zapus hudsonius*
Woodland Jumping Mouse	*Napaeozapus insignus*
Porcupine	*Erthizon dorsatum*
Coyote	*Canis latrans*
Red Fox	*Vulpes vulpes*
Gray Fox	*Urocyon cinereoargenteus*
Black Bear	*Ursus americanus*
Raccoon	*Procyon lotor*
Ermine	*Mustela erminea*
Least Weasel	*Mustela nivalis*
Long-tailed Weasel	*Mustela frenata*
Mink	*Mustela vison*
Striped Skunk	*Mephitis mephitis*
Bobcat	*Felis rufus*
White-tailed Deer	*Odocoleus virginianus*

Appendix G – Pennsylvania Natural Diversity Inventory

Species Classification Definitions

Wild Birds and Mammals:

PE: PENNSYLVANIA ENDANGERED

Species in imminent danger of extinction or extirpation throughout their range in Pennsylvania if the deleterious factors affecting them continue to operate. These are: 1). Species whose numbers have already been reduced to a critically low level or whose habitat has been so drastically reduced or degraded that immediate action is required to prevent their extirpations from the Commonwealth; or 2). Species whose extreme rarity or peripherality places them in potential danger of precipitous declines or sudden extirpation throughout their range in Pennsylvania; or 3). Species that have been classified as "Pennsylvania Extirpated", but which are subsequently found to exist in Pennsylvania as long as the above conditions 1 or 2 are met; or 4). Species determined to be "endangered" pursuant to the Endangered Species Act of 1973, Public Law 93-205 (87 Stat. 884) as amended.

PT: PENNSYLVANIA THREATENED

Species that may become endangered within the foreseeable future throughout their range in Pennsylvania unless the casual factors affecting the organism are abated. These are: 1). Species whose populations within the Commonwealth are decreasing or have been heavily depleted by adverse factors and while not actually endangered, are still in critical condition; 2). Species whose populations may be relatively abundant in the Commonwealth but are under severe threat from serious adverse factor that have been identified and documented; or 3). Species whose populations are rare or peripheral and in possible danger of severe decline throughout their range in Pennsylvania; or 4). Species determined to be "Threatened" pursuant to the Endangered Species Act of 1973, Public Law 93-205 (87 Stat. 884), as amended, that are not listed as "Pennsylvania Endangered".

Fish, Amphibians, Reptiles, and Aquatic Organisms:

PE: PENNSYLVANIA ENDANGERED

All species declared by; 1). The Secretary of the United States Department of the Interior to be threatened with extinction and appear on the Endangered Species List or the Native Endangered Species List published in the Federal Register; or 2). Have been declared by the PA Fish and Boat Commission, Executive Director to be threatened with extinction and appear on the PA Endangered Species List published in the Pennsylvania Bulletin.

PT: PENNSYLVANIA THREATENED

All species declared by: 1). The Secretary of the United States Department of the Interior to be in such small numbers throughout their range that they may become endangered if their environment worsens, and appear on a Threatened Species List published in the Federal Register; or 2). Have been declared by the PA Fish and Boat Commission Executive Director to be in such small numbers throughout their range that

they may become endangered if their environment worsens and appear on the PA Threatened Species List published in the Pennsylvania Bulletin.

PC: PENNSYLVANIA CANDIDATE
Animals that could become endangered or threatened in the future. All of these are uncommon, have restricted distribution or are at risk because of certain aspects of their biology.

PNDI LIST

Endangered species:
ARAAD02040*503, 557 & 560 PE *Clemmys muhlenbergii* – Bog turtle
AMABA04010*506 PE *Cryptotis parva* – Least shrew
AMACC01100*504, 505 & 506 PE *Myotsis sodalis* – Indiana bat

Threatened species:
ABANGA13010*503 PT *Nyctanassa violacea* – Yellow-crowned night-heron
AMAFF08014*521, 522 & 557 PT *Neotoma floridana magister* – Eastern woodrat
ABNNF06010*522 & 524 PT *Bartramia longicauda* – Upland sandpiper
AMACC01130*505 PT *Myotis leibii* – Eastern small-footed bat
ARAAD07050*507 PT *Pseudemys rubriventris* – Redbelly turtle

Rare species:
AMACC06010*501 PR *Nycticeius humeralis* – Evening bat
AMACC01150*505 PR *Myotsis septentrionalis* – Northern long-eared bat

Candidate species:
ARADEO2040*506, 507 & 538 PC *Crotalus horridus* – Timber rattlesnake

Undetermined status:
ABPBX65010*501 & 502 PU *Spiza _mericana* – Dickcissel

Appendix H – Public Participation Information - Attendance

Attendance
September 29, 2001 Forum

1. Diane Hollinger, Mechanicsburg, CCWA
2. Darwin Hollinger, Mechanicsburg, CCWA
3. Roy Kelso, Newville
4. Leroy Finkey, Newville
5. Evan Jenkins, Camp Hill (PEMA)
6. Arthur McCarter, Newville
7. Walter Heine, Newville
8. Harvey Hoover, West Pennsboro Twp.
9. Robert Smith, North Newton Twp.
10. Glenn Glesner, Newville
11. Gil Freedman, Mechanicsburg, CCWA
12. Tim Wakefield, Yellow Breeches Alliance
13. Tom Frantz, Newville
14. Margi Butts, Mt. Rock Road
15. Camilla Westcott, Creek Road, Carlisle
16. Larry Westcott, Creek Road, Carlisle
17. Ronald Glesner, Newville
18. John Cummings, Fish & Boat Commission
19. Mike Stetz, Newville
20. Andy DeGregorio, AD Marble & Company/Resident
21. Fran Flanigan, Alliance for the Chesapeake Bay
22. Karen Firehock, University of Virginia
23. Pat Devlin, Alliance for the Chesapeake Bay
24. Wilbur Wolf, CCWA
25. Kim Van Fleet, CCWA
26. Ron Freed, CCWA
27. Charlie McGarrell, CCWA
28. Vince McCollum, CCWA
29. Jerry Hollowell, CCWA
30. Jane Earle, CCWA
31. Dale Bowman, CCWA, Game Commission
32. Lillie Porter, CCWA
33. Bill Porter, CCWA
34. Joan Brehm, Newville

NOTE: 17 “no-shows” from pre-registration list.

Appendix I – Public Participation Information – Small Group Discussion

Results of Small Group Breakout Discussion, September 29, 2001 Forum
NOTE: Top 3-5 issues/ideas expressed during report-backs are highlighted in bold-faced print.

QUESTION #1: What is your general reaction to the information & priority issues presented at today's forum?

GROUP 1:
- Well- presented; handouts understandable; concerns over abiding by imposed guidelines.

GROUP 2:
- Where are sinkholes located? Need better definition/more information.
- Difficult to process information quickly -- where do we go from here?
- Plan should have achievable benchmarks -- small steps identified.
- Need for information sources.

GROUP #3:
- Agriculture was 'blamed' for problems too often in the presentations. Homeowners contribute more chemicals acre per acre because it is less expensive to treat suburban lawns with chemicals and homeowners often use a greater volume of chemicals (fertilizers and pesticides) than is warranted. A suburban development can harm a watershed more than a farm can.
- The group would have liked more information on water conservation measures, especially since a reduction of groundwater supplies is lowering the flows from springs and thus contributing to the sedimentation problem in area creeks.
- There is a concern as to whether it is good to facilitate flow of parking lot runoff into aquifers (from slide presentation) unless that water is somehow filtered first, since parking lots can contribute chemicals (oil, antifreeze, metals) and may contaminate an otherwise healthy aquifer. This is especially true in karst areas.

QUESTION #2: Can you see ways in which your local government, community, or organization can implement any of the recommendations listed under the top six priorities?

GROUP 1:
- Try innovative techniques for educating Amish/Mennonite farmers; make it personal, such as flowers, fishing, aesthetics.
- **Enforce existing rules and permit conditions**. Township officials should enforce Right-of-Ways restrictions, campground and squatter sites.
- Need buffer zones around sinkholes/enforcement.
- **Zoning and regional planning: EDUCATION NEEDED!**

- Need ways to convince townships of the benefits.
- Target audiences:
  1) Schools: Educate schools as way to educate the next generation of decision makers
  2) Local officials: Educate supervisors, planning commissions, township solicitors, plus zoning hearing boards. Be aware of problem with township supervisors not attending training that has been offered.
  3) Residents: If local representatives aren't open to ideas, need to educate residents. Municipal newsletters.

- Run for local office.
- **Groundwater message is important**: Focus on health of groundwater in messages to local governments. Use drinking water as selling point. Groundwater analyses are needed.

GROUP 2:

- Stress subwatershed groups.
- Hold work sessions with supervisors in each township.
- Provide information to township residents on benefits of implementation -- comprehensive plan, zoning, etc.
- Outreach to broad spectrum of citizens groups. (HOW?)
- Make sure information is relevant to local issues.
- **Get to municipalities.**
  - **Help municipalities sell program benefits.**
  - **Involve sportsmen groups/ school groups.**
  - **Emphasize wildlife habitat -- dual role for water protection.**
  - **Prioritize projects -- focus on what's achievable. Which is worst? Which is easiest?**
  - **Which municipalities are open to adoption?**

GROUP #3: (note the group dealt only with 'education of the public' and 'preservation of agricultural lands' due to time constraints)

- **Education of the public about natural resource protection.** Education is needed for the general public, local government officials and consulting engineers who are hired by local governments and developers but who don't always apply the most progressive measures.
  - A school program would also be useful. In schools, the function should not be 'Zoning 101' but rather a curriculum that could focus on the many different interests that are engaged in land planning decisions and options for working cooperatively to address them. The key message should be 'conflicts concerning land uses are normal but there are methods and approaches for resolving them that can engage and consider all concerns.'
  - Preparing the public to understand issues for both reactive planning (e.g. new development project proposed to a planning commission) and long-term issues

(planning for future water supplies or protection). The traditional model of holding public hearings at which people come forward to 'take sides' is not a good model for achieving understanding and new agreements. Instead, efforts should focus on developing 'fact sheets' with objective information on common proposals, such as truck terminals, cell towers, mobile home parks, timber and mining applications for instance. Additionally, groups can host seminars, which include presentations about the issues and opportunities for people to discuss ideas and options with one another first before a formal public 'hearing' is held. This will help to ensure informed input and creative ideas.

- Local governments need help in recognizing long term implications of decisions. They need facilitated access to planning tools, models, best practices and opportunities to obtain them (e.g. clearinghouses, guides, web sites, workshops, consultants).
- There are regional governance groups such as the Tri-County Planning Commission' that could be better utilized. Local governments need to be educated about why it is critical to give them requested information and the planning commission should be encouraged to communicate more often with local governments, possibly through local representatives.

- **Preserving agricultural lands**
  - Farms are increasingly being lost to development and much of this has to do with the poor economic returns of farming today and the relatively cheaper costs of buying produce from outside of the state. A 'systems' approach is needed to solve the problem, which includes the farmer, the suppliers and the marketing systems. One approach that is being looked at is the 'truck farms' (*trucking vegetables to local suppliers, farmers markets etc.) The agricultural preservation commission through Cumberland County Extension Service is looking into these ideas and may be an useful resource for the committee to consult in developing actions for this priority. (Note that we ran out of time to fully develop this priority issue.)

Appendix J – Public Participation Information- Forum Evaluation Form

Evaluation Form Responses, September 29, 2001 Forum
(17 responses)

- The forum added to my knowledge:

11 significantly 6 somewhat 0 not at all

- The forum opened doors to how I can get involved in watershed management:

6 significantly 10 somewhat 0 not at all
1 currently involved

- *Parts of the forum I like best:*
  - work group discussions, informed "side-bar" discussions.
  - good forum to get the word out; just wish it was better attended.
  - knowledgeable presenters.
  - Kim's resource tour.
  - Workshops, discussions; tour of watershed throughout county.
  - Individual presentations, particularly Kim's presentation on the creek.
  - Small group discussion.
  - It was very informative to me. I got to know about some things I wasn't sure of.
  - Group discussion and slide presentation.
  - Small groups.
  - Presentations in general; committees.
  - Recommended goals.
  - Break out group discussion was informational and valuable; sharing the results was important.
  - Separate group discussion.
  - Examples of BMPs.
  - Tour of natural resources of Conodoguinet Creek.

- *Parts of the forum I liked the least:*
  - Too little time.
  - Presentations without visuals…Let's sell this thing by the fact that it is a tool for municipalities to use to guide development and where to find $/grants to help with those things.
  - Poor acoustics.
  - Small group discussions much too short.
  - Should have been more time spend on individual group discussions.
- *Parts of the forum I liked least (continued):*
  - Committees.
  - I thought Dale Bowman was short-changed; his presentation was shortened, it seemed.

- Too much focus on local results and conditions.
- Frustration of trying to identify how to sell these programs, but promising ideas were expressed.
- Management goals??

■ *I'd like to see the following happen next:*
- Watershed Association presentations to boards of supervisors.
- Send a representative to the county township supervisors banquet in October.
- Stronger enforcement of existing rules and regulations.
- Goals achieved…even if minor achievement.
- Concentration on subwatersheds and actions beneficial to each.
- It's up to what you want to do.
- Educating residents.
- Help for planning commissions in zoning to protect water.
- More municipal participation.
- More details and data.
- Better municipality representation.
- Selling municipalities (after completion of the plan).
- A zoning ordinance for townships in order to limit cottages and camps along the creek.

■ *Additional comments:*
- Well-organized meeting.
- There are many tools out there and many regulations to help enforce all discussed. The municipalities need empowered with a tool that points them in the right direction.
- The facilitators were well prepared and presented well.
- Well done!
- Great job by all involved!
- The individual group discussion was the way to go.
- No styrofoam cups at conservation meetings!
- More help on planning commissions.
- Please keep the Yellow Breeches Watershed Alliance on your mailing list.
- Facilities were good, food was excellent.
- Was worth time and energy to be here.
- My admiration and thanks to RCP contributors for their time and effort.
- Good planning (food, space, room and time).

Appendix K – Public Participation Information – Community Survey

Conodoguinet Creek Watershed Community Survey

GENERAL QUESTIONS

- How long (in years) have you lived in this area?

  1% - < 1
  9% - 1-5
  8% - 5-10
  7% - 10-15
  12% - 15-20
  63% - 20+

- If you area new to the area (<5 years), why did you decide to move here? What do you like about this area?

- What kind of home do you live in or property do you own?

  10% - apartment
  45% - lot <1 acre
  28% - lot 1-5 acres
  9% - 5-20 acres
  8% - 20+ acres

- Are you a registered voter? *Yes – 95%*
  Do you vote? *Yes – 92%*

GENERAL QUESTIONS ABOUT PERSONAL OBSERVATIONS

1. If you are not on public water have you had to re-drill your well within the last few years? Do you have neighbors who have had to re-drill their wells in the last few years?

   Yes – 12% *No – 34%* *No Answer – 54%*

2. Have you noticed any recent changes in the water levels of streams in your area? (e.g., more flash flooding, streams drying up)

   Yes – 52% *No – 33%* *No Answer – 15%*

3. Have you noticed a decline in water quality in the streams in your area? Please describe the nature of this decline (e.g., odor, muddy water, visible algae, foamy water, steep or eroding streambanks).

   Yes – 33% No – 45% No Answer – 22%

4. (If you enjoy fishing in this area)…Do you believe that fishing quality has improved, remained the same or declined in recent years? Why?

   Improved – 3% Remained the Same – 10%
   Declined – 23% No Answer – 64%

5. Do you believe any observable decline in water quality or water supply is due (at least in part) to any of the below.

   a. Agricultural activities – *35%*
   b. Development activities (new development) – *58%*
   c. Storm water runoff – *26%*
   d. Public wastewater discharges – *19%*
   e. Other (Please list) – *5%*

6. Do you believe that the agricultural heritage, historical, and/or cultural resources of your area are being harmed by development? List any you think are being threatened.

   Loss of farmland, loss of hunting areas, quality of life, aesthetics, scenic views

ADDENDUM – CONODOGUINET CREEK DE-LISTING

Conodoguinet Creek in Cumberland County was monitored by a citizens group from 1987 to 1994 under the direction of ALLARM (Alliance for Aquatic Resource Monitoring). Based on data collected during those years, the creek was placed on the 303(d) list for nutrients from agriculture, which has been found to be inaccurate, based on recent Department of Environmental Protection (DEP) review. Average nitrate concentrations at all sites were between 2.1 and 3.9 mg/l, which is well below the water quality criteria of 10 mg/l. The maximum concentrations of 6 and 7 mg/l occurred at the two upper sites.

ALLARM also monitored dissolved oxygen. Average dissolved oxygen for all sites ranged from 9.1 to 13.5 mg/l. One site had a minimum of 4.8 mg/l and another had a minimum of 5 mg/l, otherwise, the minimums ranged from 5.3 to 11.2 mg/l. The report erroneously concluded that there were dissolved oxygen violations, because criteria require that dissolved oxygen be above 6 mg/l as a daily average, with no less than 5 mg/l allowable at any time. These criteria are for a cold-water fishery; the Conodoguinet Creek is a warm water fishery. For a warm water fishery, the criteria are 5 mg/l as an average with a minimum of 4 mg/l. None of the data collected showed violations.

Back in 1986 – 1987, DEP regional biologist Bob Schott conducted dissolved oxygen studies at several sites on the lower 34 miles of the Conodoguinet. He observed dissolved oxygen violations in an impounded reach on the lower 15 miles of the creek. Since then, the Pennsylvania Fish and Boat Commission removed the impoundment through their shad reintroduction program.

The Susquehanna River Basin Commission also assessed the Conodoguinet for the Unassessed Waters Project. According to their data, none of the stations on the Conodoguinet were impaired. Based on the most recent assessment of the Conodoguinet Creek, as well as the lack of data showing criteria violations in the ALLARM report, the Conodoguinet Creek has been removed from the 303(d) list.

The following is an excerpt from the PA Department of Environmental Protection's 2004 303(d) list:

Addendum 1: Aquatic Life Pollutant Causes Listed in 2002 but Not in 2004
These are records that appeared on the 2002 303(d) list and would have appeared on List 5 of the 2004 Integrated List except that a resurvey either found the segment is no longer impaired or the actual source or cause of pollution was other than that listed in 2002. Streams found to be no longer impaired have "Attaining-Resurveyed" in the Causes 2004 column.

State Water Plan=07B
Stream Name: Conodoguinet Creek Watershed:07B Code: 10194 DwnRMI: 16.5 UpRMI: 75.9

AMD Record	*2002 Assessment ID*	*2002 Cause Not Listed in 2004*	*2004 Assessment ID*	*2004 Census*
No	**6450**	**Nutrients**	**20030101-1200-RAK**	**Attaining-Resurveyed**
No	**6452**			**Attaining-Resurveyed**