

SUGAR & TOWANDA CREEKS RIVERS CONSERVATION PLAN

A comprehensive approach toward conserving and enhancing
the natural, recreational, and cultural resources.



"Rivers run through our history and folklore, and link us as a people. They nourish and refresh us and provide a home for dazzling varieties of fish and wildlife and trees and plants of every sort. We are a nation rich in rivers."

Charles Kuralt

"When you put your hand in a flowing stream, you touch the last that has gone before and the first of what is still to come." **Leonardo da Vinci**

"Rivers must have been the guides which conducted the footsteps of the first travelers. They are the constant lure, when they flow by our doors, to distant enterprise and adventure, and, by a natural impulse, the dwellers on their banks will at length accompany their currents to the lowlands of the globe, or explore at their invitation the interior of continents." **Henry David Thoreau**

Acknowledgements

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National

USDA, Natural Resources Conservation Service
USDA, Farm Service Agency
Endless Mountains Resource Conservation and Development

State

Pennsylvania Department of Conservation and Natural Resources
Pennsylvania Department of Environmental Protection
Pennsylvania Bureau of Forestry
Pennsylvania Bureau of State Parks
Pennsylvania Fish and Boat Commission
Pennsylvania Game Commission
Pennsylvania Department of Transportation

Regional

Endless Mountains Heritage Region
Northern Tier Regional Planning & Development Commission

County

Penn State Extension - Bradford County Office
Bradford County Commissioners
Bradford County Office of Planning and Grants
Bradford County Agricultural Land Preservation Board
Bradford County Sanitation Committee
Bradford County Council of Governments
Lycoming County Conservation District
Sullivan County Conservation District
Tioga County Conservation District

Sugar Creek Municipalities

Armenia Twp.
Burlington Borough
Burlington Twp.
Columbia Twp.
Granville Twp.
North Towanda Twp.
Smithfield Twp.
Springfield Twp.
Sylvania Borough
Towanda Borough
Towanda Twp.
Troy Borough
Troy Twp.
Ulster Twp.
West Burlington Twp.
Wells Twp.
Sullivan Twp. - Tioga County

Towanda Creek Municipalities

Alba Borough
Albany Twp.
Armenia Twp.
Asylum Twp
Burlington Twp
Canton Borough
Canton Twp.
Cherry Twp. – Sullivan County.
Fox Twp. – Sullivan County
Franklin Twp
Granville Twp.
Leroy Twp.
McNett Twp. – Lycoming County
Monroe Borough
Monroe Twp.
New Albany Borough
Overton Twp.
Terry Twp.
Towanda Twp.
Troy Twp.
Union Twp. – Tioga County
Ward Twp. – Tioga County
West Burlington Twp.

Private & Non-profit Organizations

Towanda Creek Watershed Association

Schrader Creek Watershed Association

Sugar Creek Watershed Association

Bradford / Sullivan Forest Landowners Association

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PREFACE

Many generations and cultures have been amply blessed by the bountiful natural resources, expansive recreational opportunities, and rich cultural heritage within the Sugar and Towanda Creek Watersheds. These invaluable assets are the cornerstones of our quality of life and sense of place. The forests, fields, and streams provide innumerable life supporting functions, and have supplied homes, home furnishings, fuel, economic income and food for people near and far. Pastoral scenes, ranging wildlife, and panoramic vistas invite us to wonder and awe at their splendor. Our agriculture, transportation, natural resource utilization and community-building have left their imprint everywhere within this landscape, which has remained remarkably rural, stable, and picturesque. How we collectively live within and manage these finite resources represents the difference between poverty and prosperity, uniqueness or commonness, vitality or stagnation, transience and belonging.

The proportion and influence of natural resources, recreation, and culture within the watersheds, weave together a landscape which exhibits what most Bradford County residents identify as “rural character”. The reverence and will for maintaining this rural character and small-town atmosphere resounds, time and time again, throughout conversations, surveys, and planning documents. Conversely, examples abound of these cherished values being threatened, impaired, or having ultimately disappeared. One might very well ponder a quiet childhood haunt now developed or off-limits, a favorite fishing hole now unproductive, a popular gathering place now leveled, working farms now abandoned, or memorable traditions or pastimes nearly forgotten.

This Rivers Conservation Plan is testament that there are (many) individuals and organizations with strong and common desire to conserve and enhance those special natural, recreational, and cultural qualities and occurrences within the watersheds; while at the same time looking to develop a future that will provide economic, social, and biological stability. From the list of issues to the number of strategies and actions steps, there is something to be taken up by each and every member of the community. The plan is to be used as a working, living document helping to bring the issues into focus, determine priorities, choose management options, and find assistance and tools necessary to accomplish tasks that many will appreciate.

You are urged to open this plan, find a watershed value that you truly cherish, and learn some of the issues and proposed management strategies that surround it, and take it upon yourself to ensure that it continues providing enjoyment to you and your neighbors for a long time to come.

FREQUENTLY ASKED QUESTIONS:

What is the purpose of a Rivers Conservation Plan?

The purpose of this Rivers Conservation Plan is to help protect the very things we find attractive, absorbing, and compelling about this area. It is a reference and recommendation document outlining the natural, recreational, and cultural resources of the watershed. This document identifies watershed issues, threats, and potential actions steps and management strategies that can be embarked upon to conserve and enhance those resources.

It cues potential donors of grants and services that what is being asked of them has been thought out and has broad backing and support, thereby increasing the likelihood of a successful request for funding or assistance.

What the plan is not.

This plan is not regulatory. It does not carry any power to or from government agencies. This plan is not a “black and white” or an “all or nothing” prescription for what to do in the watershed. The plan’s intent is to merely point out areas that are felt worthy of attention, and to identify a menu of action steps or management options, aimed at addressing shared concerns. It represents the “watershed community’s desire to conserve or enhance our many natural, recreation, and cultural gifts. It is not a mandate from an authoritative entity or developed using a “top down” approach, insisting “this is what you need” or “this is what you ought to do”.

How will the plan be used?

This Plan is a “stepping stone” for gaining technical and financial assistance for local municipalities and organizations to carry out planning, implementation, acquisition, and development activities. A registry is established to recognize river conservation efforts. Having a plan sets a direction and focus for individuals, municipal officials and community groups who aspire to work toward, retain, or regain one or more of the important values mention within this plan.

This plan will be used to justify requests for funding and other support from public and private grantors. It qualifies the projects contained herein to qualify for cost-share through Pennsylvania’s Department of Conservation and Natural Resources (DCNR) and other state agencies where applicable.

Who developed the plan?

Community members, public and private organizations, municipal officials, and local, state, and national agencies all contributed information found within the plan. Largely however, watershed residents had the greatest say and bearing on the issues, assets, actions steps presented herein.

How was the plan developed?

The Rivers Conservation Plan was developed using principals of Coordinated Resource Management. Public meetings were advertised and held in each municipality within the watersheds, encouraging input and suggestions from all residents. Documents such as comprehensive plans, open space plans, transportation plans, and watershed plans were gleaned for concerns, trends, and strategies toward natural, recreational, and cultural resources; again bringing further public input and legitimacy to the plan. Municipal officials, community leaders, watershed stakeholders, agencies and other interested parties (collectively the Steering Committee) worked together as a team from beginning to end. All participants were committed to the process which is inclusive, had broad involvement and relied on consensus.

The Steering Committee members were brought together to focus on the watershed-wide components of a Rivers Conservation Plan and not focus on their personal situation. Advisory Committee members were also pooled to lend their expertise in developing management strategies and action steps according to their field(s) of expertise, such as agriculture, forestry, community development, etc.

What is a watershed?

A watershed is defined as the area of land drained by a particular waterway or a connected series of waterways. Characteristics of the watershed significantly influence biologic, geologic, hydrologic, climatic, even human activity and culture.

A simple watershed model:

Imagine forming a bowl of clay. Taking one finger, at a single point, pull down the rim. If it were filled with water, this is where all the water would pour out, like the “mouth” or outlet of a stream or river. If a drop of rain fell near the rim or “headwaters” of the bowl-like watershed, it would flow downward, joining other raindrops, on their “tributary” path building in number and volume. Can you see the similarity?

A watershed can be as small as your back yard or as large as the five-state area that drains into to the Chesapeake Bay. For every flush or spill, every road paved, or every house built around you, it effects someone in Virginia, Maryland, or Delaware.

Because watersheds have such significant influence on nature and society, in many ways, they are ideal management units. Unfortunately, political boundaries, agency jurisdictions, and private ownership weave in and out, often without reference or ties to the watershed area or features.

Why should I be concerned with this plan?

(The link between “Mine” and “Ours”)

Any shortages or impairments of natural, recreational, and cultural resources are truly “our” problem, having likely been brought about through collective, ongoing actions (or lack thereof)....clearing trees to build our homes, plowing and planting our crops, building roads, railways, and bridges, ignoring things worth remembering or celebrating together. Can one say the threat to our local resources “is not my problem” since we all use and need them?

It is our collective actions that are, for the most part, responsible for the movement of the stream, the impacts on water quality, the disappearance of certain plants and animals, the close-knit, small-towns giving way to urban sprawl development and building complexes, and it is only through “OUR” collective effort that we might prevent and remedy the situation for the better.

Today’s widespread concerns over global warming, acid rain, and depleting ozone, bring the scale of natural resource management into perspective. It’s not difficult to see and experience first hand the fact that we all live in the same atmospheric neighborhood. When it comes to failing crops, dwindling fish catch, increase in tree infestations and diseases, one cannot say, “That is your problem”.

We are invariably affected (financially, socially, and psychologically), with every rise in the cost of energy. We often fend off local proposals for renewable energy “alternatives” in the form of windmills, wood systems, or solar panels. Would the resistance be greater or lesser if a coal plant or nuclear reactor were being proposed in our town? Either way, many would exclaim, “Not in my back yard!” without having pondered their contribution to the increasing use and “need” for energy. This alone is a most pertinent and pressing natural resource concern.

The wealthiest of us have achieved such status only from the hard work and earnings of our fellow citizens; those who have purchased our goods and services, fixed our cars, educated our children, delivered the fuel and electricity to our home, and grown the food that nourishes us. Therefore, we cannot say “for what do I care” about anything really. An individual is only as secure as the well-being of their community, and the community, only as enduring as the way in which our natural, recreational, and cultural resources are managed. And if not managed sustainably? Any middle-grade student today could likely tell you, “The opposite of sustainable is terminal”.

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CHAPTER I – HISTORIC BACKGROUND OF WATERSHED AREA

To properly "interpret" the significance of any area as vast as the area covered in this plan, it is extremely useful to take a moment to become familiar with its history. This becomes all the more vital when attempting to justify the allocation and utilization of funding and technical resources in addressing management needs. Obviously an area where businesses, industries and enterprises have played a historic and enduring role, will more easily justify a program to support and strengthen their continuation.

Predominantly lying within Bradford County, the Sugar and Towanda Creek watersheds lie in the northeastern portion of Pennsylvania; a region known as the Endless Mountains. Like much of rural Pennsylvania and adjacent Southern Tier of New York, natural resources have been the foundation of the County's economy and way of life since its establishment in 1810. Residents today still enjoy a predominantly rural landscape of forested hills and mountains, agricultural valleys, and small towns and villages at rural crossroads.

The Sugar and Towanda Creek watersheds are part of the dissected Allegheny Plateau, carved by the eroding forces of the Susquehanna River and its many tributaries. Glaciation, occurring nearly twelve thousand years ago, also played a prominent role in creating many irregular natural features consisting of flat stream valleys, bordered by steep, rough mountains. The great ice sheet was responsible for leaving ponds and wetlands, huge deposits of sand and gravel and for moving the soil and rocks that influence the flow of water in the creek and river watersheds.

Thousands of years before Europeans came to what is now Bradford County, migrant hunters and fishermen roamed the forested hills and valleys. They had little knowledge of agriculture but made primitive stone weapons and tools to aid them in survival as they set up camps where wildlife was most abundant. These stone-age people found the streams supported great numbers of fresh water fish. With no barriers present on the Susquehanna River, there were great spawning migrations of shad, eels, herring and other fish from the Atlantic Ocean and Chesapeake Bay that found their way up the river and its tributaries. Fish were taken with bone or flint spears, bone fishhooks, nets and weirs. The artifacts of this early culture may still be found along the streams, near hillside springs and hunting paths in the hills.

A great transition took place in the life of the Native Americans when they started to practice agriculture. Their desire and ability to become good gardeners and farmers, and their contact with white people, rank as the two most significant events in the history of these indigenous peoples.

Trees were girdled and seeds were planted beneath the dead branches. Slowly the land was cleared using crude tools. Fires would be built around the base of the trees, controlled by rings of clay and as the flames ate into the wood, grooved stone

axes would be used to cut away the charred wood. Fire, when controlled and directed, was a very useful tool, not only in felling trees and cooking food but as a weapon for protection from dangerous animals.

The limbs of the felled tree were burned off and the log trunk rolled or dragged to a place where it could be used later. Wood was used for dugout canoes, dishes, hide stretchers, stockades and wooden poles used to construct dwellings.

The soil was worked with stone hoes attached to a short handle and holes were made in the soft earth for the seeds. Because of the abundance of fish, they were often used for fertilizer. Before the seeds were planted they were soaked in water containing vegetable poisons to discourage grubs, wire worms and crows. The principal garden crops grown were corn, beans, pumpkins, squash, potatoes, sunflowers, melons, gourds and tobacco. The Native Americans did not use the "broadcast" method of planting seeds but planted in rows and hills so cultivation with the stone hoe was made easier.

Corn was the most important crop grown and the Iroquois grew at least three types. A "flour" or dent type that was ground up for meal; sweet corn that was relished on the cob; and a fluffy, white popcorn completely unknown to the Europeans at that time.

Vegetables, as well as meats were dried and stored for winter's use. Cache or storage pits are found at nearly every village site. Garden food was supplemented by foraged nuts, mushrooms, herbs, roots and wild berries when in season. Hunting and fishing was still important but survival did not depend entirely upon the success of finding game in the forests and fish and mussels in the streams.

The important thing about agriculture was that it brought the nomadic natives together in small villages where they could work together for mutual protection and plant, tend and harvest the crops that would help them survive the harsh winters. As they cleared more land and tended more crops, living conditions improved. More permanent and improved living quarters were built; pottery and better implements were developed as the people had more time to devote to the improvement of handicrafts.

The early whites that came to Bradford County found the frontier very dangerous because of poor relations with the natives; hence there were very few European or Asian settlers that moved to the region before the early 1800s. The Hartley and Sullivan Expeditions destroyed many native villages, burning the grain fields and gardens and clearing the region enabling white settlers and their families to homestead.

In the Sullivan Expedition in 1779, General George Washington sent one-third of the Continental Army into this region to kill or drive out the native inhabitants.

A number of the soldiers taking part in the expedition against the Natives were so impressed with the fertile soil, beautiful forests of pine, hemlock and hardwoods, and clean streams teeming with fish, that they returned after the war with their families to build homes and start farming the partially cleared lands. The early settlers, who were mostly of English, Irish and Scotch-Irish descent, settled in the river valley but as the stories about this “land of milk and honey” spread, the migration increased. Many settlers, pushing up the valleys of the Susquehanna tributaries, began their life anew along Towanda, Wyalusing, Wysox, Sugar Run, Tuscarora, Tunkhannock, Sugar and other creeks throughout the region.

Bradford County was established in 1810 from portions of Lycoming and Luzerne Counties. Early residents of Bradford County migrated from southeastern



Figure 1.1 - Bradford County Regional Location

Pennsylvania and New England, particularly from Connecticut. Many came directly from eastern ports looking for available land and political freedom. These people were rooted in conservative religions and strong work ethics, and worked hard to clear the floodplain lands for fields and pastures and to set up farms along the stream and river valleys and the mountain foothills.

Among the early County pioneers was a group of French exiles who settled along the banks of the Susquehanna River in the autumn of 1793. Within a few years, a lively community established several small shops, a schoolhouse, a chapel, and a theatre around the market square. A gristmill, blacksmith shop and a distillery were also erected, and the manufacture of potash and pearlash began. In time, as local monies were exhausted and financial support from France ceased, many of the émigrés drifted away by 1803. A few families, the LaPortes, Homets, LeFevres,

Brevosts and D'Autremonts remained in Pennsylvania where their progeny helped to establish Wysox, Wyalusing, Athens, Towanda and other communities.

FACTS ABOUT BRADFORD COUNTY

Location: Northeast Pennsylvania, USA
Date of Establishment: February 21, 1810
Namesake: General William Bradford (1755-1795)
Number of Municipalities: 51
County Seat: Towanda
Form of Government: 6th Class County; elected 3-member Board of Commissioners
Size: 1,151 square miles (736,640 acres); 2nd largest in the Commonwealth of Pennsylvania
Population (2000): 62,761; 2004 estimate 62,596
Largest/Smallest Municipality by population (2000)
Sayre Borough: 5,813 persons
Armenia Township: 166 persons
Median Age: 38.9 years
Community / Economic Profile:
Leading Industries (by employment)
Manufacturing
Educational, health, and social services
Leading Industry (by revenue)
Agriculture (dairy, veal)
Employment centers
Towanda-Wysox
Athens-Sayre-South Waverly
Wyalusing
Troy-Canton
Schools
7 public districts
7 private institutions
Public Libraries: 10
Natural Setting:
Major waterways/watersheds:
Susquehanna River
Chemung River
Sugar Creek
Towanda Creek
Wyalusing Creek
Wysox Creek
Forest cover: 432,000 acres (59% of County)
Predominant hardwoods: oak, maple, cherry and ash
Predominant softwoods: hemlock and pine
Mineral resources: flagstone, gravel, sand, sandstone, natural gas, and coal
Public Lands:
State Lands: Mount Pisgah State Park, Tioga State Forest, 10 State Game Lands
County Parks: Larnard-Hornbrook, Mount Pisgah, and Sunfish Pond
Municipal parks: 45

If soil is the cradle of life, it was also the lifeblood that helped colonize the region. The soil supported many grain or plant varieties. The first crops grown by the settlers were corn and potatoes. As they cleared more acres, wheat, rye, oats, buckwheat, flax, barley, and hops were grown. Hay was an important crop from the time of the first white settlers and remains so today. In addition to field crops, pumpkins, squash, cabbage, beans, peas and other vegetables were grown for home consumption as well as for sale. Maple products, first made by the Indians of the region, were also exported by the county settlers and continue to be part of the economy today.

In 1832, the major commodities exported by the county were grain, flour, whiskey, fruit, salted meat, livestock and lumber. The

lumber industry, significant at the turn of the century, had begun to decline around 1880 as the forests were cleared. By this time, dairy had become the dominant industry. A North Central Railway agent in Troy, on Sugar Creek, reported that over 3 million tons of butter were shipped out by rail in 1880.

For nearly a hundred years, Bradford County claims to have led the nation in the production of buckwheat, although it is not grown commercially in the County today. Another successful crop, not grown in the county presently, was tobacco. In the 1900 Bradford County Directory, 340 tobacco growers are listed and 17 cigar manufacturers.

The discovery of coal on Barclay Mountain spurred growth in the early 1800s. Miners initially dug tunnels to extract the coal, but later found that stripping the surface of the forest and removing the soil surface gave them ready access to timber for fuel as well as the coal itself. Towns developed as miners and mining companies built homes near the mining sites. Barclay, Carbon Run and Laquin each originated during the prime of coal extraction. Railroads were constructed to transport the coal quickly to larger cities and urban markets. While mining extracted primarily coal, the forest was heavily impacted by the demand for lumber to construct mine supports, railroads, and buildings, as well raw timber for fuel. By the late 1800s, the natural coal supply had been exhausted as had much of the forest. The mining companies moved elsewhere, and the towns and villages were abandoned.

Land owners continued to clear virgin and regenerating forests. Hemlock was harvested for its bark, important to the tanning industry and raw timber was cut, dragged through small streams and floated downstream and milled en route to lumberyards supplying the building materials for the construction up and down the east coast. The vast areas of clear cutting had immense impacts on the landscape. Timber was often dragged through stream beds or the streams were dammed to float logs down stream. Fragile woodland soils on steep slopes were left bare to erode into the valleys and their streams, often filling valleys with tremendous layers of sediment. The aptly-named Endless Mountains seemed to have endless forest stands to be harvested for profit. These profits filled the pockets of land, rail, and mill owners from the 1840s into the 1900s and fostered the development of the County's major towns and villages. The timber heyday declined once the seemingly "endless" forest had been cut, leaving a legacy of tremendous sediment, land impacts and stream channel instability as a result. Lumber companies moved south and west into the Great Lakes and lower mid-Atlantic regions. The prosperous communities these companies had once supported faced economic collapse as wages declined and jobs disappeared. Today, there has been a revival of interest in lumber and wood products, partially due to increased knowledge of timber management which makes it possible to utilize regenerating forest lands in a more sustainable manner.

Manufacturing breathed new life into the County in the mid 1900s. Job opportunities attracted young workers to settle close to home. A few immigrants also noticed the County's attractive employment and rural living opportunities which further spurred this growth through the late 1900s.

CHAPTER II - WATERSHED AREA CHARACTERISTICS

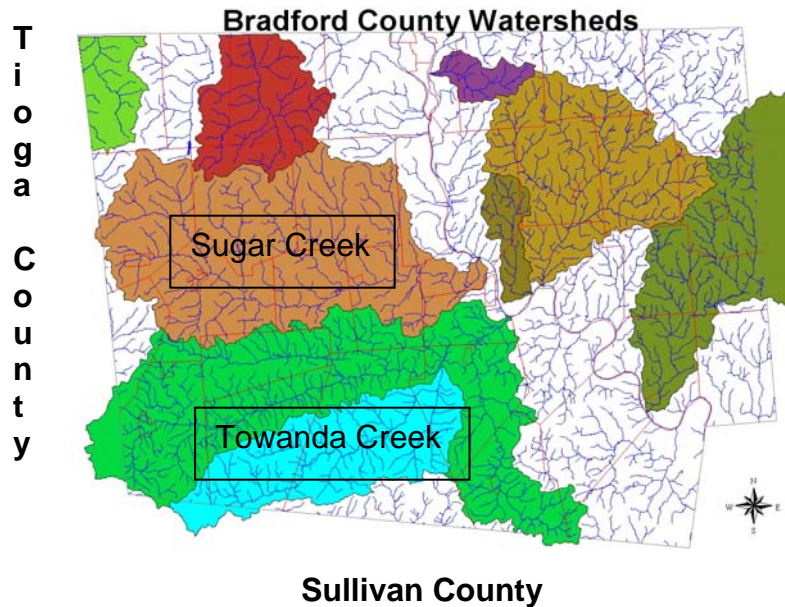
Location - State and Regional Context

The Sugar and Towanda Creek Watersheds are located near Pennsylvania's northern border with New York State. Using Bradford County as reference (containing the vast majority of the watershed), adjacent Pennsylvania counties include Susquehanna to the east, Wyoming to the southeast, Sullivan to the south, Lycoming to the southeast, and Tioga to the west. Chemung and Tioga Counties, New York, lie to the north.

The Sugar / Towanda Creek watersheds are part of **two multi-county service regions** that will be referenced throughout this plan. The **Endless Mountains Heritage Region** (EMHR) is a Pennsylvania Heritage Park, a region that contains a multitude of cultural, historic, recreational, natural and scenic resources of state and national significance that collectively exemplify the industrial heritage of Pennsylvania. The EMHR includes Bradford, Sullivan, Susquehanna, and Wyoming Counties. The **Northern Tier** includes those same counties with the addition of Tioga County. These counties are served by the Northern Tier Regional Planning and Development Commission, a local development district (LDD) providing economic and community development services to businesses and communities in its service region.

The watersheds are located within two hours of Wellsboro, Williamsport and Wilkes-Barre—Scranton, as well as Binghamton and Elmira, New York. New York City and Philadelphia are within a 4-hour drive.

Figure 2.1 - Bradford County Watersheds



Towanda – Sugar Creek Watershed Conservation Plan July 2009

The watersheds encompass over one-third of Bradford County's landmass and includes smaller portions of Tioga, Sullivan, and Lycoming Counties.

Municipalities

Seventeen (17) municipalities are represented within the Sugar Creek watershed including 4 boroughs, and 13 townships:

Armenia Twp., Burlington Borough, Burlington Twp., Columbia Twp., Granville Twp., North Towanda Twp., Smithfield Twp., Springfield Twp., Sylvania Borough, Towanda Borough, Towanda Twp., Troy Borough, Troy Twp., Ulster Twp., West Burlington Twp., Wells Twp., Sullivan Twp.(Tioga Co).

Twenty-four (24) municipalities are represented within the Towanda Creek watershed including 4 boroughs, and 20 townships:

Alba Borough, Albany Twp., Armenia Twp., Asylum Twp., Burlington Twp., West Burlington Twp., Canton Borough, Canton Twp., Cherry Twp. (Sullivan Co.), Fox Twp. (Sullivan Co.), Franklin Twp., Granville Twp., Leroy Twp., McNett Twp. (Lycoming Co.), Monroe Borough, Monroe Twp., New Albany Borough, Overton Twp., Terry Twp., Towanda Twp., Troy Twp., Union Twp. (Tioga Co), Ward Twp. (Tioga Co.), West Burlington Twp., Wilmot Twp.

Table 2.1 - Sugar Creek Watershed Municipalities

Municipality Name	County	Areas in the Watershed	
		Acres	Square Miles
Armenia Township	Bradford	2,259.10	3.50
Burlington Borough	Bradford	305.20	.50
Burlington Township	Bradford	11,566.60	18.10
Columbia Township	Bradford	20,540.70	32.10
Granville Township	Bradford	925.70	1.40
North Towanda Township	Bradford	4,517.10	7.10
Smithfield Township	Bradford	22,060.00	34.50
Springfield Twp	Bradford	20,401.90	31.90
Sylvania Borough	Bradford	715.10	1.10
Towanda Borough	Bradford	26.40	.04
Towanda Township	Bradford	1,933.20	3.00
Troy Borough	Bradford	479.80	.70
Troy Township	Bradford	20,430.70	31.90
Ulster Township	Bradford	2,408.30	3.80
Wells Township	Bradford	47.60	.07
West Burlington Township	Bradford	12,190.40	19.00
Sullivan Township	Tioga	211.90	.33
Totals		121,019.70	189.04

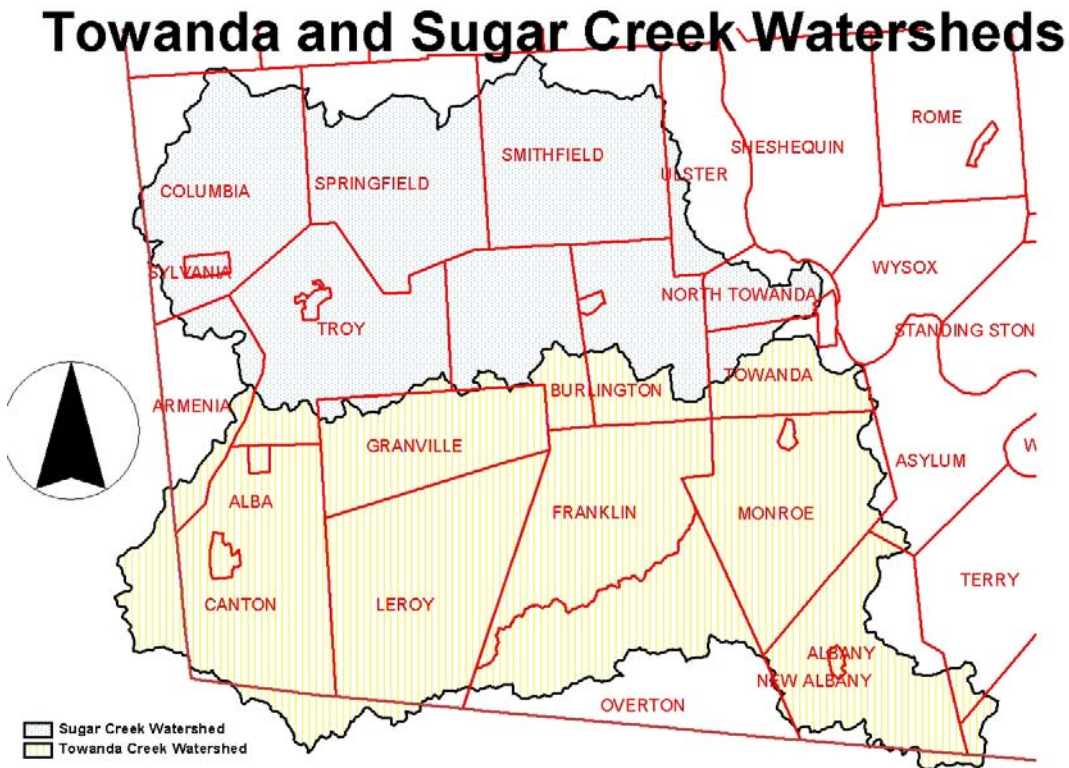
Source – Sugar Creek Watershed Background Report, Bradford County Conservation District, December, 2004

Table 2.2 - Towanda Creek Watershed Municipalities

Municipality Name	County	Area in the watershed	
		Acres	Square Miles
Leroy Township	Bradford	28059.2	43.8
Canton Township	Bradford	23678.8	37
Monroe Township	Bradford	22314.7	34.9
Franklin Township	Bradford	21604.3	33.8
Overton Township	Bradford	16927.3	26.4
Albany Township	Bradford	16179.6	25.3
Granville Township	Bradford	14887.8	23.3
Towanda Township	Bradford	6661.2	10.4
Union Township	Tioga	4655.8	7.3
Burlington Township	Bradford	4429.5	6.9
West Burlington Township	Bradford	3216.7	5
Fox Township	Sullivan	2804	4.4
Troy Township	Bradford	2733.5	4.3
Armenia Township	Bradford	2099.7	3.3
Wilmot Township	Bradford	910.8	1.4
Terry Township	Bradford	873.9	1.4
Canton Borough	Bradford	721.6	1.1
McNett Township	Lycoming	688.6	1.1
Cherry Township	Sullivan	646.8	1
Ward Township	Tioga	605.3	0.9
Asylum Township	Bradford	499.6	0.8
Alba Borough	Bradford	431.4	0.7
Monroe Borough	Bradford	277.6	0.4
New Albany Borough	Bradford	269.9	0.4
Totals		176,177.6	277.3

Source – Towanda Creek Watershed Background Report, Bradford County Conservation District, March, 2004

Figure 2.2 - Towanda & Sugar Creek Watersheds - Municipal Locations



Size of the Watershed

For their State Water Plan (June 1979), the Department of Environmental Protection divided Pennsylvania into 20 watershed basins. The area encompassed by Upper Susquehanna River Subbasin 4 is located along Pennsylvania's northern border and includes all of Bradford, Susquehanna and Wyoming Counties; approximately half of Tioga County; and portions of Potter, Sullivan, Luzerne and Lackawanna Counties.

The Upper Susquehanna River Subbasin 4 is divided into seven watersheds. The fourth largest is the 467 square miles of the combined Towanda/Sugar Creek Watersheds, Sub-basin 4-C.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
STATE WATER PLAN
WATERSHED BOUNDARIES

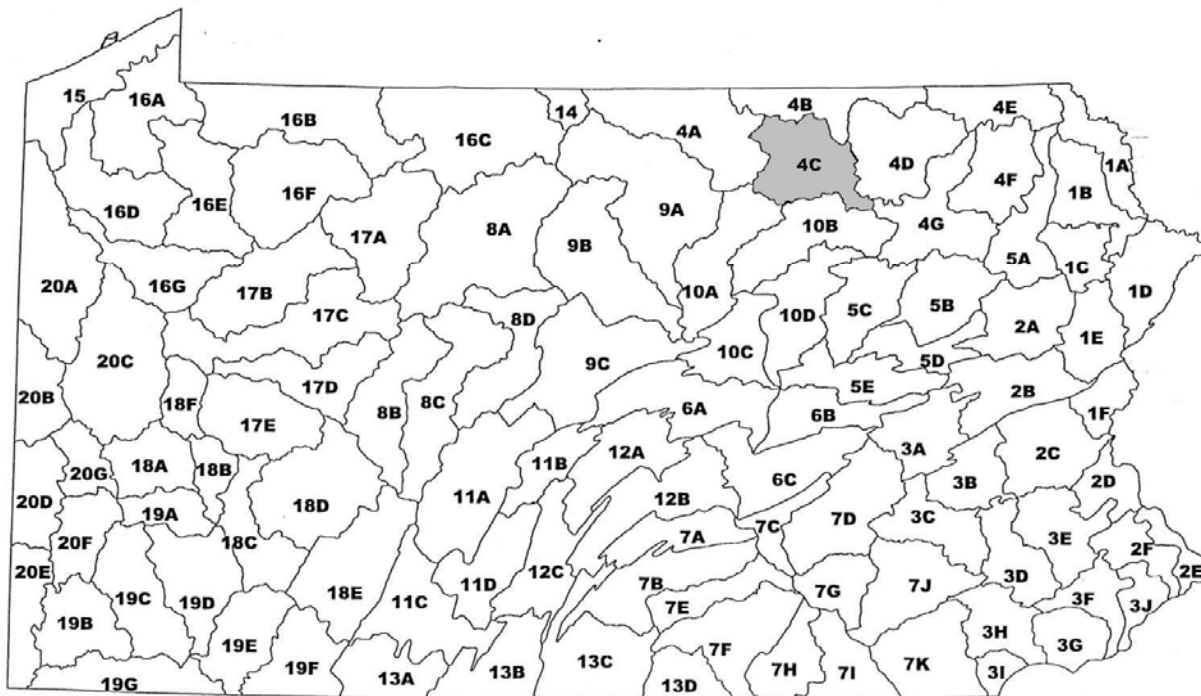


Figure 2.3 - State Water Plan Watershed Boundaries

Sugar Creek

The Sugar Creek watershed has a drainage area of 189.04 mi² (square miles) (121,019.7 acres) to its mouth at the confluence with the Susquehanna River. It originates at approximately 1,699.51 feet above mean sea level on the northern slopes of Armenia Mountain in Columbia Township and flows generally east for 31.62 miles to its confluence with the North Branch of the Susquehanna River at River Mile (RM) 148.20, 41°47'57" Latitude and 76°27'37" Longitude, in North Towanda Township. The majority of the drainage basin lies within the limits of Bradford County, while a small portion is located in Tioga County. The basin area is encompassed on the Bentley Creek, Canton, East Troy, Gillett, Leroy, Roseville, Sayre, Towanda, Troy, and Ulster United States Geological Survey's 7.5 minute Quadrangles.

Towanda Creek

The Towanda Creek watershed encompasses 277.3 mi.² (square miles) (177,472 acres) in Bradford, Tioga, Sullivan and Lycoming Counties. Elevations within the

Towanda Creek Watershed range from about 698 feet above mean sea level near the mouth of Towanda Creek to 2360 feet on the plateau.

The main stem of Towanda Creek flows generally east for 35.1 miles to its confluence with the North Branch of the Susquehanna River, at River Mile (RM) 148.20, 41°47'57" Latitude and 76°27'37" Longitude, near the southern part of Towanda Township and adjoining border of Asylum Township. The majority of the drainage basin lies within the limits of Bradford County, while a small portion is located in Tioga, Lycoming, and Sullivan Counties. The basin area is encompassed predominantly within the Canton, Grover, Shunk, Powell, Gleason, Leroy, Overton, Monroeton, Dushore, and Colley United States Geological Survey's 7.5 minute Quadrangles.

Topography

Major Land and Water Features in the Sugar & Towanda Creek Watersheds

The Sugar / Towanda Creek watersheds lie within the Low Plateau Section of the Appalachian Plateaus Province. Most of the watershed consists of upland or mountainous terrain; the remaining land is composed of valley bottoms and rolling lowlands. The bedrock formations in this area are all of sedimentary origin. Most of the topographic relief in the County, however, has resulted from the eroding action of streams and rivers cutting into the bedrock.

The topography of the watersheds has also been significantly influenced by glaciation. As the glaciers advanced and receded, they scoured the fine particles from the surface and deposited them back on the surface. This process formed the topography beneath the extensive glacial lakes and wetlands. Melting glaciers generated the tremendous volumes of water that sculpted the wide floodplains, rolling hills and steep cliffs.

Starting in the upper reaches of the watersheds, topography generally ranges between steep mountainous-like outcrops to rolling or moderate hillsides. Valleys are typically V-shaped or narrow in width. Found at these higher elevations are numerous springs, rivulets, tributaries, first and second order streams, ponds, small lakes, and a variety of wetlands. Waters frequently cascade due to rapid drop in elevation in a direct, somewhat perpendicular path to the main stem.

Typically, the lower reaches are dominated by moderate to gentle slopes, broadened valley bottoms and broad floodplains. Streams of third and fourth order are dominant water bodies, experiencing lesser drop in elevation and increased sinuosity. Wetlands and other water bodies are frequently located within or in close proximity to floodplains, riparian areas and associated high water tables.

Barclay Mountain lies along the County's southern border adjacent to Sullivan County. Schrader Creek, Millstone Creek, S. Branch Towanda Creek and Satterlee Run steeply divide the mountain into smaller ridges. The majority of the ridge and side slopes of the mountain are managed as State Game Lands (SGL) 12 and 36. Holcomb and Sunfish Ponds, two of the larger ponds in the County, are located within SGL 36. The foot slopes and a few in-holdings are privately owned.

The tip of **Armenia Mountain** extends into the County from Tioga County and is managed as part of the Tioga State Forest (District #16).

According to the 1988 USDA Natural Resources Conservation Service's Natural Resource Inventory, agricultural and forest lands constitute the two single largest land cover types and together cover roughly 97 percent of the watershed; development occupies only 3 percent of the watershed. The Bradford County Natural Areas Inventory analyzed the extensive forest resources, presenting illustrations of the significant forest blocks. Research performed by the Pennsylvania Cooperative Extension indicates that the forest cover alone may be as high as 59 percent and is predominantly owned by private landowners.

Climate

The Upper Susquehanna River, Subbasin 4, is dominated by atmospheric flow patterns common to the humid continental regions lying in the North Temperate Zone. Most of the weather systems that influence Subbasin 4 originate either in Canada or the Central Plains of the United States and are moved eastward by the prevailing westerly flow aloft. Another flow pattern and primary source of heavy precipitation is associated with cyclonic circulation from the Gulf of Mexico northward through the study area. As a result of the dominant westerly airflow into the area, the moist airflow from the Atlantic Ocean to the east is a modifying rather than a controlling climatic factor. Periodically, considerable moisture is picked up by storms developing and moving up along the southeastern coastline of the United States. A disturbance of this type usually brings moderate to heavy precipitation to the Upper Susquehanna River Subbasin area due to the general up slope motion of moist air over the area's rugged major topography. In the colder months when temperatures are near or below freezing, these storms many times deposit heavy amounts of wet snow throughout the area.

The normal successions of high and low pressure systems moving eastward across the United States produces weather changes in the area every few days in the winter and spring of the year. In the summer and fall, the weather changes are less frequent due to a slowing down of the general atmospheric circulation during the warmer months. Low pressure cyclonic systems usually dominate the area with southerly winds, rising temperatures, and some form of precipitation. The high pressure anticyclonic systems normally bring west to northwest winds, lowering temperatures and clearing skies to the area.

Hurricanes or tropical disturbances, as they move northward, follow a northeasterly path in the middle latitudes and produce heavy rainfalls and strong surface winds in the study area. Frequently affecting water supplies and causing floods, these tropical storms are observed during the hurricane season, June through November.

Weather elements or activities of the atmosphere such as precipitation, temperature, wind direction and speed, relative humidity, and sunshine, are measurable quantities that affect the study area.

Winter is typically cold and summer is moderately warm, with occasional hot spells. Areas of higher elevation are markedly cooler than lowland areas. Precipitation in both liquid and solid forms is well distributed throughout the year and is usually adequate for growing crops. Across the watersheds, yearly precipitation typically ranges from 30 to 39 inches, with an average of 33.5 inches. Much of this falls as snow between the months of December and March. The snowfall is moderately heavy, averaging about 49 inches annually.

Air temperatures are important to the management of water resources and water quality. Average daily temperatures range from 20.1° F in January to 68.5° F in July. The highest average maximum daily temperature is 78.4° F (July). Lowest average minimum daily temperature is 10.0° F (January). The average annual temperature for this area is about 48°F. The mean annual freeze-free period is about 140 days. Because of the rugged topography, the freeze-free season is variable, ranging between 125 days in the north to 155 days in the south. Compared with other areas in the State, Subbasin 4 is subject to somewhat lower temperatures and more frequent sudden changes in temperature due to its topographic features. Temperatures as high as 107°F have been recorded in the northern portion of the study area during the month of July, and temperatures as low as -32°F have been recorded during the month of February.

Winds are important hydrologic factors because of their evaporative effects and their association with major storm systems. The prevailing wind direction in the area is westerly during the winter months and southerly during the summer months, with an average wind speed of 11 mph.

Relative humidity also affects evaporation processes. The mean monthly relative humidity for the months of January, April, July and October is about 76 percent, 65 percent, 75 percent and 70 percent respectively.

Sunshine, which varies with latitude and time of year, is a factor to be considered in the various aspects of waste treatment processes. The mean annual sunshine in hours per year for the study area is about 2,300 hours.

The evaporation process is controlled by temperature, wind, sunshine and humidity. The rate of evaporation during the warmer months has an important impact on water

storage in reservoirs and on irrigation. High evaporation rates can cause humid regions to become vulnerable to droughts. The mean May to October evaporation for the area accounts for about 75 percent of the annual total evaporation.

Table 2.3 - Watershed Climatic Data 1961 - 2003

Climatic Data 1961 – 2003 (° F)						
Month	Average Min. Temp	Heating Degree Days₁	Cooling Degree Days₁	Average Max. Temp₂	Average Precip. (as liquid, inches)	Average Daily Temp.
January	10.0	1,391	0	28.0	2.7	20.1
February	10.2	1,220	0	30.2	2.5	21.6
March	21.4	1,008	0	40.3	3.1	32.4
April	31.6	630	0	53.4	3.3	43.9
May	41.5	313	11	65.3	3.8	55.0
June	50.7	79	52	73.8	4.0	64.0
July	55.4	11	121	78.4	4.2	68.5
August	54.3	31	88	76.3	3.8	66.7
September	46.6	194	14	68.5	3.5	59.0
October	35.8	520	0	57.2	3.4	48.2
November	28.2	828	0	44.8	3.4	37.4
December	17.8	1,206	0	32.5	3.2	26.2
Year	33.6	7,431	286	54.1	3.4	45.3

(Data collected from Soil Survey of Bradford and Sullivan Counties, 1986, and NCDC Station, Binghamton, NY 1961 – 2003).

The number of heating degree days is calculated for each day by subtracting the day's mean temperature from a base temperature (65F). The daily totals are accumulated for each month and the monthly totals are accumulated for the "heating year" from July through June. In the same manner, cooling degree days are calculated for each day by subtracting 65F from the day's mean temperature. Monthly and yearly values are calculated in the same manner as heating degree days. Energy usage is closely linked to the number of heating and cooling days a region experiences each year.

The monthly normals for maximum temperature and precipitation are computed by averaging the appropriate temperatures for the time period evaluated, per the National Climatic Data Center.

Land Cover

Land cover within a watershed is important when determining the amount of runoff and types of potential pollutants transported within the watershed. Alterations to existing land cover can create increases in runoff that adversely affect stream channels by altering the hydrologic characteristics of the stream system. Forested watersheds typically yield little runoff, pollutants, nutrients, and sediments. Primarily agricultural watersheds may yield high nutrient and sediment runoff, while developed watersheds typically yield high pollutant loads and a large amount of runoff (PADEP, 2000).

Land cover is almost exclusively a mixture of Appalachian mixed forest, agriculture, and single-family rural residences. More concentrated residential development is located in Sylvania, Towanda, North Towanda, Troy, and Canton.

Table 2.4 - Land Uses in the Sugar Creek Watershed

LAND USE TYPE	Acres	Miles ²	% of Watershed
Cropland & Pasture	79,417.60	124.09	65.68%
Deciduous Forest	34,829.55	54.42	28.80%
Evergreen Forest	3,501.75	5.47	2.90%
Mixed Forest	1,793.17	2.80	1.48%
Residential	594.80	0.93	0.49%
Shrub and Brush Range Land	300.56	0.47	0.25%
Reservoirs	181.40	0.28	0.15%
Commercial & Services	130.36	0.20	0.11%
Quarries and Gravel Pits	42.32	0.07	0.03%
Industrial	41.48	0.06	0.03%
Orchards & Groves	32.29	0.05	0.03%
Transportation & Communication	29.99	0.05	0.02%
Lakes	24.93	0.04	0.02%
Streams	1.69	< .01	< .01%
Totals	120,921.90	188.94	100.00%

Source: USDA Natural Resources Conservation Service

Table 2.5 - Land Uses in the Towanda Creek Watershed

LAND USE TYPE	Miles²	Acres	% of Watershed
Cropland and Pasture	109.7	70194.6	39.5 %
Deciduous Forest	154.4	98838.8	55.7 %
Mixed Forest	10.5	6695.5	3.8 %
Evergreen Forest	2.4	1583.1	.9 %
Residential	1.1	673.1	.4 %
Wetland	.5	320.2	.2 %
Transitional Areas	.4	271.4	.1 %
Reservoirs	.3	213.4	.1 %
Orchards and Groves	.3	202.8	.1 %
Mixed Urban or Build up land	.2	138.5	> .1 %
Lakes	.2	108.6	> .1 %
Commercial and Services	.2	96.4	> .1 %
Transportation / Communication	.1	37.1	> .1 %
Industrial	.1	18.5	> .1 %
Totals	277.3	177,472	100%

Source: USDA Natural Resources Conservation Service

A study conducted by the Bradford County Conservation District in September of 1989, entitled “Bradford County Chesapeake Bay Watershed Assessment”, delineated land cover in the sub-watersheds as shown in Table 2.6 and Table 2.7.

Table 2.6 - Land Cover Chart – 4C /Towanda Creek (by sub-watershed)

ID#	SUBWATERSHED	ROW CROPS	HAY/ PAST.	FOREST	RES./ URBAN	WATER	TOTAL
T-1	Urban Towanda	0	284.9	604.6	974.6	7.6	1,871.7
T-2	French Run – Monroeton to Franklindale	844.4	4640.7	4551.4	570.7	187.5	10,794.6
T-3	Preacher Brook	302.6	3505.3	2291.1	25.6	36.6	6,161.2
T-4	N. Branch Towanda Creek East Section	1235.9	8036	4527.6	141.7	89.3	14,030.8
T-5	Gulf Brook / Towanda Creek	928.6	4875.3	4785.3	109.8	89.5	10788.1
T-6	Wallace Brook East Canton	914.6	2993.5	1262.2	41.1	20.7	5232.1
T-7	N. Branch Towanda Creek – West Section	427.7	1912.3	1323.5	38.8	43.5	3745.8
T-8	Alba Creek/Mill Creek/Canton Area	1378.3	6473.1	8515.8	979	158.7	19,504.9
T-9	Beech Flats Creek	461.8	2702.9	4048.9	27.5	39.9	7280.9
T-10	Little Schrader (both sides) Sunfish Pond	0	895.5	15985.7	0	165.7	17,046.8
T-11	Schrader Creek Minerville / Quinlaintown	0	757.2	13546.5	33.7	134.1	14,471.5
T-12	Upper Section Schrader Creek	0	465.5	7583.5	51.6	32	8,132.6
T-13	Millstone Creek	6.3	707.8	10965.8	24.6	33.7	11,738.2
T-14	Saterlee Run	7.13	231.1	4598.2	8.89	2.51	4,847.8
T-15	Ladds Creek West & Beaver Run	232.6	2559.4	5744.3	123.6	29.9	8,689.7
T-16	Bowman Creek – Laddsburg	262.4	2210.8	3370.6	24.3	43.9	5,912
T-17	French Creek – New Albany	198.8	1598.7	1103.4	23.9	8.5	2,933.2
T-18	Kent Run & Fenner Run	7.9	280	4243.6	29.8	6.1	4,567.4
T-19	Liberty Corners – South Branch	419.1	2094.6	3367.3	111.3	11.7	6,004
T-20	Townada Creek – Powell to W. Franklin	111.9	1252.5	3282.2	73.30	4.5	4,725.4
TOTALS		11,728.9	71,972.9	81,848.4	7,389.2	1,689.7	170,629.2

Source – Bradford County Chesapeake Bay Watershed Assessment, 1989, Bradford County Conservation District

Table 2.7 - Land Use Chart - 4C / SUGAR CREEK (by sub-watershed)

ID#	SUBWATERSHED	ROW CROPS	HAY/ PAST.	FOREST	RES./ URBAN	WATER	TOTAL
S-1	North Towanda	262.96	2203.40	3201.34	257.23	19.84	5,944.77
S-2	Bailey Run	448.40	2522.09	2965.15	93.50	60.45	6,089.59
S-3	Pond Run/ Mtn. Lake	171.14	1741.54	1891.12	11.98	49.14	3,864.92
S-4	Browns Creek	876.39	5847.12	3470.77	24.29	38.13	10,256.70
S-5	Wallace Run	481.85	2020.03	1133.00	16.30	11.30	3,662.48
S-6	Tomjack Creek	1496.62	9146.04	5918.74	290.53	84.55	16,936.48
S-7	Mill Creek	1161.20	5002.51	5071.34	136.08	127.82	11,498.95
S-8	Pisgah Minor Creek	399.80	1682.10	1614.76	-----	-----	3,696.66
S-9	No Name (W. Burlington)	206.80	983.17	561.69	10.48	2.71	1,764.85
S10	Leonard & Brace Creeks	1101.29	4639.33	4434.93	146.45	38.52	10,360.49
S11	Sugar-No. Branch (Int. below Wolfe)	277.96	2027.52	1542.33	123.43	3.26	3,974.50
S12	Wolfe Creek	716.34	3748.29	2544.85	59.04	8.77	7,077.29
S13	North Branch Sugar (West)	677.26	3465.05	2308.27	92.96	6.83	6,550.37
S14	Sylvania/ Sugar Ck.W.	999.32	4350.79	3429.78	184.61	21.89	8,986.39
S15	Fall Brook/ Sugar W.& S.	615.10	4744.13	3837.63	617.92	90.24	9,905.02
S16	Mud Creek	520.44	2535.34	1379.43	51.16	4.57	4,491.44
S17	Canfield Creek	210.97	831.77	503.89	8.00	1.22	1,555.85
TOTALS		10,623.84	57,490.19	45,809.02	2,213.96	569.24	116,616.0

Source – Bradford County Chesapeake Bay Watershed Assessment, 1989, Bradford County Conservation District

CHAPTER III - LAND USE PLANNING and PROTECTION

Growth Management Policy

The authority to establish growth management policy and implement management tools in Pennsylvania lies primarily with local government, as authorized by the Pennsylvania Municipalities Planning Code (as enacted and amended). Any national or state policy simply provides guidance to local decision makers and does not supersede established local policy and standards.

National Policy

While no national policy exists, several states have developed policies on growth management, which can serve as references for county and municipal policy development in Pennsylvania. Maryland and Oregon have perhaps the strongest statewide policies on record. Maryland has, in fact, established the Governor's Office of Smart Growth "to better coordinate the State's renowned anti-sprawl program and to strengthen its core mission of encouraging development in older communities." The department has also enabled the county designation of priority funding areas to attract development and published a number of guidance documents for local government. Oregon has also taken a cooperative approach between its Department of Transportation and Department of Land Conservation and Development to support sound land use and transportation development at the state and local levels.

State Policy

The Pennsylvania Municipalities Planning Code was enacted in 1968 and amended as recently as 2000. The recent amendments expanded county and municipal authority and responsibility to plan for their futures. Amendments included provisions for farmland preservation, forestry activities, mixed uses and new tools for designating the most basic of land use planning decisions: growth and conservation areas. The Municipalities Planning Code (MPC) has historically required counties to provide regional guidance; and now requires local municipal planning efforts to be consistent with this guidance.

While Pennsylvania has no statewide growth management policy, the State Planning Board was reinstated in 2004. "This advisory board, comprised of cabinet secretaries, state legislators and citizens, has a mission to monitor trends and issues of concern to the Commonwealth, gather input from state and local officials and citizens and develop reports and recommendations for the Governor and the Legislature on improved state policies and programs."

County Policies

The Bradford County Comprehensive Plan includes a future land use map and policy for guiding future growth and development. The text and map define and illustrate four broad land use categories to characterize the type of development suited to the goals of promoting distinct town, village and countryside landscapes, protecting

sensitive resources and fostering community values and identities. In 2006 the County adopted the Bradford County Open Space, Greenways and Outdoor Recreation Plan as a supplement to the County Comprehensive Plan. This plan provides “A vision, inventory and strategy for natural and cultural resource conservation and outdoor recreation in Bradford County, Pennsylvania.”

Town and Village Growth Areas are primarily intended to accommodate and permit growth and development of intensive land uses, including residential, commercial, industrial and institutional uses at higher densities.

Rural Resource Production Areas are primarily intended to encourage natural resource based industries and non-developed uses, while accommodating limited growth and development

Resource Preservation Areas are intended to protect natural resources from direct and indirect development and disturbance impacts.

The various strategies identified in the plan outline specific tasks to increase development interest in towns and villages, reduce development pressure in rural areas, and maintain community character—whether town/village or rural—as ownership changes and new development occurs.

Bradford County provides a countywide subdivision and land development ordinance (SALDO) that is used by 45 of its municipalities. The SALDO was most recently updated in 2003.

Local Policies

Comprehensive municipal planning in Bradford County dates to the early 1970s when the federal government offered community planning with grants through the Department of Housing and Urban Development (HUD). While communities continued to develop through the 1970s and 1980s, “official” planning languished for many years. Planning became a priority again in the early 1990s and continues to gain acceptance, as many municipalities have their first official planning efforts underway. Nine municipalities within the the Sugar / Towanda Creek Watersheds have adopted municipal comprehensive plans; another eight are currently preparing individual or regional plans.

Fewer municipalities have implemented their comprehensive plans through zoning ordinances. Only 5 municipalities have adopted a zoning ordinance to manage the type and density of land uses within the watershed.

Indeed some growth management can be accomplished through subdivision and land development regulations; however, the municipal zoning ordinance offers additional management options.

In the absence of municipal planning and with the authorization from municipal government, county government may establish growth and development policy and standards. Enforcement remains a municipal responsibility that can be conducted at the municipal or county level at the direction of municipal officials. This provision for countywide policy applies to both zoning and subdivision and land development ordinances. Troy Borough has adopted its own municipal subdivision and land development ordinances. The remaining municipalities abide by the countywide subdivision and land development ordinance.

While the regulations are the standards by which to measure growth and development's fit to local communities, it is the planners and planning commission members that are essential as the authors and enforcers of these principles. Less than half of the municipalities in the watershed have municipal planning commissions.

Resource and Recreation Planning In the Sugar & Towanda Creek Watersheds

While the Open Space, Greenways and Outdoor Recreation Plan is the first Countywide plan of its kind in the region, many previous studies and plans have provided data, analysis, policy recommendations and priority projects with similar or related objectives for resource protection and management and recreation services.

The **Bradford County Natural Areas Inventory** was completed in early 2005. This inventory of "outstanding natural features, flora, fauna and geology, in Bradford County" is intended to inform residents and local leaders about the living natural resources in their County and to provide them with a tool to use in planning the future and protecting the resources of their communities. The inventory presents sites of significance to Pennsylvania and to Bradford County by rank of significance and by municipality and provides site specific management recommendations for each of the 72 identified sites. Concentrations of significant sites are located along the Susquehanna River and throughout the southwestern region of the County.

The **Northern Tier bicycle and pedestrian transportation plan** is a regional beginning and prioritization toward developing off-road trail mapping, trails and greenways, and facilitating shoulder improvements. It aims to initiate or improve items such as pedestrian facilities and "walking audits" to determine how community performs at the pedestrian level - examining such features as crosswalks, traffic calming needs, engineering and design, intersection geometry, pedestrian signals, signs and markings, sidewalks and pathways, grade separation, ADA compliance, and maintenance (as noted in the Transportation section) .

Municipal resource and recreation planning in Bradford County has been limited. For this plan, a review of adopted municipal comprehensive plans was conducted, pertinent issues and information was highlighted and collated in the

Issues and Strategies sections. In each plan, analysis, conclusions, and recommendations were made in support of open space, greenways and outdoor recreation planning and perpetuation.

There are few local ordinances in place that protect the area's natural resources through specific standards; floodplain protection ordinances are an exception. Currently all municipalities in Bradford County have adopted floodplain ordinances with the exception of Herrick Township. In addition, each municipality participates in the National Flood Insurance Program. Most municipalities rely on the County subdivision and land development ordinance and very few have municipal zoning ordinances.

There are few local measures to protect prime agricultural soils, however several of the municipalities with comprehensive plans include policy statements on supporting landowner enrollment in the Agricultural Security Area program.

Mineral resource extraction operations. Small mining and quarrying is one of the most pervasive conservation issues the County is facing in regard to natural resource management. Many small "mom and pop" quarries and mining operations are emerging. While PA Department of Environmental Protection, Bureau of Mining has jurisdiction over these sites, impacts outside of water quality play little part in permitting and enforcement. Even greater potential impact is anticipated with the new influx of gas well operations associated with the Marcellus shale deposits. Bituminous coal resources are estimated at 5 million tons in the Watershed.

Specific municipal planning for public recreation has not received much attention in Bradford County. Some facility planning and service programming has occurred in the major communities. While none of the municipalities have adopted park and recreation plans, a few of the municipal comprehensive plans note feasibility studies and master plans for specific facilities. And recently adopted comprehensive plans show that increasingly communities are recognizing the value that public recreation facilities add to the overall quality of life, with or without mention of specific facilities.

No municipality within the watersheds has an Act 167 Stormwater Management Plan.

Three Watershed Associations are working at various stages of watershed and resources assessment, planning and management: Towanda Creek Watershed Association, Schrader Creek Watershed Association, and Sugar Creek Watershed Association (See History of Watershed Associations section for more details).

Table 3.1 - County and Municipal Planning Efforts - Sugar & Towanda Creeks Watershed Municipalities

Municipality	Comp Plan	Zoning Ordinance	Subdivision and Land Development Ordinance	Planning Commission
Bradford County	2004	No	Yes	Yes
Alba Borough	No	No	County	No
Albany Township	No	No	County	No
Armenia Township	No	No	County	No
Burlington Borough	No	No	County	No
Burlington Township	No	No	County	No
Canton Borough	Yes	1976	County	Yes
Canton Township	Yes	No	County	Yes
Columbia Township	No	No	County	Yes
Franklin Township	No	No	County	No
Granville Township	Yes	No	County	Yes
Leroy Township	No	No	County	No
Monroe Borough	No	1969/2001	County	Yes
Monroe Township	No	No	County	No
New Albany Borough	No	No	County	No
North Towanda Twp.	1985 / Current draft	1969	County	Yes
Overton Township	No	No	County	No
Smithfield Township	No	No	County	No
Springfield Township	No	No	County	No
Sylvania Borough	No	No	County	No
Towanda Borough	Current draft	1970	County	Yes
Towanda Township	Current draft	No	County	No
Troy Borough	Yes	1957	Yes	Yes
Troy Township	Yes	No	County	Yes
W.Burlington Township	No	No	County	No
Tioga County	Yes	Proposed	Yes	Yes
Sullivan Township	Yes	No	No	Yes
Union Township	Yes	No	County	Yes
Ward Township	Yes	No	County	Yes
Lycoming County	Yes	Yes	Yes	Yes
McNett Township	Yes	No	County	No
Sullivan County	Yes	No	Yes	Yes
Cherry Township	No	No	No	No
Fox Township	No	No	No	No

Source: Bradford County Community Matrix; Pennsylvania E-Library, Tioga, Lycoming & Sullivan Planning Commissions

Protected and Preserved Lands

Incentives and Contracts

The Agricultural Security Areas (ASA) and the Clean and Green Programs are heavily used by County landowners. These programs provide incentives for private landowners to maintain agricultural and forest land. The tax incentives associated with these programs reduce property taxes paid by the landowners and the tax revenues received by the local municipalities. ASA properties are found across the County in all but five townships.

The Agricultural Security Area (ASA) program has enrolled 138,000 acres in the County. The ASA program was first created under Act No. 43 and it allows a landowner or landowners, who collectively own 250 or more acres of viable farmland, to protect their land from nonagricultural uses and obtain special considerations under local ordinances and state regulations. Unlike the conservation easement program, parcels included in an ASA are reevaluated every seven years and new parcels may be incorporated at any time.

There is very limited governance over the management of **private forests and croplands**. Regulation or oversight regarding productivity or sustainability are non-existent.

The **USDA Natural Resource Conservation Service (NRCS)** currently administers a number of federal conservation programs in the watershed offering land use incentives and term land use protection through contract. These include CRP (Conservation Reserve Program), CREP (Conservation Enhancement Reserve Program), AMA (Agricultural Management Assistance), WHIP (Wildlife Habitat Incentives Program), and EQIP (Environmental Quality Incentive Program).

The **Chesapeake Bay Foundation, PA Department of Environmental Protection, and Ducks Unlimited** administer programs to protect riparian areas and water quality through incentive cost-share and technical assistance.

The **Bradford County Conservation District** administers several programs and numerous grants where maintenance commitments are built into the delegated program or contract, providing term use protection toward the invested resource.

The **Bradford County Agricultural Land Preservation Board** has taken action to preserve land for agriculture. To date, over 116 acres have been preserved by the County's Agricultural Land Preservation Board. The program includes soil quality among its criteria for ranking properties for agricultural easements; higher quality soils increase a property's rank for competitive county farmland preservation funding.

The **Northcentral Pennsylvania Conservancy and North Branch Land Trust** are active in the area and are gradually increasing the land base on which are held conservation or agricultural easements.

The **USDA Natural Resource Conservation Service (NRCS)** also administers incentive programs protecting lands and land use in the long-term to include: Wetlands Reserve Program (WRP), Grasslands Reserve Program (GRP), and Debt for Nature. Federal Farmland and Ranchland Protection Program Grants are made available to assist county Agricultural Land Preservation programs.

Table - 3.2 - Preserved Lands – Towanda & Sugar Creeks Watersheds

PARCEL	ORGANIZATION / INSTRUMENT TYPE	ACREAGE
39-57-20	Agricultural Land Preservation Board; Agriculture Conservation Easement	116.26
16-106-97	Northcentral Pennsylvania Conservancy; Conservation Easement	91.0
24-99.2-27	Northcentral Pennsylvania Conservancy; Conservation Easement	19.0
42-56-20	Natural Resources Conservation Service; Wetland Reserve Easement	13.2
Total		239.46

Source: Bradford County Agricultural Land Preservation Program 2007

CHAPTER IV - SOCIAL & ECONOMIC PROFILE

Major Communities in the Sugar & Towanda Creek Watersheds

Towanda Area

The Towanda area includes three municipalities: Towanda Borough, Towanda Township and North Towanda Township. North Towanda Township, County government, Osram-Sylvania, and Dupont are the major employers in the area. Towanda Borough is the County seat and has a historic district that includes its main street business district and adjacent residential areas. Recent improvements in the area include a multi-million dollar River Street extension, designed to alleviate congestion at the town's major intersection; the project also created a one-mile walking trail along the river

Troy-Canton Area

Troy-Canton is located in the western portion of the County. Troy is located at the junction of US Route 6 and PA Route 14; Canton lies a few miles south of Troy along PA 14 between Armenia and Barclay Mountains. Alparon Park, home of the County Fair, is located in Troy.

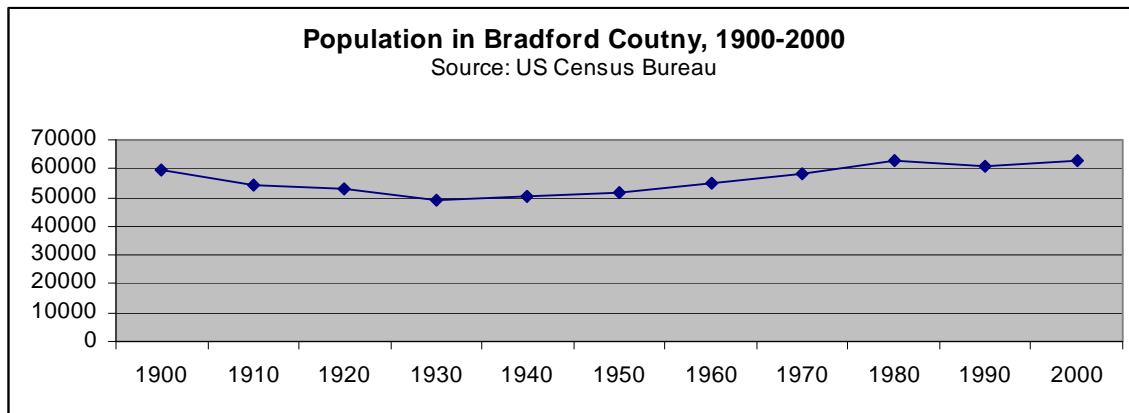
Recent Socioeconomic Conditions and Trends

Note: Where indicated, the following information depicts Bradford County versus the Towanda / Sugar Creek watershed. Because Bradford County contains a vast majority of the watershed and the presence of numerous similarities between the small watershed areas adjoining Bradford County, it is generally assumed that the trends and conditions are likewise similar.

Population

The total number of residents in Bradford County is slightly higher than it was 100 years ago. The 1900 census reported 59,400 persons and the 2000 census reported nearly 63,000 persons. The trend has not been slow steady growth but rather a steady decline and rebound as residents moved out and moved into the County based on employment opportunities. During this time, the economy was transitioning from a resource-based economy to one led by manufacturing. Population levels in the last two decades have not continued the increase that was experienced from 1930 to 1980. This trend may suggest that job opportunities are relatively limited and that another transition is underway.

Figure 4.1 - Population in Bradford County, 1900-2000



**Table 4.1 - Population Change for Bradford County, 1970-2000
Sugar & Towanda Creek Watersheds Municipalities**

Municipality	Total Population				Population Change	
	1970	1980	1990	2000	1990-2000	
					#	%
USA	203,302,031	226,542,199	248,709,873	281,421,906	32,712,033	13.2
Pennsylvania	11,800,766	11,864,720	11,882,842	12,281,054	398,212	3.4
BRADFORD COUNTY	57,962	62,919	60,967	62,761	1,794	2.9
Alba Borough	184	222	170	186	16	9.4
Albany Township	705	853	927	927	0	0.0
Armenia Township	62	191	134	166	32	23.9
Burlington Borough	148	162	479	182	-297	-62.0
Burlington Township	585	765	705	799	94	13.3
Canton Borough	2037	1,959	1,966	1,807	-159	-8.1
Canton Township	1645	1,898	2,099	2,084	-15	-0.7
Columbia Township	1042	1,119	1,077	1,162	85	7.9
Franklin Township	387	559	557	698	141	25.3
Granville Township	761	903	837	873	36	4.3
Leroy Township	587	639	610	627	17	2.8
Monroe Borough	627	627	540	514	-26	-4.8
Monroe Township	1004	1,214	1,235	1,271	36	2.9
New Albany Borough	382	336	306	306	0	0.0
North Towanda Township	801	1,003	909	927	18	2.0
Overton Township	155	239	157	187	30	19.1
Smithfield Township	1397	1,536	1,520	1,538	18	1.2
Springfield Township	1061	1,121	1,118	1,167	49	4.4
Standing Stone Township	383	419	436	596	160	36.7
Stevens Township	347	412	401	414	13	3.2
Sylvania Borough	241	236	203	200	-3	-1.5
Towanda Borough	4224	3,526	3,242	3,024	-218	-6.7
Towanda Township	1075	1,269	1,133	1,131	-2	-0.2
Troy Borough	1315	1,381	1,262	1,508	246	19.5
Troy Township	1545	1,666	1,797	1,645	-152	-8.5
West Burlington Township	588	637	417	782	365	87.5

Source: U.S. Census Bureau

**Table 4.2 - Population Projections for Bradford County, 2005-2020
Sugar & Towanda Creek Watersheds Municipalities**

<i>Population Projections, 2005-2020</i>							
Municipality	Population Projections					Change 2000-2020	
	2000	2005	2010	2015	2020	#	%
BRADFORD COUNTY	62,761	63,642	64,545	65,473	66,428	3,667	5.8
Alba Borough	186	192	198	204	211	25	13.2
Albany Township	927	926	925	923	922	-5	-0.6
Armenia Township	166	183	201	219	238	72	43.4
Burlington Borough	182	187	192	197	203	21	11.3
Burlington Township	799	847	896	947	999	200	25.0
Canton Borough	1,807	1,725	1,642	1,558	1,474	-333	-18.4
Canton Township	2,084	2,074	2,063	2,052	2,039	-45	-2.1
Columbia Township	1,162	1,204	1,247	1,291	1,335	173	14.9
Franklin Township	698	772	849	930	1,015	317	45.4
Granville Township	873	891	908	926	944	71	8.1
Leroy Township	627	635	643	651	658	31	5.0
Monroe Borough	514	500	486	472	457	-57	-11.1
Monroe Township	1,271	1,288	1,305	1,321	1,338	67	5.3
New Albany Borough	306	306	306	305	305	-1	-0.4
North Towanda Township	927	935	943	951	959	32	3.5
Overton Township	187	203	219	236	253	66	35.4
Smithfield Township	1,538	1,546	1,553	1,559	1,566	28	1.8
Springfield Township	1,167	1,191	1,214	1,238	1,262	95	8.1
Sylvania Borough	200	198	197	195	193	-7	-3.5
Towanda Borough	3,024	2,911	2,796	2,679	2,562	-462	-15.3
Towanda Township	1,131	1,128	1,126	1,122	1,119	-12	-1.1
Troy Borough	1,508	1,636	1,768	1,905	2,047	539	35.7
Troy Township	1,645	1,567	1,487	1,408	1,327	-318	-19.3
West Burlington Township	782	811	841	871	901	119	15.2
Source: U.S. Census Bureau; BonData Services							

Residence

Bradford County residents are choosing suburban and rural living over more urban-like neighborhoods found in the County's boroughs. While the total County population count was relatively stable, more dramatic changes occurred between the municipalities. Eighty percent of Bradford County's municipalities experienced

population increases between 1970 and 2000. The majority of the remaining municipalities that lost population were boroughs.

Both borough and township communities are impacted by this shift to township living. The boroughs are left to maintain their infrastructure of roads, water and sewer, and services with support from a shrinking population. Rural townships that had little development between the early and mid 1900s now host “modern” development densities, patterns, and designs that seem non-traditional and impact increasingly larger portions of the rural landscape.

Demographics

While older generations appreciate the quality of life Bradford County has to offer, younger generations are deterred by the lack of employment and lifestyle options beyond the County. This trend has occurred as significant numbers of retirees move into the County and young individuals and families seek diverse employment opportunities and recreation and leisure amenities outside the County. Between 1990 and 2000, the County experienced significant population increases among older age groups, including a 33.1 percent increase in the 45-54 age group, a 28.3 percent in the 55 to 59 age group, and a 30 percent increase in the over 85 age group. During the same period, the County experienced a 29.1 percent decrease in the number of people in the 25 to 44 age group, the group most heavily engaged in the labor force, home buying, and family formation and development.

These changes in the demographic composition of the County may have substantial impacts on the demand for recreation, leisure, and transportation services; they may also affect income-based government revenue and the overall availability of disposable income for household and leisure pursuits and capital and community investments.

Bradford County school enrollments are lower than in previous years, reflecting the decline in young adult and youth age groups. Six of the seven school districts in Bradford County saw a decrease in enrollments between 1990 and 2000.

Bradford County is projected to grow by an estimated 3,667 persons, or at a rate of 5.8 percent, over the next 15 years, based on the 1990-2000 trends. This growth is expected to occur predominantly in the northern and south central townships.

More dramatic changes in municipal population, again based on the 1990-2000 trends, suggest that the population will continue to shift within the County. Seventeen municipalities are projected to lose a total of 2,165 persons, while the remaining 24 municipalities gain 5,833 persons. Only four of the fourteen boroughs are projected to grow: Alba, Burlington, Sayre, and Troy.

Income

While the County's median household income saw negligible growth, the County's per capita income rose significantly between 1989 and 1999. Bradford County's 1999 median household income saw real growth of 1.7 percent, while per capita income experienced real growth of 10.3 percent. However, the County's per capita income is still below state and national levels.

An especially positive trend for Bradford County is the decline in the poverty rate. The percentage of the total population with an income below the poverty level was 11.8 percent in 2000, a decline of 1.5 percentage points from 1990. Poverty in Bradford County is declining. Of the total population, 11.8 percent was considered to be below the poverty level in 2000, which is down 1.5 percent since 1990. This is a particularly positive trend for Bradford County.

The County's average household size is declining more rapidly than state and national rates. The average household size has decreased from 2.67 in 1990 to 2.52 in 2000. This decrease is somewhat expected in a rapidly aging community, where young families are moving out.

Housing values in the County typically fall below state and national levels, but are consistent with surrounding counties. Just over 60 percent of the County's specified owner-occupied housing units fall within the \$50,000 to \$99,999 value range; an additional 18.7 percent had values less than \$50,000. Housing affordability is critical to community development, particularly the affordability of starter homes whose sale supports transactions throughout the housing market.

CENSUS DATA – Sugar Creek

Information from the 2000 US Census has been used to compile demographic data for the Sugar Creek Watershed. The total population within the watershed was recorded at 11,444. Records indicate 4,875 housing units and 9,363 households in the watershed. Average per capita income in the watershed is \$16,268. Per capita income for each of the census blocks in the watershed ranges from \$14,211 to \$22,494. In 2001, the National per capita income was \$22,851. For the state of Pennsylvania, per capita income was \$20,880.

CENSUS DATA – Towanda Creek

Information from the 2000 US Census has been used to compile demographic data for the Towanda Creek Watershed. The total population within the watershed was recorded at 12,118. Records indicate 6003 housing units in the watershed. The average annual household income (derived from the mean of all median values for each census tract in the watershed) is \$34,107.77. Median annual household incomes for all census tracts in the watershed range from \$26,848 to \$39,318. This compares to the average annual median household income for the state of

Pennsylvania, which is \$43,577. Comparatively, national median household income was \$37,066. Average per capita income in the watershed is \$15,819.55. Per capita income for each of the census blocks in the watershed ranges from \$13,416 to \$17,858. In 2001, the National per capita income was \$22,851. For the State of Pennsylvania, per capita income was \$20,880.

Major Sources of Employment

Table 4.3 - Resident Employment by Industry for Persons 16 Years of Age and Over, 2000

Industry	USA		Pennsylvania		Bradford County	
	#	%	#	%	#	%
Agriculture, forestry, fishing and hunting, and mining	2,426,053	1.9	73,459	1.3	1,777	6.3
Construction	8,801,507	6.8	339,363	6.0	1,565	5.6
Manufacturing	18,286,005	14.1	906,398	16.0	7,284	26.0
Wholesale trade	4,666,757	3.6	201,084	3.6	638	2.3
Retail trade	15,221,716	11.7	684,179	12.1	3,121	11.2
Transportation and warehousing, and utilities	6,740,102	5.2	304,335	5.4	1,334	4.8
Information	3,996,564	3.1	148,841	2.6	459	1.6
Finance, insurance, real estate and rental and leasing	8,934,972	6.9	372,148	6.6	845	3.0
Professional, scientific, management, administrative, and waste management services	12,061,865	9.3	478,937	8.5	1,117	4.0
Educational, health and social services	25,843,029	19.9	1,237,090	21.9	6,507	23.3
Arts, entertainment, recreation, accommodation, food services	10,210,295	7.9	397,871	7.0	1,304	4.7
Other services (except public administration)	6,320,632	4.9	274,028	4.8	1,278	4.6
Public administration	6,212,015	4.8	235,767	4.2	756	2.7
Totals	129,721,512	100.0	5,653,500	100.0	27,985	100.0

Source: U.S. Census Bureau, 2000

Recent labor force statistics again reflect an aging population; fewer residents are working. The total civilian labor force has declined from 28,100 in 1990 to 27,900 in 2000, as older residents retire and young residents leave the County for job and lifestyle options elsewhere.

The top three industries employ more than 50 percent of the work force, notably higher figures than those of the state and nation for these industries. The leading industry in Bradford County is manufacturing, employing 26.0 percent of the workforce. Major manufacturing employers in the County include Taylor Meat Packing, Mills Pride, International Paper-Masonite, Osram-Sylvania, DuPont and Ingersoll Rand. The educational, health, and social services industry follows close behind, employing 23.3 percent of the workforce. The Guthrie Clinic/Robert Packer Hospital, a teaching hospital and trauma center located in Sayre, and the various school districts boost this industry toward the top.

The third leading employment sector is the resource cluster of agriculture, forestry, fishing and hunting, and mining, representing 6.3 percent of the workforce, a noticeably higher proportion than in the State overall (1.3%).

In the 1800's, much of the watersheds was settled primarily by farm families. Throughout the 1800's and 1900's, the rail station at Troy served as an export center for much of the butter, buckwheat and other agricultural commodities produced in abundance by the region. Through the years, agriculture remains the leading industry within Bradford County and the Sugar / Towanda Creek watershed.

Farm numbers and farm size have slipped slightly in recent years, but market value has been on the rise. According to the USDA Census of Agriculture, the number of farms has decreased by 44 from 1,539 in 1997 to 1,495 in 2002. The County's average farm size is approximately 202 acres, down just slightly from 204 acres in 1997. It should be noted that while farm size hasn't changed much according to the census, the number of acres under a cropping system appears to be decreasing due to changes in farms and the availability of a number of conservation reserve programs. Meanwhile, total market sales were up four percent from 1997, totaling \$99.8 million in 2002 and placing the County 8th among State counties in total market sales. The vast majority of these sales (\$92.6 million) was in livestock, placing Bradford County 5th in the State for livestock sales.

The Bradford County Conservation District, under the Chesapeake Bay Program, conducted an assessment of the Sugar and Towanda Creek Watersheds in 1989. During that assessment a team identified the location and type of each of the farming operations in the watershed. At that time approximately 490 livestock operations were identified in the Sugar-Towanda Creek Watersheds.

These three industries thrive in Bradford County for logical reasons, and their contribution to the community and landscape of the County is significant. Natural resources are readily available for cultivation and production, extraction and

processing into raw materials. Businesses have access to regional markets through the highway and a limited rail system. A technically capable and skilled workforce is available. With these assets at hand, these industries may continue to thrive and, in fact, play a part in further community development and conservation. Farmers, forester and miners are active managers of land and water resources.

Manufacturers are the leading economic reason people live in the County; their profitability and ultimate viability is influenced by community support and workforce readiness. Finally, while the education, health, and social services industry manage a far smaller portion of land and water resources, the employees can be strong advocates for health and wellness supported by livable communities with clean air and water and recreation sites and walkable neighborhoods for fitness.

Over 60 percent of Bradford County's workforce is employed in white-collar occupations. Management, professional and related occupations account for 27.6 percent of these white-collar positions. Almost 26 percent of residents are employed in the production, transportation, and material moving occupations. The distribution of occupations is of interest in that it reflects the diversity of job opportunities in the County economy.

Bradford County is a leader in Pennsylvania agriculture. Total receipts from all agricultural activity in the County exceeded \$200 million in 2002 (3rd in the State and 49th in the nation). Sales from 450 dairy farms alone exceeded \$85 million in 2002. When compared to Pennsylvania as a whole, the County has a high number of farms with annual gross sales over \$50,000 and a high percentage of farmers who farm as their principal occupation. Again, the importance of farmers as land and water resource managers cannot be overstated.

However, the regional economy has changed significantly over the past 30 years as the worldwide agricultural industry and markets have affected the way local farmers do business. Agricultural processing operations have moved closer to production sites and national cooperatives have established set prices for agricultural products. These changes in the industry have challenged local farmers to make farm operation evermore efficient to sustain profitability.

The estimated value of standing timber in the County is in excess of \$287 million. As a result, this forest plays a significant role in the economic well being and quality of life in the County. This, and forestland in surrounding counties, supports approximately 35 wood products establishments, including significant employers such as Mill's Pride, Craftmaster, and Oak Hill Veneer. In addition to those involved directly in the wood manufacturing sector, there are many loggers, foresters, and truckers that are employed in the forestry sector - a sector which contributes an additional \$15.3 million to the local economy.

Tourism and related service industries are growing in the County. The history and natural resources of the area attract more and more visitors to the County each year.

The developing Marcellus gas fields are anticipated to develop into the major economic influence in the County in the next decade.

Transportation Facilities

There are 602.2 miles of paved roads in the watersheds maintained by PennDOT or by local municipal authorities. In addition, there are also 334.8 miles of unpaved roads within the watershed. Of these, 313.9 miles are located in Bradford County, 12.3 miles in Tioga County, 7.6 miles in Sullivan County, and 1.0 mile in Lycoming County.

Major Transportation Corridors in the Sugar & Towanda Creek Watersheds

The Northern Tier Long Range Transportation Plan identifies 15 corridors of regional significance in its 5-county region, including six that travel through Bradford County: US 6, US 220, PA 14, PA 414, PA 187 and PA 706. The discussion below considers the corridors in terms of their recreation potential.

US Route 6 crosses Bradford County in an east-west pattern through Wyalusing, Towanda, Wysox, Burlington, Troy, and Sylvania. This transcontinental highway from Provincetown, MA to Long Beach, California is recognized for its scenic and strategic importance. In 1995, the US Congress designated the roadway as part of its National Highway System (NHS) and PennDOT designated the route as part of its network of cross-state bicycle facilities (BicyclePA Route Y). The route provides a strategic connection to out-of-county, off-road trail facilities such as the Iroquois Trail in Wyoming County and the Pine Creek Trail in Tioga County.

US Route 220 transects the County from north to south from Waverly, New York to Rockingham, North Carolina passing through the Valley region, Ulster, Towanda, Monroe, and New Albany. The Long Range Transportation Plan (LRTP) notes the need for bicycle and pedestrian facilities in this corridor, not only for recreational purposes, but for journey to work trips as well.

PA Route 14 is primarily located in Bradford County and passes through its western region in a north-south pattern. It passes through Canton, Alba, Troy and several villages on its way to New York.

PA Route 414 passes through Bradford, Lycoming and Tioga Counties from Waterville to Monroe. This corridor has some potential to be considered as part of a scenic byway. (Lycoming County has developed a county scenic byways program and may consider this designation for its portion of the PA 414 corridor.) Major natural features include large acreages of state game lands, Sunfish Pond, Holcomb Pond and Tioga State Forest. Portions of the PA 414 roadway are also used during the annual bicycle race known as the "Tour de Shunk."

PA Bikeways

One Bicycle PA Route passes through Bradford County: Route Y follows US Route 6. Additional bicycle routes have been proposed by the local development district, Northern Tier Regional Planning and Development Commission to PennDOT.

Bicycle PA – Route J will travel through Bradford County once route design and construction/improvements are complete. The route will travel from the Tioga County line near Canton to the New York State line in South Waverly as follows:

PA 14	Tioga County line to PA 414, Canton, 4.57 miles
PA 414	PA 14 North junction to US 220, 21.99 miles
US 220	PA 414 junction to SR 2027 (Bus. US 220), 1.68 miles
SR 2027	US 220 to US 6, Towanda, 1.80 miles
US 6	SR 2027 to SR 1041, 1.79 miles
SR 1041	US 6 to SR 1043, 0.74 miles
SR 1043	SR 1041 to SR 1056, E. Athens, 12.04 miles
SR 1056	SR 1043 to PA 199, Athens, 0.60 miles
PA 199	SR 1056 to NY line, S. Waverly, 3.09 miles

The Northern Tier Bicycle and Pedestrian Transportation Plan identified the following action items for Bradford County to enhance and improve its bicycle and pedestrian systems. These action items were included in the Northern Tier Long Range Transportation Plan, which programs projects for all modes of transportation in the Northern Tier and Endless Mountains regions:

- Development of off-road trail mapping
- Development of off-road trail systems/greenways
- Shoulder improvements on PA 414 between Canton and Monroeton
- Development of a rail-trail between Elmira and Williamsport (including bicycle and pedestrian improvements in Canton Borough)
- Shoulder improvements on US 6
- Develop a trail/lodging promotional brochure.

Travel Linkages

The road network in Bradford County totals over 1,695 miles. PennDOT maintains 902 miles of State roads in the County while local municipal roads comprise the remaining 1,593 miles of the public road network.

Two rail freight lines operate within Bradford County. The Towanda Monroeton Shippers Lifeline is 5.6 miles long and runs from Towanda to a feed mill in Monroe Borough. The Norfolk Southern Railway Company operates a rail freight line that runs from within New York State to Wyoming County where it connects with the Reading Blue Mountain and Northern Railroad.

Both rail lines are expected to continue commercial operations for the foreseeable future. Planners in the Northern Tier and Endless Mountains regions have noted that in the event that one of the lines is prepared for sale or abandonment, a regional rail authority could be established to protect the rail right-of-way for future rail access or conversion to a rail trail.

Currently no rail passenger transportation facilities exist in Bradford County.

The Bradford County Airport operates as a business class airport. The airport continues to be up-graded to attract additional business and accommodate larger planes. Some recreational flying originates here.

The Endless Mountains Transportation Authority (EMTA) provides public transportation in Bradford County. Ridership on the EMTA has increased by an average of 15 percent annually over the past three years. Much of the increase can be attributed to increased ridership on the agency's Blue Buses, which run on a set schedule between major communities. Additional services provided by EMTA include access to work and shared ride services, as well as special services for community events.

EMTA offers scheduled service for four routes within Bradford County:

- ⇒ Route 10 - Sayre/Towanda via US 220.
- ⇒ Route 20 - Towanda/Troy/Canton via US 6.
- ⇒ Route 25 - Wyalusing/Camptown/Wysox/Towanda via US 6; will stop at YMCA in Towanda on request.
- ⇒ Route 35 – LeRaysville/Rome/Wysox/Towanda/Athens.

As well as four routes that connect Bradford County to adjacent communities,

- ⇒ Route 15 - Dushore/New Albany/Wysox/Towanda/Sayre – US 220 – 3/3.
- ⇒ Route 40 - Towanda/Sayre to Arnot Mall (New York) Saturday only.
- ⇒ Route 50 - Lycoming Mall via US 220 - Tuesday and Friday Only.
- ⇒ Route 60 - Valley Loop - Athens, Sayre, South Waverly and Waverly - Saturday only. Stops may be made anywhere it is safe for passenger boarding and exiting.

Public parking is primarily provided as on-street parking in the major downtown areas. A few select off street lots are associated with public facilities such as the County Courthouse.

CHAPTER V - GEOLOGY and SOILS

During most of the Paleozoic Era, (600 to 230 million years ago), the area of the Sugar/Towanda Creek watershed was covered by a shallow sea. Runoff from the surrounding land area deposited sandy, silty and clayey sediments to this sea. Towards the end of the Paleozoic Era, these sediments were raised above sea level through geologic processes and were compacted and cemented into the bedrock that presently underlies the watershed area. This bedrock is of Devonian (405 to 350 million years ago), Mississippian (350 to 310 million years ago), and Pennsylvanian age (310 to 280 million years ago).

The Devonian bedrock is primarily of the Susquehanna Group, which in the Sugar/Towanda Creek watershed comprises the Lock Haven Formation (interbedded light olive gray, very fine grained, fossiliferous sandstone, light gray siltstone, and gray silty shale) and Catskill Formation (chiefly red to brownish shale and sandstone). The Mississippian bedrock is primarily the Pocono Group (predominantly gray, hard, massive, cross-bedded conglomerate and sandstone with some shale). The Pennsylvanian bedrock is primarily the Pottsville Group (light gray to white, coarse-grained sandstone and conglomerate with some mineable coal).

In the time after the Paleozoic Era, the landscape was heavily eroded and worn down to a flat, featureless plain, and then was raised again by geologic processes. The last cycle of upwarping and erosion was interrupted about one million years ago by the advance of glacial ice from the north. During the ice age (Pleistocene Epoch), glaciers moved over and retreated from the northern United States four times. It is not known for certain if all four ice advances covered Bradford and Sullivan Counties; at least two of these advanced far enough south to cover the area of the present-day Sugar/Towanda Creek watershed. The last, or Wisconsin, ice advance retreated from the area 12,000 to 15,000 years ago. The Wisconsin Glacier is the only ice advance to leave significant evidence of its presence. As the Wisconsin, and possibly earlier ice, advanced over the area, it ground down hilltops and filled the valleys with rock material, flattening the area. Besides scouring the landscape, the Wisconsin Glacier deposited large amounts of glacial till on the uplands and side slopes. It also left glacial outwash and lacustrine deposits in the river valleys. These glacial materials, derived from the Devonian bedrock of the area, became the parent material of the soil types currently found in the Sugar/Towanda Creek watershed.

Although the glacier reduced the relief of the area by grinding and filling, it did not completely obscure or alter the pre-glacial topography of the region. The major hills and ridges that were present prior to glaciation still exist today. However, the softer bedrock material found in the present-day Sugar/Towanda Creek watershed area was more easily eroded than bedrock formations underlying other parts of the region. This explains the elevation differences between the northern and southern parts of Bradford County.

In the Sugar/Towanda Creek watersheds and surrounding areas, the bedrock has greatly affected the nature of the glacial deposits. The bedrock for the northern part of Bradford County that encompasses the Sugar/Towanda Creek watershed is primarily gray shale and sandstone of Devonian age. These rocks produced the grayish brown till in which Volusia, Mardin, and Lordstown soil association developed. The shale and sandstone of the Catskill Formation has given a distinctive red color to the parent material of Morris, Oquaga, and Wellsboro soil association. (Soil Survey of Bradford and Sullivan Counties, Pennsylvania)

Geology

The Sugar/Towanda Creek watershed is located in the glaciated region of northern Pennsylvania, within the Glaciated Low Plateau Section of the Appalachian Plateau's Physiographic Province. Topography within the Glaciated Low Plateau Section consists of rounded hills and broad to narrow valleys all of which have been modified by glacial erosion and deposition. The rock formations in this region are all of sedimentary origin, the rock strata are generally horizontal but have been slightly upwarped, which has given rise to some relief; however, most of the relief in the County is produced by streams cutting into the rock strata.

This section reflects the interplay between bedrock of various types, mainly sandstones and siltstones, and glacial erosion and deposition. The more erosion-resistant rocks form the hills, while the less erosion-resistant rocks were scoured to form valleys. Glacial deposits, mainly glacial till or sand and gravel, may occur anywhere, but are found mainly in the valley bottoms and margins (PADCNr, 2002).

The surficial aquifer in the region is a valley-fill glacial aquifer. The underlying bedrock was deeply eroded by pre-glacial drainage. Pre-glacial erosion was enhanced by glacial scour that broadened and deepened the valleys and rounded off the hilltops. The last retreat of glacial ice allowed streams to erode and redeposit some of the glacial deposits. As a result, outwash and alluvial sand and gravel cover the floor of the main and tributary valleys. Glacial till lines the valley walls along much of Sugar/Towanda Creeks and their tributaries, although several prominent bedrock features occur throughout the watershed, primarily on the tributaries.

Sand and gravel deposits in the aquifer are generally unconfined (groundwater table aquifers) and saturated to the level of the streams that cut through them. Some recharge to the aquifer is by infiltration of precipitation that falls directly on the aquifer. Recharge also takes place from inflow from the adjacent bedrock and by down-valley movement of water through the aquifer. Where tributary streams flowing in bedrock channels begin to flow over alluvial fan and outwash deposits, the water level in the streams is commonly higher than that of the water table in the underlying aquifer. (Soil Survey of Bradford and Sullivan Counties, Pennsylvania)

Catskill Formation (Dck) of Devonian age - This formation is a complex unit consisting of shale, siltstone, sandstone, and conglomerate. The thickness of the exposed rocks decreases to the west. The relative amount of red beds decreases to almost zero in northwestern Pennsylvania. The formation forms plateaus of medium relief. Natural slopes are stable at fairly steep angles. Shale disintegrates rapidly when exposed to moisture, weathering to small, platy, triangular fragments. Undercutting of resistant coarser beds can cause poor quality slopes and result in rockfalls. In glaciated regions, drainage is poor. (Soil Survey of Bradford and Sullivan Counties, Pennsylvania)

Lock Haven Formation (Dlh) of Devonian age - This formation consists of interbedded light olive gray, very fine grained, fossiliferous sandstone, light gray siltstone, and gray silty shale. It is locally hematitic and contains angular shale pebbles. A few conglomerate beds occur near the top. Approximate thickness of the formation is 4,000 feet. The formation forms hills and ridges of moderate relief. Natural slopes are fairly steep to steep. Slopes are stable. Water quality problems include brackish water and hydrogen sulfide. The formation has good surface drainage. (Soil Survey of Bradford and Sullivan Counties, Pennsylvania)

Soil Associations

Volusia-Mardin-Lordstown: Soils of this association are deep and moderately deep, gently sloping to moderately steep, somewhat poorly drained to well drained soils. They are located on broad hillsides and hilltops that are dissected by drainageways. Generally, the soils are sloping, but are steeper where these soils are on hillsides. The association consists of approximately 52 percent Volusia soils, 14 percent Mardin soils, 12 percent Lordstown soils, and 22 percent minor soils. Volusia soils are deep and somewhat poorly drained, have a fragipan, and a seasonal high water table. Mardin soils are deep and moderately well drained, have a fragipan, and a seasonal high water table. Lordstown soils are deep and moderately well drained. (Soil Survey of Bradford and Sullivan Counties, Pennsylvania)

Morris-Oquaga-Wellsboro: Soils of this association are on deep and moderately deep, sloping to steep, somewhat poorly drained to somewhat excessively drained soils on narrow hillsides and hilltops. They are located on narrow hillsides and hilltops, dissected by drainageways. The soils are mainly sloping, but some on hillsides are steeper. The association consists of approximately 43 percent Morris soils, 15 percent Oquaga soils, 12 percent Wellsboro soils, and 30 percent minor soils. Morris soils are deep and somewhat poorly drained. Oquaga soils are moderately deep and are well drained and somewhat excessively drained. Wellsboro soils are poorly drained. They have a fragipan and a seasonal high water table. (Soil Survey of Bradford and Sullivan Counties, Pennsylvania)

Wellsboro-Oquaga-Morris: Soils of this association are deep and moderately deep, gently sloping to moderately steep, somewhat excessively drained to somewhat

poorly drained soils. They are located on broad plateaus and mountaintops that are dissected by drainage-ways. The soils are gently sloping and sloping, but some on side slopes are steeper. The association consists of approximately 32 percent Wellsboro soils, 22 percent Oquaga soils, 18 percent Morris soils, and 28 percent minor soils. Wellsboro soils are deep and are moderately well drained and somewhat poorly drained. Oquaga soils are moderately deep and are well drained and somewhat excessively drained. Morris soils are deep and somewhat poorly drained. They have a fragipan and a seasonal high water table. (Soil Survey of Bradford and Sullivan Counties, Pennsylvania)

Dystrochrepts-Oquaga-Wellsboro: These soils are deep and moderately deep, moderately steep to very steep, somewhat excessively drained to somewhat poorly drained soils. They are found on mountainsides and in their associated narrow stream valleys. The soils generally are very steep, but some soils in the valleys are nearly level to moderately steep. The association consists of approximately 27 percent Dystrochrepts, 20 percent Oquaga soils, 15 percent Wellsboro soils, and 38 percent minor soils. Dystrochrepts are well drained and somewhat excessively drained. Characteristics of the Oquaga and Wellsboro soils are similar to those listed for the Morris-Oquaga-Wellsboro association. (Soil Survey of Bradford and Sullivan Counties, Pennsylvania)

Soils – Sugar & Towanda Creek Watersheds

Table 5.1 - Soils in the Sugar Creek Watershed

Soil Type	Soil Description	Acres	Miles ²	Percent
ArC	Arnot very channery loam, rocky, 3 to 15% slopes	230.21	0.36	0.19%
AsD	Arnot-Rock outcrop complex, 3 to 25% slopes	73.60	0.12	0.06%
BaB	Braceville silt loam, 0 to 8% slopes	215.87	0.34	0.18%
CaA	Canadice silty clay loam, 0 to 3% slopes	316.92	0.50	0.26%
CnB	Chenango gravelly loam, 0 to 8% slopes	1,371.98	2.15	1.14%
CpA	Chippewa silt loam, 0 to 3% slopes	1,089.03	1.70	0.91%
CpB	Chippewa silt loam, 3 to 8% slopes	2,438.18	3.81	2.02%
DyF	Dystrochrepts, deep Wellsboro-Oquaga association, steep	12,384.13	19.35	10.25%
Ho	Holly soils	2,679.18	4.19	2.22%
Ln	Linden soils coarse silt loam, floodplain, 0-3% slopes	1,362.78	2.13	1.13%
LoB	Lordstown channery silt loam, 3 to 8% slopes	1,639.94	2.55	1.35%
LoC	Lordstown channery silt loam, 8 to 15% slopes	2,567.09	4.01	2.12%

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LoD	Lordstown channery silt loam, 15 to 25% slopes	2,413.55	3.77	2.00%
LpB	Lordstown very stony silt loam, 3 to 8% slopes	17.99	0.03	0.01%
LpD	Lordstown very stony silt loam, 8 to 25% slopes	587.93	0.92	0.49%
MaB	Mardin channery silt loam, 3 to 8% slopes	1,360.38	2.12	1.12%
MaC	Mardin channery silt loam, 8 to 15% slopes	3,238.43	5.06	2.68%
MaD	Mardin channery silt loam, 15 to 25% slopes	1,795.16	2.80	1.49%
MbB	Mardin very stony silt loam, 3 to 8% slopes	5.21	0.01	< .01%
MbD	Mardin very stony silt loam, 8 to 25% slopes	365.40	0.57	0.30%
Md	Medisaprists, ponded	111.37	0.17	0.09%
MoB	Morris channery silt loam, 3 to 8% slopes	9,108.70	14.24	7.54%
MoC	Morris channery silt loam, 8 to 15% slopes	12,118.71	18.94	10.03%
MsB	Morris very stony silt loam, 3 to 8% slopes	928.13	1.45	0.77%
MsD	Morris very stony silty loam, 8 to 25% slopes	2,952.00	4.62	2.45%
NoB	Norwich very stony silty loam 0 to 8% slopes	124.70	0.20	0.10%
OcF	Ochrepts-Rock outcrop complex, steep 15-100% slopes	49.71	0.08	0.04%
OgB	Oquaga channery silt loam, 3 to 8% slopes	1,715.67	2.68	1.42%
OgC	Oquaga channery silt loam, 8 to 15% slopes	2,664.02	4.16	2.20%
OgD	Oquaga channery silt loam, 15 to 25% slopes	3,425.35	5.35	2.83%
OsB	Oquaga extremely stony silt loam, 3 to 8% slopes	150.22	0.24	0.13%
OsD	Oquaga extremely stony silt loam, 8 to 25% slopes	1,769.83	2.77	1.47%
Po	Pope soils	436.11	0.68	0.36%
ReA	Rexford silt loam, 0 to 3% slopes	357.76	0.56	0.30%
ReB	Rexford silt loam, 3 to 8% slopes	417.64	0.65	0.35%
ReC	Rexford silt loam, 8 to 12% slopes	292.07	0.46	0.24%
Uc	Udifluvents, cobbly	3,156.16	4.93	2.61%
UnB	Unadilla silt loam, 3 to 8% slopes	39.02	0.06	0.03%
VoB	Volusia channery silt loam, 3 to 8% slopes	14,092.05	22.02	11.67%
VoC	Volusia channery silt loam, 8 to 15% slopes	19,156.75	29.94	15.86%
VoD	Volusia channery silt loam, 15 to 25% slopes	3,453.11	5.40	2.86%
VsB	Volusia very stony silt loam, 3 to 8% slopes	116.00	0.18	0.10%
VsD	Volusia very stony silt loam, 8 to 25% slopes	133.12	0.21	0.11%
W	Wellsboro soils	716.85	1.12	0.59%
WbB	Wellsboro channery silt loam, 3 to 8% slopes	906.50	1.41	0.75%
WbC	Wellsboro channery silt loam, 8 to 15% slopes	2,645.63	4.13	2.19%
WgB	Wellsboro very stony silt loam, 3 to 8% slopes	2,233.28	3.48	1.84%
WgD	Wellsboro very stony silt loam, 8 to 25% slopes	5.570	0.01	< .01%
WmB	Wyoming gravelly sandy loam, 3 to 8% slopes	349.85	0.55	0.29%

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WmC	Wyoming gravelly sandy loam, 8 to 15% slopes	92.59	0.15	0.08%
WmD	Wyoming gravelly sandy loam, 15 to 25% slopes	194.67	0.31	0.16%
WmF	Wyoming gravelly sandy loam, 25 to 45% slopes	400.49	0.63	0.33%
WbD	Wellsboro channery silt loam, 15 to 25% slopes	327.70	0.51	0.27%
	Totals	120,794.29	188.76	100%

Table 5.2 - Soils in the Towanda Creek Watershed

Soil Type	Soil Description	Acres	Miles²	Percent
Ab	Alluvial land	16.10	0.03	0.01%
AgB	Alton gravelly sandy loam, 0 to 8% slopes	2.12	0.00	0.00%
Ao	Arnot channery loam,	110.83	0.17	0.06%
AoB	Arnot channery loam, 3 to 12% slopes	42.83	0.07	0.02%
ArB	Arnot - Rock outcrop complex, 3 to 12% slopes	8.04	0.01	0.00%
ArC	Arnot very channery loam, rocky, 3 to 15% slopes	679.14	1.06	0.38%
AsD	Arnot-Rock outcrop complex, 3 to 15% slopes	5393.97	8.43	3.01%
BaB	Braceville silt loam, 1 to 8% slopes	179.81	0.28	0.10%
CaA	Canadice silty clay loam, 0 to 3% slopes	107.12	0.17	0.06%
CkA	Chippewa silt loam, 0 to 3% slopes	28.19	0.04	0.02%
CkB	Chippewa silt loam, 3 to 8% slopes	26.10	0.04	0.01%
CnB	Chenango gravelly loam, 1 to 8% slopes	2490.69	3.89	1.39%
CpA	Chippewa silt loam, 0 to 3% slopes	1701.56	2.66	0.95%
CpB	Chippewa silt loam, 3 to 8% slopes	1108.50	1.73	0.62%
Du	Dumps, mine	14.23	0.02	0.01%
DyF	Dystrochrepts, deep Wellsboro-Oquaga association, steep	27514.06	42.99	15.35%
Ho	Holly soils	2895.33	4.52	1.61%
LaB	Lackawanna channery loam, 3 to 12% slopes	7.44	0.01	0.00%
LaC	Lackawanna channery loam, 12 to 20% slopes	13.14	0.02	0.01%
LbB	Lackawanna extremely stony loam, 3 to 8% slopes	57.49	0.09	0.03%
LbD	Lackawanna extremely stony loam, 15 to 25% slopes	57.78	0.09	0.03%
Ln	Linden soils coarse silt loam, floodplain, 0 to 3% slopes	1987.89	3.11	1.11%
LoB	Lordstown channery silt loam, 3 to 8% slopes	998.35	1.56	0.56%

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LoC	Lordstown channery silt loam, 8 to 15% slopes	1790.70	2.80	1.00%
LoD	Lordstown channery silt loam, 15 to 25% slopes	2012.70	3.14	1.12%
LpD	Lordstown very channery silt loam, 8 to 25% slopes	282.55	0.44	0.16%
MaB	Mardin channery silt loam, 3 to 8% slopes	1734.22	2.71	0.97%
MaC	Mardin channery silt loam, 8 to 15% slopes	4007.40	6.26	2.24%
MaD	Mardin channery silt loam, 15 to 25% slopes	1454.32	2.27	0.81%
MbB	Mardin very stony silt loam, 3 to 8% slopes	1463.03	2.29	0.82%
MbD	Mardin very stony silt loam, 8 to 25% slopes	3061.40	4.78	1.71%
Md	Medisaprists, ponded	526.58	0.82	0.29%
MoA	Morris channery silt loam, 0 to 3% slopes	19.69	0.03	0.01%
MoB	Morris channery silt loam, 3 to 8% slopes	7392.80	11.55	4.12%
MoC	Morris channery silt loam, 8 to 15% slopes	10920.69	17.06	6.09%
MoD	Morris channery silt loam, 15 to 25% slopes	9.39	0.01	0.01%
MrB	Morris, very stony silt loam, 0 to 8% slopes	60.67	0.09	0.03%
MsB	Morris very stony silt loam, 3 to 8% slopes	9413.08	14.71	5.25%
MsD	Morris very stony silt loam, 8 to 25% slopes	4932.95	7.71	2.75%
No	Norwich silt loam	43.35	0.07	0.02%
NoB	Norwich very stony silty loam, 0 to 8% slopes	1153.95	1.80	0.64%
Ns	Norwich very stony silty loam,	15.85	0.02	0.01%
NxB	Norwich, very stony silt loam, 0 to 8% slopes	27.06	0.04	0.02%
OcF	Ochrepts-Rock outcrop complex, steep 15 to 100% slopes	717.16	1.12	0.40%
OgB	Oquaga channery silt loam, 3 to 8% slopes	2348.62	3.67	1.31%
OgC	Oquaga channery silt loam, 8 to 15% slopes	3153.01	4.93	1.76%
OgD	Oquaga channery silt loam, 15 to 25% slopes	2945.24	4.60	1.64%
OsB	Oquaga extremely stony silt loam, 3 to 8% slopes	6745.08	10.54	3.76%
OsD	Oquaga extremely stony silt loam, 15 to 25% slopes	10994.50	17.18	6.13%
OTF	Oquaga and Lordstown soils	649.90	1.02	0.36%
Ow	Orrville silt loam	27.70	0.04	0.02%
OxB	Oquaga and Lordstown extremely stoney silt loam, 3 to 8% slopes	131.99	0.21	0.07%
OxD	Oquaga and Lordstown extremely stoney silt loam, 15 to 25% slopes	238.60	0.37	0.13%
OxE	Oquaga and Lordstown extremely stoney silt loam, 25 to 45% slopes	36.77	0.06	0.02%
Po	Pope soils	524.68	0.82	0.29%
ReA	Rexford silt loam, 0 to 3% slopes	98.50	0.15	0.05%
ReB	Rexford silt loam, 3 to 8% slopes	435.19	0.68	0.24%
ReC	Rexford silt loam, 8 to 12% slopes	289.28	0.45	0.16%
Uc	Udifluvents, cobbly	4666.68	7.29	2.60%
Ud	Udorthents, very channery	306.70	0.48	0.17%

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UnB	Unadilla silt loam, 3 to 8% slopes	82.38	0.13	0.05%
UnC	Unadilla silt loam, 8 to 15% slopes	13.08	0.02	0.01%
VoA	Volusia channery silt loam, 0 to 3% slopes	4.04	0.01	0.00%
VoB	Volusia channery silt loam, 3 to 8% slopes	10226.48	15.98	5.70%
VoC	Volusia channery silt loam, 8 to 15% slopes	12908.79	20.17	7.20%
VoD	Volusia channery silt loam, 15 to 25% slopes	1109.11	1.73	0.62%
VsB	Volusia very stony silt loam, 3 to 8% slopes	80.12	0.13	0.04%
VsD	Volusia very stony silt loam, 8 to 25% slopes	100.01	0.16	0.06%
W	Wellsboro soils	976.77	1.53	0.54%
WbB	Wellsboro channery silt loam, 3 to 8% slopes	3451.98	5.39	1.93%
WbC	Wellsboro channery silt loam, 8 to 15% slopes	4095.28	6.40	2.28%
WbD	Wellsboro channery silt loam, 15 to 25% slopes	1777.41	2.78	0.99%
WeB	Wellsboro channery loam, 3 to 8%	177.78	0.28	0.10%
WeC	Wellsboro channery loam, 8 to 15%	204.89	0.32	0.11%
Thu		15.32	0.02	0.01%
WgB	Wellsboro very stony silt loam, 3 to 8% slopes	3939.58	6.16	2.20%
WgD	Wellsboro very stony silt loam, 8 to 25% slopes	8524.09	13.32	4.75%
WIB	Wellsboro flaggy silt loam, 3 to 8% slopes	14.81	0.02	0.01%
WIC	Wellsboro flaggy silt loam, 8 to 15% slopes	8.56	0.01	0.00%
WmB	Wyoming gravelly sandy loam, 3 to 8% slopes	488.91	0.76	0.27%
WmC	Wyoming gravelly sandy loam, 8 to 15% slopes	624.00	0.98	0.35%
WmD	Wyoming gravelly sandy loam, 15 to 25% slopes	810.49	1.27	0.45%
WmF	Wyoming gravelly sandy loam, 25 to 45% slopes	510.47	0.80	0.28%
WoC	Wyoming very stony sandy loam, 3 to 15% slopes	191.14	0.30	0.11%
WxB	Wurtsboro extremely stony loam, 3 to 8% slopes	17.67	0.03	0.01%
WxD	Wurtsboro extremely stony loam, 15 to 25% slopes	61.98	0.10	0.03%
Wz	Wyoming gravelly loam, flooded	22.44	0.04	0.01%
Totals		180,510.27	282.05	100.00%

The distribution and the physical and chemical properties of each of these soils can be found in the Soil Survey of Bradford and Sullivan Counties.

In the **Sugar Creek** watershed, a total of 5,671.6 acres are comprised of soils that, because of their characteristics and quality, have been designated as Prime Farmland Soils. An additional 69,946.62 acres are comprised of Soils of Statewide

Importance. These readily farmed soils are dominant in the agriculture industry in Pennsylvania.

In the **Towanda Creek** watershed, a total of 7,097.2 acres are comprised of soils that, because of their characteristics and quality, have been designated as Prime Farmland Soils. An additional 64,349.7 acres are comprised of Soils of Statewide Importance. These readily farmed soils are dominant in the agriculture industry in Pennsylvania.

Table 5.3 - Prime Farmland Soils in the Sugar Creek Watershed

Soil Type	Soil Description	Acres	Miles ²	% of PF Soils
BaB	Braceville silt loam, 0 to 8% slopes	215.87	0.34	3.81%
CnB	Chenango gravelly loam, 0 to 8% slopes	1,371.98	2.15	24.19%
Ln	Linden soils coarse silt loam, floodplain, 0-3% slopes	1,362.78	2.13	24.03%
LpB	Lordstown very stony silt loam, 3 to 8% slopes	17.99	0.09	0.32%
MaB	Mardin channery silt loam, 3 to 8% slopes	1,360.38	2.12	23.99%
Po	Pope soils	436.11	0.68	7.69%
WbB	Wellsboro channery silt loam, 3 to 8% slopes	906.50	1.41	15.98%
	Totals	5,671.61	8.86	100%

Table 5.4 - Prime Farmland Soils in the Towanda Creek Watershed

Soil Type	Soil Description	Acres	Miles²	% of PF Soils
AgB	Alton gravelly sandy loam, 0 to *% slope	2.12	0.00	0.03%
BaB	Braceville silt loam, 1 to 8% slopes	179.81	0.28	2.53%
CnB	Chenango gravelly loam, 1 to 8% slopes	2490.69	3.89	35.09%
Ln	Linden soils coarse silt loam, floodplain, 0 to 3% slopes	1987.89	3.11	28.01%
MaB	Mardin channery silt loam, 3 to 8% slopes	1734.22	2.71	24.44%
Po	Pope soils	524.68	0.82	7.39%
WeB	Wellsboro chanery loam, 3 to 8%	177.78	0.28	2.50%
	Totals	7,097.19	11.09	100.00%

Table 5.5 - Soils of Statewide Importance in the Sugar Creek Watershed

Soil Type	Description	Acres	Miles ²	% of SI Soils
LoC	Lordstown channery silt loam, 8 to 15% slopes	2,567.09	4.01	3.67%
MaC	Mardin channery silt loam, 8 to 15% slopes	3,238.43	5.06	4.63%
MoB	Morris channery silt loam, 3 to 8% slopes	9,108.70	14.24	13.03%

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MoC	Morris channery silt loam, 8 to 15% slopes	12,118.71	18.94	17.33%
OgC	Oquaga channery silt loam, 8 to 15% slopes	2,664.02	4.16	3.81%
ReA	Rexford silt loam, 0 to 3% slopes	357.76	0.56	0.51%
ReB	Rexford silt loam, 3 to 8% slopes	417.64	0.65	0.60%
ReC	Rexford silt loam, 8 to 12% slopes	292.07	0.46	0.42%
Uc	Udifuvents, cobbly	3,156.16	4.93	4.51%
UnB	Unadilla silt loam, 3 to 8% slopes	39.02	0.06	0.06%
VoB	Volusia channery silt loam, 3 to 8% slopes	14,092.05	22.02	20.14%
VoC	Volusia channery silt loam, 8 to 15% slopes	19,156.75	29.94	27.39%
WbC	Wellsboro channery silt loam, 8 to 15% slopes	2,645.63	4.13	3.78%
WmB	Wyoming gravelly sandy loam, 3 to 8% slopes	92.59	0.15	0.13%
	Totals	69,946.62	109.30	100%

Table 5.6 - Soils of Statewide Importance in the Towanda Creek Watershed

Soil Type	Soil Description	Acres	Miles²	% of SI Soils
LoC	Lordstown channery silt loam, 8 to 15% slopes	1790.70	2.80	2.78%
MaB	Mardin channery silt loam, 3 to 8% slopes	1734.22	2.71	2.69%
MaC	Mardin channery silt loam, 8 to 15% slopes	4007.40	6.26	6.23%
MoB	Morris channery silt loam, 3 to 8% slopes	7392.80	11.55	11.49%
MoC	Morris channery silt loam, 8 to 15% slopes	10920.69	17.06	16.97%
OgB	Oquaga channery silt loam, 3 to 8% slopes	2348.62	3.67	3.65%
OgC	Oquaga channery silt loam, 8 to 15% slopes	3153.01	4.93	4.90%
ReA	Rexford silt loam, 0 to 3% slopes	98.50	0.15	0.15%
ReB	Rexford silt loam, 3 to 8% slopes	435.19	0.68	0.68%
Uc	Udifuvents, cobbly	4666.68	7.29	7.25%
UnB	Unadilla silt loam, 3 to 8% slopes	82.38	0.13	0.13%
VoB	Volusia channery silt loam, 3 to 8% slopes	10226.48	15.98	15.89%
VoC	Volusia channery silt loam, 8 to 15% slopes	12908.79	20.17	20.06%
WbC	Wellsboro channery silt loam, 8 to 15% slopes	4095.28	6.40	6.36%
WmB	Wyoming gravelly sandy loam, 3 to 8% slopes	488.91	0.76	0.76%
	Totals	64,349.65	100.55	100.00%

Hydric soils have the ability to retain water for extended periods of time. These soils are critical components of wetlands. In the Sugar and Towanda Creek watershed region, these soils typically occur in bottomland areas, often within floodplains. Oftentimes, these soils are hydrologically connected to nearby surface waters.

While the number and extent of soils demonstrating hydric characteristics are listed in Table 5.7 and 5.8, the restrictive “fragipan” that exists with many of the other soils in the watershed can create saturated conditions in the top portions of the soil profiles that create hydric conditions in many areas of the landscape. These “inclusions” of hydric soil conditions on “non-hydric” soils create considerable pockets of wetland conditions.

Table 5.7 - Sugar Creek Watershed Hydric Soils

Soil Type	Description	Hydric Group	Acres	Miles²	% of Hydric Soils
CaA	Canadice silty clay loam, 0 to 3% slopes	D	316.92	0.50	8.01%
CpA	Chippewa silt loam, 0 to 3% slopes	D	1,089.03	1.70	27.41%
CpB	Chippewa silt loam, 3 to 8% slopes	D	2,438.18	3.81	61.40%
NoB	Norwich very stony silty loam 0 to 8% slopes	D	124.70	0.20	3.18%
Totals			3,968.83	6.21	100%

Table 5.8 - Towanda Creek Watershed Hydric Soils

Soil Type	Soil Description	Hydric Group	Acres	Miles²	% of Hydric Soils
Ao	Arnot channery loam,	D	110.83	0.17	1.32%
CaA	Canadice silty clay loam, 0 to 3% slopes	D	107.12	0.17	1.27%
CpA	Chippewa silt loam, 0 to 3% slopes	D	1701.56	2.66	20.19%
CpB	Chippewa silt loam, 3 to 8% slopes	D	1108.50	1.73	13.15%
Ho	Holly soils	D	2895.33	4.52	34.36%
Md	Medisaprists, ponded	D	526.58	0.82	6.25%
NoB	Norwich very stony silty loam, 0 to 8% slopes	D	1153.95	1.80	13.69%
ReA	Rexford silt loam, 0 to 3% slopes	D	98.50	0.15	1.17%
ReB	Rexford silt loam, 3 to 8% slopes	D	435.19	0.68	5.16%
ReC	Rexford silt loam, 8 to 12% slopes	D	289.28	0.45	3.43%
Totals			8426.84	13.17	100.00%

Table 5.9 - Sugar Creek Watershed Soils Containing Hydric Components

Soil Type	Description	Hydric Group	Acres	Miles²	%of Hydric Soils
ArC	Arnot very channery loam, rocky, 3 to 15% slopes	C	230.21	0.36	0.25%
AsD	Arnot-Rock outcrop complex, 3 to 25% slopes	C	73.60	0.12	0.08%
BaB	Braceville silt loam, 0 to 8% slopes	C	215.87	0.34	0.23%
LoB	Lordstown channery silt loam, 3 to 8% slopes	C	1,639.94	2.55	1.75%

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LoC	Lordstown channery silt loam, 8 to 15% slopes	C	2,567.09	4.01	2.75%
LoD	Lordstown channery silt loam, 15 to 25% slopes	C	2,413.55	3.77	2.58%
LpB	Lordstown very stony silt loam, 3 to 8% slopes	C	17.99	0.03	0.02%
LpD	Lordstown very stony silt loam, 8 to 25% slopes	C	587.93	0.92	0.63%
MaB	Mardin channery silt loam, 3 to 8% slopes	C	1,360.38	2.12	1.45%
MaC	Mardin channery silt loam, 8 to 15% slopes	C	3,238.43	5.06	3.47%
MaD	Mardin channery silt loam, 15 to 25% slopes	C	1,795.16	2.80	1.92%
MbB	Mardin very stony silt loam, 3 to 8% slopes	C	5.21	0.01	0.01%
MbD	Mardin very stony silt loam, 8 to 25% slopes	C	365.40	0.57	0.39%
MoB	Morris channery silt loam, 3 to 8% slopes	C	9,108.70	14.24	9.75%
MoC	Morris channery silt loam, 8 to 15% slopes	C	12,118.71	18.94	12.96%
MsB	Morris very stony silt loam, 3 to 8% slopes	C	928.13	1.45	0.99%
MsD	Morris very stony silty loam, 8 to 25% slopes	C	2,952.00	4.62	3.16%
OgB	Oquaga channery silt loam, 3 to 8% slopes	C	1,715.67	2.68	1.83%
OgC	Oquaga channery silt loam, 8 to 15% slopes	C	2,664.02	4.16	2.85%
OgD	Oquaga channery silt loam, 15 to 25% slopes	C	3,425.35	5.35	3.66%
OsB	Oquaga extremely stony silt loam, 3 to 8% slopes	C	150.22	0.24	0.16%
OsD	Oquaga extremely stony silt loam, 8 to 25% slopes	C	1,769.83	2.77	1.89%
ReA	Rexford silt loam, 0 to 3% slopes	C	357.76	0.56	0.38%
ReB	Rexford silt loam, 3 to 8% slopes	C	417.64	0.65	0.45%
ReC	Rexford silt loam, 8 to 12% slopes	C	292.07	0.46	0.31%
VoB	Volusia channery silt loam, 3 to 8% slopes	C	14,092.05	22.02	15.07%
VoC	Volusia channery silt loam, 8 to 15% slopes	C	19,156.75	29.94	20.49%
VoD	Volusia channery silt loam, 15 to 25% slopes	C	3,453.11	5.40	3.69%

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VsB	Volusia very stony silt loam, 3 to 8% slopes	C	116.00	0.18	0.12%
VsD	Volusia very stony silt loam, 8 to 25% slopes	C	133.12	0.21	0.14%
WbB	Wellsboro channery silt loam, 3 to 8% slopes	C	906.50	1.41	0.97%
WbC	Wellsboro channery silt loam, 8 to 15% slopes	C	2,645.63	4.13	2.83%
WbD	Wellsboro channery silt loam, 15 to 25% slopes	C	2,233.28	3.48	2.38%
WgB	Wellsboro very stony silt loam, 3 to 8% slopes	C	5.57	0.01	0.01%
WgD	Wellsboro very stony silt loam, 8 to 25% slopes	C	349.85	0.55	0.37%
Totals			93,502.72	146.11	100.00%

Table 5.10 - Towanda Creek Watershed Soils Containing Hydric Components

Soil Type	Soil Description	Hydric Group	Acres	Miles ²	Percent
BaB	Braceville silt loam, 1 to 8% slopes	C	179.81	0.28	0.19%
Ln	Linden soils coarse silt loam, floodplain, 0 to 3% slopes	C	1987.89	3.11	2.06%
MaB	Mardin channery silt loam, 3 to 8% slopes	C	1734.22	2.71	1.80%
MaC	Mardin channery silt loam, 8 to 15% slopes	C	4007.40	6.26	4.16%
MaD	Mardin channery silt loam, 15 to 25% slopes	C	1454.32	2.27	1.51%
MoB	Morris channery silt loam, 3 to 8% slopes	C	7392.80	11.55	7.68%
MoC	Morris channery silt loam, 8 to 15% slopes	C	10920.69	17.06	11.34%
MsB	Morris very stony silt loam, 3 to 8% slopes	C	9413.08	14.71	9.78%
MsD	Morris very stony silt loam, 8 to 25% slopes	C	4932.95	7.71	5.12%
Po	Pope soils	C	524.68	0.82	0.54%
Uc	Udifluvents, cobbly	C	4666.68	7.29	4.85%
Ud	Udorthents, very channery	C	306.70	0.48	0.32%
VoB	Volusia channery silt loam, 3 to 8% slopes	C	10226.48	15.98	10.62%
VoC	Volusia channery silt loam, 8 to 15% slopes	C	12908.79	20.17	13.41%
VoD	Volusia channery silt loam, 15 to 25% slopes	C	1109.11	1.73	1.15%

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VsD	Volusia very stony silt loam, 8 to 25% slopes	C	100.01	0.16	0.10%
WbB	Wellsboro channery silt loam, 3 to 8% slopes	C	3451.98	5.39	3.59%
WbC	Wellsboro channery silt loam, 8 to 15% slopes	C	4095.28	6.40	4.25%
WbD	Wellsboro channery silt loam, 15 to 25% slopes	C	1777.41	2.78	1.85%
WgB	Wellsboro very stony silt loam, 3 to 8% slopes	C	3939.58	6.16	4.09%
WgD	Wellsboro very stony silt loam, 8 to 25% slopes	C	8524.09	13.32	8.85%
WmB	Wyoming gravelly sandy loam, 3 to 8% slopes	C	488.91	0.76	0.51%
WmC	Wyoming gravelly sandy loam, 8 to 15% slopes	C	624.00	0.98	0.65%
WmD	Wyoming gravelly sandy loam, 15 to 25% slopes	C	810.49	1.27	0.84%
WmF	Wyoming gravelly sandy loam, 25 to 45% slopes	C	510.47	0.80	0.53%
WoC		C	191.14	0.30	0.20%
Totals			96278.96	150.44	100.00%

Limitations / Suitability

The variable terrain of Bradford County creates spectacular vistas of sculpted valleys and top-of-the-world views across the repetitious mountain ridges, as well as a variety of habitats for local wildlife.

The drainage patterns, bedrock material and vegetation have created deep soils on the shallow slopes of the valley lowlands. These deep soils, particularly those along Sugar and Towanda Creeks, as well as the Susquehanna River, are of great value for agriculture. These relatively flat lands are rich in minerals and are usually well drained by their depth.

Prime agricultural soils and soils of statewide importance are abundant in the watershed, as shown in Tables 5.3 and 5.4.

Where poorer soils are found on farmland, they are typically utilized for pasturelands and forestlands. Drainage is the most limiting factor in the agricultural quality of soils. County-wide, nearly 70 percent of the soils have drainage limitations, although some of these soils have other factors that make them suited for agricultural production.

A number of soils are particularly sensitive to disturbance and development. Soils found on steep slopes contribute sediment to surface waters under conditions of disturbance and pressure. Hydric soils are susceptible to compaction and uneven settling under the same conditions. Within the watersheds, there are no municipalities in Bradford County that regulate development on steep slopes.

Glacial outwash created sand and gravel deposits that support local mining operations. Such operations include large scale commercial quarries, as well as small scale extraction occurring on personal properties. Other mineral resources of value consist of flagstone, bluestone, natural gas, and coal.

The land resources in Bradford County support agriculture, forestry, mining, recreation and tourism. Ecologically, they utilize the land as productive open space—land with a permeable surface from which products are harvested or extracted with minimal infrastructure. These factors enable rain and snow to penetrate the surface and recharge the surface and groundwater and retain the connectedness of vegetation. Economically, these industries provide jobs and wages for individuals and families. Finally, these resources provide scenic and physically challenging features for recreationists and tourists.

Relationship Between Geology, Soils and Watershed Streams

Hydrologic function of a drainage basin is directly impacted by the characteristics of the indigenous geology and soils distributed across the watershed. Geologic composition and structure dictates soil type. Soil properties and composition have an impact on drainage, erosion, and stability. This impact is determined by the ability of a particular soil type to retain or drain water, as well as its erosion potential, acidity/buffering capacity and compactibility. The amount of sediment and resultant turbidity caused by erosion of exposed material is, in part, dependent upon these characteristics. Suspension of finer sediments, such as silt and clay, will generate proportionally higher turbidity and sedimentation levels than other larger, consolidated materials. A high turbidity level indicates a larger amount of finer suspended material. While this may not create high levels of abrasion and scour downstream, suspension of fines may increase siltation (AASHTO, 1992).

Soil types and local climate determine the type of vegetation that can most easily grow in the watershed, including crops and riparian buffers. Changes in vegetative cover or an increase in the amount of impervious cover in a watershed causes increased runoff and a greater peak discharge, which in turn increases streambed/streambank erosion and scour potential. The Pennsylvania Department of Agriculture has determined that the impervious area in a watershed increases by 5% for every one person per hectare (2.47 acres) of added population. Changes in land cover from a natural undisturbed condition to one of an urban setting that includes considerable impervious conditions can result in runoff rates to receiving stream increasing from 10% of the precipitation to over 60%.

The erodibility of soils within a watershed is an important component of streambank/channel stability or instability. Soils with a high erosion potential can be quite stable if adequate vegetation is present. When vegetative cover is altered or removed (often due to timbering, farming practices, or land development), erosion typically increases. (Soil Survey of Bradford and Sullivan Counties, Pennsylvania) DEP's water quality survey of Sugar/Towanda Creek and many of its major tributaries in July of 1984 reported erosion and sedimentation were more limiting factors for fisheries than nutrient enrichment. When asked what they felt were the most important issues facing Sugar/Towanda Creek Watershed, participants at the March 31, 1999 "Planning for Better Resource Management" workshop repeatedly identified erosion, deposition of gravel and flooding as their major concerns. These are directly related to the area's soils, geology and topography.

CHAPTER VI - WASTE MANAGEMENT and RECYCLING

The Pennsylvania Municipal Waste Planning, Recycling and Waste Reduction Act 101 of 1988, requires counties to develop formal plans for managing municipal wastes. Plans are subject to municipal ratification and approval from the PADEP. In accordance with the Act, each County must ensure 10 years of available disposal capacity and establish a post-closure care trust fund for landfills.

The Northern Tier Municipal Solid Waste Management Plan for Bradford, Sullivan and Tioga Counties was last updated in 2000 by the Northern Tier Solid Waste Authority (NTSWA) as per Act 101 requirements. The 2000 Plan contains information regarding NTSWA's operations and plans for solid waste collection, recycling and disposal. Elements from the 2000 Plan are summarized below:

Construction and Demolition Waste

There is very little recycling of construction and demolition waste at this time because the composition of such waste makes it difficult to remove materials from the waste stream. The NTSWA has purchased a "woodhog" to grind wood based waste.

Yard Waste

NTSWA disposal facilities are equipped to handle yard waste, yet very little is transported in the County due to backyard composting in rural areas and organized municipal operations. The NTSWA has investigated the need for composting sewage, septage sludge and yard waste, but a regional facility is not presently needed.

Bulk Items

Appliances, mattresses, furniture and other non-recyclable materials are considered as municipal waste and disposed at appropriate facilities. Metal objects are not sent to landfills, but rather to brokers or recyclers. NTSWA has trained staff to remove Freon gas from refrigerators and similar appliances prior to recycling.

Hazardous Waste

Hazardous waste generated by major industries, is not covered under the Northern Tier Solid Waste Management Plan and the NTSWA does not accept hazardous waste for disposal. It is the responsibility of the entity generating such waste to properly collect, store, transport and dispose of such waste. Household hazardous waste is considered part of the municipal waste stream and sent for reclamation or

recycling and therefore, not accepted at the County's landfill. This waste is handled on a case-by-case basis.

Sewage and Septage Waste

Bradford County residents rely predominately upon on-lot septic systems for the management and treatment of home septage. The 2002 Census records show that of the 29,055 housing units in the County at the time, 20,193 houses were utilizing on-lot systems. These households produce an estimated 20,193,000 gallons of septage annually.

Bradford County adopted a comprehensive septage management plan for the County. Funded under a PA Dept. of Environmental Protection, Water Quality Planning, Section 604B, grant, the County evaluated the economic and environmental need and impact of various septage management option. These options included: landfilling; increasing the capacity of present waste water facilities; composting; mine reclamation utilization; land application; trucking to waste water facilities in Williamsport and Wilkes Barre; development of specialized waste water facilities; wetland/composting; incineration; or no changes to current management. Through the evaluation of options and input from a series of public meetings, the option of land application was overwhelmingly adopted.

The strategy called for increased public education on the maintenance of on-lot septic systems as well as securing sites for utilization of the septage bio-solids. The plan called for the equivalent of 12 average sized farms for the adequate land utilization and treatment of all County-produced septage. To date, one demonstration farm has been successfully developed in the eastern part of the County. Land application of septage, both agricultural and forested, may prove to be more cost effective, as well as environmentally appealing, as both water quality standards and costs rise.

The NTSWA Leachate Treatment Facility accepts only a fraction of septage sludge from the area, but has capacity to treat much more. Due to soil conditions and cost factors there is little land application of this material at this time.

Special Handling Waste

Asbestos and contaminated soils are considered as special handling wastes. Generators of such waste must submit proper DEP documentation prior to any acceptance at a NTSWA facility. Infectious, pathological and chemotherapeutic wastes are not accepted for disposal at NTSWA facilities.

Agricultural wastes and other associated hazardous wastes have relied on the State's "ChemSweep" Program in the past.

Recycling

The NTSWA operates the Recycling Plus Program as part of its waste management. The NTSWA conducts much of the collection, storage, processing and transport of materials in the County.

As mandated by Act 101 the State's recycling goal has been increased to 35 percent for 2003. In 1998 Bradford County exceeded the previous State goal of 25 percent by recycling approximately 27 percent of its waste stream. This total increased to 29.4 percent in 1999 and 31 percent in 2000. The NTSWA anticipates that Bradford County will be able to achieve the 35 percent goal.

Currently, all municipalities within the watershed recycle on a volunteer basis relating to Act 101 requirements. Presently, curbside recycling is conducted in:

- ⇒ Canton Borough
- ⇒ Columbia Township
- ⇒ Monroe Borough
- ⇒ Springfield Township
- ⇒ Towanda Borough
- ⇒ Troy Borough
- ⇒ Troy Township

Bradford County Landfill

The NTSWA's Landfill #2 is located on an 88-acre tract of land along U.S. Route 6 in West Burlington Township, approximately nine miles east of Troy. The landfill accepts waste Monday through Friday from 8:00 am to 4:00 pm and Saturdays from 8:00 am to noon. Permit conditions allow for 46.3 acres of disposal area as a double-lined municipal solid waste landfill. Remaining acreage is for support services and operation.

The landfill receives approximately 295 tons of waste per day. A maximum of 750 tons per day can be accepted, but average tons per day cannot exceed 500 tons under permit requirements. Wastes accepted at the facility include municipal waste, residual waste, asbestos contaminated waste, contaminated soil and sewage sludge. Leachate treatment, landfill gas and tire shredding operations are conducted on site. In addition, the landfill also produces and sells methane gas as part of their operations. Waste received from outside the NTSWA service area is limited to 10 percent of the total amount of all solid waste generated in Bradford, Tioga and Sullivan Counties on a yearly basis. It is estimated that the remaining life of the landfill is at least 20 years.

Private Waste Facilities

Three private-owned salvage yards recycle metal materials in Bradford County. These include Towanda Iron and Metal in Towanda; Strobe's Salvage Yard in North

Towanda; and Schill's Salvage in Burlington. Towanda Iron and Metal also accepts plastics and paper.

Hazard Areas

As of 6/30/04, EPA's STORET lists the Towanda Dupont facility as being under a RCRA permit for the storage of hazardous waste and a Corrective Action Permit to investigate and define contamination. "On the basis of this investigation, Dupont has found groundwater contamination in 2 areas. The groundwater in both areas is closely monitored and is contained on-site. The groundwater does not pose a risk because the groundwater is not used for drinking water and geologic conditions are preventing the plume from expanding. There is also evidence that the plume is degrading due to the action of naturally occurring microbes. EPA is in the process of using the available information to propose a Final Remedy for the facility."

The Dupont plant occupies a 51-acre parcel of land on the northern side of Towanda, PA and borders Sugar Creek. This facility has been in operation since the early 1940s and is a manufacturing site for x-ray screens, coated films, and wet-processing solutions. In these processes, Dupont used various chlorinated solvents and methylene chloride. These substances have been found in the groundwater at two locations at the facility. In one area the groundwater is contaminated with methylene chloride, possibly from a storage tank which has been removed. In 1994, Dupont found methylene chloride contaminated groundwater seeping into Sugar Creek and quickly built a system to intercept and treat it. From 1995 to 1996, Dupont stopped using methylene chloride in their manufacturing processes. Since that time, Dupont shut down the recovery system and is monitoring the contaminated groundwater. The contamination remains on-site and is not spreading.

In the second location, Dupont has been monitoring, and continues to monitor, groundwater contaminated with chlorinated solvents and their breakdown products. The presence of breakdown products shows that natural processes are degrading the solvents. In neither case is the contamination moving off-site nor posing a threat to human health or the environment.

RCRA Corrective Action activities at the Dupont-Towanda facility are being conducted under the direction of EPA with assistance from PADEP. EPA is working on a Statement of Basis and Proposed Permit Modification for a Final remedy. When these documents are ready, EPA will solicit comments from the public on the proposed final remedy.

Mines & Quarries

Historically, the southern range of the Towanda Creek watershed, or the Schrader Creek portion, has experienced extensive coal mining. Early mines were hand dug deep mines, many of which were later strip mined from the surface. A few sand and gravel mines exist in the watershed area to a limited degree.

CHAPTER VII - WATER RESOURCES

Hydrology

Hydrology deals with the quantity of water delivered to a selected outlet and the watershed characteristics that influence it. Broad scope concepts of hydrology include the origin of water (ground or surface water), its circulation (precipitation, evaporation, interception, infiltration etc.) and its distribution (rainfall intensity, storm localization, stream channels, etc). The understanding of hydrology is crucial in dealing with a number of environmental and socioeconomic concerns within the watershed. These issues may deal with bank and channel instabilities as well as flooding and water consumption. Hydrology is also important to the comprehension of fluvial processes and the quality of aquatic habitat.

Management of water resources requires knowledge of the quantity of water that is available for use and which must be managed in order to provide for the safety and welfare of the public. For studies of water use and quality, low flow conditions are of general concern, whereas for flood management, it is necessary to know the high flow characteristics of streams. Hydrologic factors discussed in this section include main stream systems, annual basin runoff, low flows, and flooding.

Hydrology in the watershed, with its locality in the Allegheny Mountain physiographic province within the Appalachian Plateau, is controlled predominantly by storm generated precipitation. The average rainfall for this boundary within the Sugar/Towanda Creek watershed is 34 inches annually. Ambient watershed characteristics influencing hydrology, specifically runoff response, include: geology; soils; slope and land cover.

Runoff also has a distinct seasonal variation, with the period with the highest percentage of runoff occurring in late winter or early spring, and the period of lowest runoff percentage occurring in late summer and early fall. The seasonality of evapo-transpiration accounts for a portion of this variation. Other influences include snowmelt, spring rains, saturated soils, frozen ground, etc.

Low flow conditions develop after prolonged periods of little or no precipitation and persist until sufficient rainfall relieves the situation. Flow deficiencies of significant duration may cause new water supply problems and may magnify existing water quality problems. Oftentimes, low flow conditions are attributed to the overall lack of infiltration and percolation of precipitation throughout the watershed. Although floods occur in all seasons, studies of the relations among storm intensity, duration, affected area, and seasonality suggest a tendency for flooding of principal streams to occur in winter and flooding on small streams to occur in summer. Large area floods are caused by storms of low rainfall intensity and long duration covering the entire area of principal watersheds. Small area floods, on the other hand, are caused by storms of high rainfall intensity and relatively short duration. An exception to this is tropical

storms that normally occur during the summer months and cause extensive flooding over large areas.

Generally speaking, the runoff generated from the glaciated areas in the northern part of the State, including Sugar and Towanda Creeks, is higher than the average for the whole State. Subsequently, the sustained low flows are frequently below average in this region and high flows return at a higher frequency. Much of this deviation from State averages is attributed to the fragipan dominated coverage contained within the soil column. This restrictive zone, often within 12 inches of the soil surface, prevents infiltration thus increasing runoff and restricting groundwater recharge, which is critical for base flow. Additionally, this restrictive layer, composed of clay soils, creates wetland conditions wherever depressions exist in the landscape.

Tributaries & Drainage Areas

Sugar Creek

There are 285.88 miles of streams within the watershed, including 21 named tributaries and numerous unnamed tributaries, wetlands, farm ponds, and small glacial lakes. The named tributaries are: Bailey Run, Brace Creek, Browns Creek, Canfield Run, Deerlick Run, Fall Brook, Leonard Creek, Mill Creek, Morgan Creek, Mud Creek, North Branch Sugar Creek, Peas Creek, Pisgah Creek, Pond Run, Spring Creek, South Fork, Tomjack Creek, Wallace Run, West Branch Sugar Creek, West Branch Tomjack Creek, and Wolfe Creek.

Sugar Creek watershed consists of 23 major sub-basins. Each of these sub-basins drains a significant portion of the watershed area. Drainage areas for each are listed as follows:

Table 7.1 – Sugar Creek Sub-Basins

Sugar Creek Sub-Basins	Area (mi²)	% of Watershed	Stream Mi
Bailey Run	8.47	4.50	15.76
Brace Creek	4.84	2.60	10.35
Browns Creek	15.55	8.20	22.62
Canfield Run	2.23	1.20	4.07
Deerlick Run	1.22	.65	2.05
Fall Brook	2.97	1.60	4.64
Leonard Creek	11.44	6.00	17.28
Mill Creek	12.94	6.80	16.28
Morgan Creek	1.80	.95	2.42
Mud Creek	5.57	2.90	9.02
North Branch Sugar Creek	22.58	11.90	32.77

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Peas Creek	2.66	1.40	3.53
Pisgah Creek	1.58	.84	1.72
Pond Run	1.38	.73	2.09
South Branch Sugar Creek	6.62	3.50	13.03
Slater Hollow	.40	.21	.88
Sugar Creek	47.03	24.90	71.75
Tomjack Creek	13.52	7.10	20.02
Van Horn Glen Run	1.55	.82	1.58
Wallace Run	4.55	2.40	5.83
West Branch Sugar Creek	4.74	2.50	6.41
West Branch Tomjack Creek	10.87	5.70	15.99
Wolfe Creek	4.55	2.40	5.79
Totals	189.06	100.00	285.88

Towanda Creek

There are 539.78 miles of streams within the Towanda Creek watershed, including 40 named tributaries, likewise having many unnamed tributaries, wetlands, and other lesser water features. The major tributaries are: South Branch Towanda Creek, Towanda Creek (4 main branches), North Branch Towanda Creek, and Schrader Creek.

Towanda Creek watershed consists of 40 distinct sub-basins. Each of these sub-basins drains a significant portion of the watershed area. Drainage areas for each are listed as follows:

Table 7.2 – Towanda Creek Sub-Basins

Towanda Creek Sub-Basins	Acres	Area (mi²)	% of Watershed	Stream Miles
DEEP HOLLOW	2760.90	4.31	1.57	7.42
WILLIAMS HOLLOW	1118.01	1.75	0.63	3.13
ALBA CREEK	8228.05	12.86	4.67	28.06
BEAVER RUN	2265.99	3.54	1.29	5.99
BEECH FLATS CREEK	2652.68	4.14	1.51	9.03
BOWMAN CREEK	3337.86	5.22	1.89	8.93
BULL RUN	675.74	1.06	0.38	1.82
CABIN RUN	415.89	0.65	0.24	1.16
CARBON RUN	2116.36	3.31	1.20	4.74
CHILSON RUN	889.13	1.39	0.50	2.13
COAL RUN	1435.01	2.24	0.81	3.36
FALLS CREEK	1429.28	2.23	0.81	4.02
FENNER RUN	582.65	0.91	0.33	1.46
FRENCH CREEK	1312.00	2.05	0.74	4.39
FRENCH RUN	2923.39	4.57	1.66	9.75
GULF BROOK	1432.79	2.24	0.81	4.68

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KENT RUN	2290.58	3.58	1.30	6.47
LADDS CREEK	2442.37	3.82	1.39	8.45
LITTLE SCHRADER CREEK	2932.03	4.58	1.66	8.28
LONG VALLEY RUN	2037.08	3.18	1.16	5.74
LYE RUN	1651.54	2.58	0.94	5.98
MARSH RUN	655.98	1.02	0.37	0.8
MCCRANEY RUN	756.93	1.18	0.43	1.55
MILL CREEK	2493.76	3.90	1.42	7.17
MILLSTONE CREEK	5872.56	9.18	3.33	16.88
NATES RUN	835.51	1.31	0.47	3.01
NORTH BRANCH TOWANDA CREEK	17799.24	27.81	10.10	57.37
PINE SWAMP RUN	2363.91	3.69	1.34	6.37
PREACHER BROOK	5204.13	8.13	2.95	16.1
ROLLINSON RUN	1521.27	2.38	0.86	5.82
SATTERLEE RUN	3202.63	5.00	1.82	8.15
SCHRADER CREEK	18425.19	28.79	10.46	48.95
SOUTH BRANCH TOWANDA CREEK	15836.42	24.74	8.99	45.25
SUGAR RUN	3985.39	6.23	2.26	9.52
SWAMP RUN	221.53	0.35	0.13	0.75
THOMAS RUN	801.23	1.25	0.45	2.98
TOWANDA CREEK	48051.90	75.08	27.27	164.56
TURNIP PATCH RUN	236.93	0.37	0.13	0.62
WALLACE BROOK	2408.24	3.76	1.37	6.82
WOLF RUN	604.37	0.94	0.34	2.12
Totals	176206.45	275.32	100.00	539.78

Stream Order

Stream order classification is a method of naming (or numbering) a stream by its relative watershed location. Numbering starts with a 1st order stream, a stream without tributary inputs. At the intersection of two 1st order streams, the corresponding stream is labeled 2nd order (confluence of two 2nd orders returns a 3rd, etc.) Using this stream order classification system (established by Strahler in 1952) Sugar Creek Watershed has 162.44 miles of first order streams (56.74% of total stream miles), 69.95 miles of second order streams (24.43% of total), 30.40 miles of third order streams (10.62% of total), and 23.49 miles of fourth order streams (8.21% of total). The Fisheries Management Report prepared December 2000 by the Pennsylvania Fish and Boat Commission lists the stream order hierarchy for the Sugar Creek Basin (404C).

Using the same stream order classification system for the Towanda Creek Watershed, there are 314 miles of 1st order, 112.6 miles of 2nd order, 47.1 miles of 3rd order, 39.7 miles of 4th order and 25.59 miles of 5th order streams.

Wetlands

Wetlands are protected under federal and state law. Nationwide, wetlands are federally regulated under Section 404 of the Clean Water Act. In addition, the State of Pennsylvania regulates wetlands through the Dept. of Environmental Protection, under Title 25, Chapter 105 of the Pennsylvania Code as mentioned in the Streams, Rivers, and Lakes Section. Federal regulations fall under the jurisdiction of the United States Army Corps of Engineers (USACOE).

Wetlands are defined as those areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, including swamps, marshes, bogs and similar areas (U.S. Army Corps of Engineers Wetlands Delineation Manual, 1987). As described previously, many of the soil conditions with their restrictive “fragipans” encourage the formation of many small isolated wetlands throughout the watershed area. Wetlands provide a number of useful benefits including:

- ⇒ Provide water retention areas that mitigate the effects of flood and drought by storing water and releasing it at rates lower than the surrounding xeric landscape,
- ⇒ Act as buffer areas that reduce water velocities during high flows, reducing the erosion potential of high flow events,
- ⇒ Provide valuable habitat for a myriad of organisms, many of which are currently threatened or endangered,
- ⇒ Provide spawning and nesting habitat for wildlife, including migratory birds, fish, and amphibians,
- ⇒ Act as natural filtration systems, efficiently removing many harmful pollutants such as chemicals, excess nutrients, and sediments from both groundwater and surface waters,
- ⇒ Provide a multitude of recreational opportunities, such as boating, fishing, hunting, and wildlife watching, and
- ⇒ Help decrease the need for costly stormwater and flood protection facilities.

Wetland Inventories

A National Wetlands Inventory (NWI), prepared by the United States Department of the Interior – Fish and Wildlife Service (USFWS), identifies the location of major wetland areas nationwide. It is important to note that smaller, isolated wetland areas

are often not included. The Soil Survey of Bradford and Sullivan Counties, Pennsylvania is also an important tool for remote identification as it lists areas of hydric or wetland soils.

SUGAR CREEK

Within the Sugar Creek watershed, identified wetland units cover 3,617.86 acres (5.65 square miles). NWI wetlands account for 2.99% of the Sugar Creek Watershed. Soil studies indicate 6.207 sq mi. or 3.29% of the area in Sugar Creek Watershed have hydric soils.

TOWANDA CREEK

Within the Towanda Creek watershed, identified wetland units cover 4,285 acres (6.69 square miles). NWI wetlands account for 2.37% of the Towanda Creek Watershed. Soil studies indicate 13.17 sq mi. or 4.66% of the area in Towanda Creek Watershed have hydric soils.

The Bradford County Natural Areas Inventory noted that the high plateau in the southern region of the County (Towanda Creek Watershed) is “one of the highest quality natural areas in the State,” and that the County “accounts for a disproportionate share of the State’s wetlands.” Despite its upland location, this region contains extensive wetlands, seeps, rock outcrops, and waterfalls due to its glaciated history and retains these features under an almost contiguous forest cover.

Landowners have enrolled more than 86 acres in the NRCS Wetland Reserve Program. This voluntary program offers landowners the opportunity to protect, restore, and enhance wetlands on their property through long-term conservation and wildlife practices.

Lakes & Ponds

Stephen Foster Lake – Mt. Pisgah State Park

Stephen Foster Lake is located within Mt. Pisgah State Park in the northern mountain region of Bradford County, Pennsylvania. The lake was created in 1977 through the construction of a 46-foot-high earth and rock hill dam across Mill Creek (tributary to Sugar Creek), encompasses 70 acres, and has an average depth of 10.5 feet. Stephen Foster Lake offers numerous recreational opportunities to its nearly 150,000 annual visitors. It is a popular boating spot and has a reputation as one of the best bass and panfish fisheries among the Pennsylvania State Parks. More than half of the surrounding 6,577-acre watershed is used for agriculture; the remainder is predominantly forested. Over time, Mill Creek has supplied excess sediment and

nutrients to the lake, creating anoxic conditions. Large, unsightly algae blooms have, at times, reduced the amount of oxygen available to aquatic organisms, including the fish species that attract visitors. As a result, in 1996 the Pennsylvania Department of Environmental Protection (PADEP) added Stephen Foster Lake to the State's list of impaired waters for nutrient and sediment runoff due to agricultural activities. The lake will not meet its designated recreational uses until the algae blooms no longer manifest and the Trophic State Index values are closer to 60 than to 70. In 1996, through the Bradford County Conservation District (BCCD), Coastal Environmental Services completed a Clean Lakes Study of Stephen Foster Lake. In the spring of 2001, the PADEP established a Total Maximum Daily Load (TMDL) for the lake that called for reductions of 49 percent for phosphorus and 52 percent for sediment. All the information used for the TMDL computations was taken from the Clean Lakes Study.

Bradford County Conservation District, its partner agencies, and the farming community worked diligently to address nonpoint source pollution issues in the watershed. In May 1993 EPA awarded BCCD a Clean Lakes Program grant to study potential nonpoint source controls and demonstrate the benefits of implementing best management practices (BMPs). By 2004, eleven of the thirteen farms in the watershed had fully implemented agricultural BMPs. Upstream of the lake, farmers and the BCCD installed 9 miles of stream fencing and an alternative water supply system to help prevent cattle from wandering into waterways. They also constructed agricultural crossings to swiftly move cattle across streams and prevent the animals from grazing near waterways and destroying streambanks. Project partners also built 11 systems to store and treat animal waste, planted riparian buffers, and restored 2,500 feet of stream channel. Finally, they stabilized a box culvert outlet to reduce further erosion and sedimentation into the stream. Following BMP implementation, PADEP conducted biological monitoring and analysis of Mill Creek's benthic communities. By 2005, data showed improvements in biological conditions in the stream. With the sources of pollution into the lake effectively addressed, more attention could be paid to the lake itself.

Preliminary lake water quality data following BMP implementation reflected slight decreases in the levels of total phosphorus and total suspended solids. Trophic State Index (TSI) values are calculated based on seasonal means of chlorophyll *a*, total phosphorus, and Secchi disc transparency. TSI values are used to compare lakes within a region and to assess changes in the productivity level of a lake over time. Although results show a decrease in TSI values, representing improvements in water quality, more substantial lake water quality improvements are needed. Further improvements are expected to emerge slowly, however, because of the large residual amounts of legacy sediment that release phosphorus during seasonal periods of low dissolved oxygen. Additional in-lake treatments are being researched to treat the phosphorus-laden sediment at the bottom of the lake. Recently, additional Section 319 funding was awarded to help achieve water quality goals by implementing an in-lake treatment, such as aeration or an alum treatment, by 2009.

Other Significant Lakes / Ponds

<u>Lake Name</u>	<u>Township Location</u>	<u>Storage (mil. gal.)</u>	<u>Surface (acres)</u>	<u>Drainage (m²)</u>
Lake Nephawin	Canton Township	90	28	.6
Sunfish Pond	Leroy Township	?	35	.26
Mountain Lake	Burlington Township	?	38	1.9
Mud Lake	Leroy	68	30	.3
Tennessee Gas	Troy	26	8	.9

Floodplains

Floodplains are areas adjacent to streams which would potentially become inundated due to an increase in water surface elevation, namely as a result of precipitation events. Floodplains are critical in the dissipation of flow energy during high water events. As flowing water begins to inundate, the floodplain energy is lost as a result of increased roughness and alteration of the width/depth regime. This in turn reduces velocity and lowers the potential erosive effect of the high water event. Floodplain areas also increase the storage capacity of the basin, helping to maintain channel stability.

As with wetlands, vegetated floodplain areas promote storage within the drainage basin, thereby increasing the retention of a greater volume of floodwater. Retention of floodwaters within the floodplain reduces peak discharges by lengthening the time to peak runoff. This helps to reduce flood velocities, mitigating stream erosion and runoff hazards. Removal of floodplain vegetation decreases the storage potential of these floodplain areas, which in turn decreases time to peak discharge, and increases runoff volume, thereby increasing the likelihood of downstream flooding. Loss of riparian or floodplain vegetation also increases the instability of stream banks and often results in increased rates of channel migration.

Floodplain effectiveness is also compromised by longitudinal or transverse encroachment. Longitudinal encroachment occurs when roadway fill, buildings, or other structures encroach upon the floodplain parallel to the stream channel. This encroachment may reduce or constrict the flood carrying capacity of the floodplain and/or channel that can result in higher velocities and/or an increase in upstream flood elevations. Transverse encroachment occurs when fill or structures encroach or span the floodplain perpendicular to the stream channel, such as bridges or culverts. This type of encroachment eliminates floodplain access during high flow events, and increases scour and degradation by forcing the increased volume of water through a smaller opening, increasing its velocity. This may also increase upstream flooding due to backwater effects caused by the encroachment.

In the **Sugar Creek** watershed, identified floodplains (for a 100–year flood event) account for 6,429.39 acres, or 10.05 square miles. Hundred–year floodplains comprise 4.4% of the total watershed area.

In the **Towanda Creek** watershed, identified floodplains (for a 100–year flood event) account for 7,335 acres, or 11.46 square miles. Hundred–year floodplains comprise 4.06% of the total watershed area.

Riparian Areas

Riparian areas, those transitional areas between aquatic and upland ecologies, such as floodplains and wetlands, provide critical ecological functions and serve economic and community interests. They offer unique habitat for flora and fauna, as well as intriguing sites for passive recreation. They also provide critical water storage and recharge areas in times of flooding, preventing downstream flood damage.

The primary protection of the watersheds' riparian resources is the responsibility of the local municipalities. Currently, all municipalities within the watersheds have adopted floodplain ordinances to protect the 100-year floodplain from inappropriate development.

Today, landowners have enrolled more than 17,000 acres in the NRCS Conservation Reserve Enhancement Program; with contributions from PA Game Commission. This voluntary program offers landowners the opportunity to protect, restore, and enhance streams and waterways on their property through term conservation and wildlife practices.

Water Quality Standards, Designations & Protected Use

What is a water quality standard?

The Clean Water Act sets a national minimum goal that all waters be “fishable” and “swimmable.” To support this goal, states must adopt water quality standards, which are state regulations that have two components. The first component is a designated use, such as “warm water fishes” or “recreation.” States must assign a use, or several uses, to each of their waters. In PA this is accomplished through Title 25, Chapter 93 which identifies water quality standards for specific stream segments throughout the State. The second component relates to the in-stream conditions necessary to protect the designated use(s). These conditions or “criteria” are physical, chemical, or biological characteristics, such as temperature, minimum levels of dissolved oxygen, and maximum concentrations of toxic pollutants.

It is the combination of the “designated use” and the “criteria” to support that use that make up a water quality standard. If any criteria are being exceeded, then the use is not being met and the water is said to be impaired.

What is a TMDL?

A Total Maximum Daily Load (TMDL) sets a limit on the pollutant loads that can enter a water body so the water body will meet established water quality standards. The Clean Water Act requires states to assess streams and water bodies and compile a list of all waters that do not meet their water quality standards even after pollution controls required by law are in place, commonly referred to as the 303(d) list, which refers back to the specific section in the Federal Clean Water Act. For these waters, the state must calculate how much of a substance can be put in the water without violating the water quality standard and distribute that quantity to all the sources of the pollutant on that water body. A TMDL plan may include load allocations for sources of pollution being discharged from treatment ponds on active mining operations, pollution load allocations for sources of abandoned mine drainage, and a margin of safety.

The Clean Water Act requires states to submit their TMDLs to EPA for approval. If a state does not develop the TMDL, the Clean Water Act states that the EPA must do so.

The quality of the surface waters in Bradford County is assessed by PA DEP. The 2004 Pennsylvania Integrated Water Quality Monitoring and Assessment Report categorizes water bodies according to the extent to which their quality is adequate to meet all designated uses. The categorization scheme is expressed in some detail in the listing below. The categorization of the Sugar/Towanda Creek Watershed water bodies is as follows:

Category 1 – The water body meets all of its designated uses.

- ⇒ None in the Watershed.

Category 2 – The water body meets some of the designated uses (typically aquatic habitat).

- ⇒ Most water bodies in the Watershed fall in this category.

Category 3 -- There is insufficient data at the time of DEP's report to make a conclusive assessment.

- ⇒ Long Valley Run (Towanda Creek), Schrader Creek, South Branch of Towanda Creek, the main stem of Towanda Creek.

Category 4a – The water body is impaired for one or more designated uses but does not require a TMDL because one has been completed.

- ⇒ The 75-acre Stephen Foster Lake is impaired by excess nutrient and sediment loading; the lake was listed in 1996 and its TMDL approved in 2001.

Category 4b - The water body is impaired for one or more designated uses but does not require a TMDL because it is expected to meet all designated uses within a reasonable timeframe).

- ⇒ None in the Watershed.

Category 4c. The water body is impaired for one or more designated uses but does not require a TMDL because its impairment is not caused by a pollutant.

⇒ None in the Watershed.

Category 5 – The water body is in the process of TMDL development

- ⇒ 3.4 miles of Coal Run (Towanda Creek), impaired by abandoned mine drainage/pH; a TMDL is required by 2015.
- ⇒ 1.6 miles of Long Valley Run (Schrader Creek, Towanda Creek), impaired by abandoned mine drainage/pH from underground coal mining began in the watershed around the 1820s. This run was recognized to be impacted by AMD by the Pennsylvania Fish Commission as early as 1931. The run's swampy headwaters contribute an additional tendency toward acidity and lend little buffering to acidic inputs from AMD. A TMDL was approved in 2004 prior to the 2005 target date.
- ⇒ 6.9 miles of Sugar Creek, impaired by mercury from unknown sources; a TMDL is required by 2011.
- ⇒ 6.6 miles of Towanda Creek, also impaired by mercury from unknown sources; a TMDL is required by 2011.
- ⇒ The 35-acre Sunfish Pond, impaired by atmospheric deposition/mercury; a TMDL is to be established by 2015.

Classifications used in the 2004 Pennsylvania Integrated Water Quality Monitoring and Assessment Report:

Category 1: Waters attaining all designated uses.

Category 2: Waters where some, but not all, designated uses are met. Attainment status of the remaining designated uses is unknown because data are insufficient to categorize a water consistent with the State's listing methodology.

Category 3: Waters for which there are insufficient or no data and information to determine, consistent with the State's listing methodology, if designated uses are met.

Category 4: Waters impaired for one or more designated use but not needing a TMDL.

Category 4A: TMDL has been completed.

Category 4B: Expected to meet all designated uses within a reasonable timeframe.

Category 4C: Not impaired by a pollutant.

Category 5: Waters impaired for one or more designated uses by any pollutant.

Category 5 includes waters shown to be impaired as the result of biological assessments used to evaluate aquatic life use even if the specific pollutant is not known unless the State can demonstrate that non-pollutant stressors cause the impairment or that no pollutant(s) cause or contribute to the impairment. Category 5 constitutes the Section 303(d) list that EPA will approve or disapprove under the CWA. Where more than one pollutant is causing the impairment, the water remains in Category 5 until all pollutants are addressed in a completed/EPA-approved TMDL or one of the delisting factors is satisfied.

--PA Department of Environmental Resources

TMDLs have recently been established by the PA DEP for Long Valley Run, Towanda Creek Watershed. These water quality standards prescribe maximum inputs of manganese and acidity to the water. A vertical flow AMD passive treatment system, constructed in 1997, has helped improve water quality by elevating pH levels and reducing levels of iron and aluminum.

TMDLs have also been established for Stephen Foster Lake at Mount Pisgah State Park, Sugar Creek Watershed. Water quality concerns include excessive algae growth, low hypolimnetic (bottom water) dissolved oxygen concentrations and localized sedimentation. According to the TMDL report, “algal blooms have occurred in the lake since shortly after construction of the impoundment. The blooms have increased in recent years, limiting the recreational use of the lake. Siltation is a concern near the lake inlet. There are no point source discharges in the Stephen Foster Lake watershed.” A land use analysis indicated that cultivated fields were the predominant source of phosphorus and nitrogen, although, pasture and forest lands were also significant contributors. Developed areas, as well as the resource production areas were deemed to be major sources of sediment.

Designated & Protected Uses

(Title 25, Chapter 93 of the Pennsylvania Codes)

Table 7.3 - PA DEP Designated/Protected Water Uses In the Sugar & Towanda Creek Watersheds

Stream	Zone	Water Uses Protected
Sugar Creek Watershed		
Sugar Creek	Basin, Tomjack Creek to Mouth	WWF
Tomjack Creek	Basin	TSF
Towanda Creek Watershed		
Towanda Creek	Basin, Source to Canton Borough	CWF
Towanda Creek	Main Stem, Canton Borough to South Branch	TSF
Towanda Creek	Main Stem, South Branch to Mouth	WWF
Alba Creek	Basin	CWF
Coal Run	Basin	HQ-CWF
Mill Creek	Basin	CWF
North Branch Towanda Creek	Basin	CWF
Preacher Brook	Basin	CWF
Schrader Creek	Basin, Source to Coal Run	EV
Schrader Creek	Basin, Coal Run to Mouth	HQ-CWF
South Branch Towanda Creek	Basin	CWF
Unnamed Tributaries	Basins, Canton Borough to South Branch	CWF
Unnamed Tributaries	Basins, South Branch to Mouth	CWF

CWF *Cold Water Fishes*—Maintenance or propagation, or both, of fish species including the family Salmonidae and additional flora and fauna which are indigenous to a cold water habitat.

WWF *Warm Water Fishes*—Maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.

TSF *Trout Stocking*—Maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.

Special Protection

HQ High Quality Waters

EV Exceptional Value Waters

Source: The Pennsylvania Code (93.3 Protected Water Uses)

SUGAR CREEK

The 23 major sub-basins of Sugar Creek Watershed account for 285.88 miles of stream. Of these, the entire Sugar Creek basin from the mouth of Tomjack Creek downstream to the confluence with the Susquehanna River is designated as a warm water fishery (WWF), accounting for 71.14 stream miles. The Pennsylvania Department of Environmental Protection (PA DEP) designates Warm Water Fisheries as waters supporting conditions suitable to the maintenance and propagation of fish species and additional flora and fauna that are indigenous to a warm water habitat. The Sugar Creek basin from the headwaters downstream to the mouth of Tomjack Creek, including Tomjack Creek, is designated as TSF (Trout Stocked Fishery). This area accounts for 168.22 stream miles. TSF designation simply signifies that conditions exist to provide a recreational fishery sustained by periodic trout stockings. Currently, approximately 7.62 miles of Sugar Creek are stocked with trout by the Pennsylvania Fish and Boat Commission.

Sugar Creek North Branch (mouth upstream to fairgrounds) and Sugar Creek (East Troy to confluence of South Branch of Sugar Creek) are officially classified as "approved trout waters", which means they meet criteria qualifying them to be stocked with trout by the Fish & Boat Commission. No streams have been designated as Wild Trout waters, nor have any been found to support natural trout reproduction.

TOWANDA CREEK

The upper portion of the Schrader Creek basin, from the headwaters to the confluence with Coal Run, is designated as an Exceptional Value (EV) watershed. This area accounts for 44.8 mi.², 55% of the Schrader Creek basin and 16.3% of the entire Towanda Creek watershed. There are 80.8 miles of stream in this EV watershed. The lower portion of the basin (from the confluence of Schrader Creek and Coal Run to the mouth of Schrader Creek) is designated as a High Quality – Cold Water Fishery (HQ-CWF). This 37.4 mi.² encompasses 45% of the Schrader Creek basin and accounts for 13.6% of the Towanda Creek watershed. There are 63.2 miles of stream within this HQ-CWF watershed.

The four main branches of Towanda Creek (Main stem, North Branch, South Branch, and Schrader Creek) and their tributaries account for 539.1 miles of stream. Of these, 366.7 miles are designated as Cold Water Fisheries (CWF). An additional 24.2 miles are designated as Trout Stocked Fisheries (TSF). The main stem of Towanda Creek from the confluence with South Branch to the mouth is designated as a Warm Water Fishery (WWF), a distance of 4.2 miles. There are 83.7 miles of stream in the watershed which support natural trout reproduction, 18.6 miles of which are designated as Class A wild trout waters.

Table 7.4 - Class “A” Wild Trout Waters in the Sugar & Towanda Creek Watersheds

Stream	Tributary To:	Segment Boundary	Drainage Area Mi²
Bull Run	Schrader Creek	Headwaters dnst to mouth	1.04
Chilson Run	Millstone Creek	Headwaters dnst to mouth	1.28
Deep Hollow	Millstone Creek	Headwaters dnst to mouth	4.3
Kent Run	South Branch Towanda Creek	Headwaters dnst to mouth	3.65
Ladds Creek	South Branch Towanda Creek	Headwaters dnst to mouth	3.73
Little Schrader Creek	Schrader Creek	Marsh Creek dnst to mouth	7.23
Lye Run	Schrader Creek	Headwaters dnst to mouth	6.57
Marsh Run	Little Schrader Creek	Headwaters dnst to mouth	0.79
McCraney Run	Little Schrader Creek	Headwaters dnst to mouth	1.49
Millstone Creek	Schrader Creek	Headwaters dnst to mouth	15.1
Nates Run	Schrader Creek	Headwaters dnst to mouth	1.32
Pine Swamp Run	Lye Run	Headwaters dnst to mouth	3.48
Rollinson Run	Schrader Creek	Headwaters dnst to mouth	2.37
Satterlee Run	South Branch Towanda Creek	Headwaters dnst to mouth	5.03
Schrader Creek	Towanda Creek	Headwaters dnst to Bull Run	85
Sugar Run	Schrader Creek	Headwaters dnst to mouth	6.25
Swamp Run	Little Schrader Creek	Headwaters dnst to mouth	0.31
Turnip Patch Run	McCraney Run	Headwaters dnst to mouth	0.34

Water Quality – Point Source Pollution

A point source of pollution comes from a drainage pipe which discharges pollution directly into surface water such as a stream, river or lake. DEP has issued the following discharge permits within Sugar Creek and Towanda Creek Watersheds:

Smithfield Township Sewer System STP
Oak Hill Veneer Mill
Canton Borough Authority Sewer System (1)
Canton Borough Authority Sewer System (2)
Mary Beth Dodge RES
Bradford County Manor
New Albany Borough Sewer System STP
Charles Miller SRSTP
Edna Landon RES
Fairfield IND Park Sewer System STPB
Carol Beirne SFTF
David M & Louise W. Ross
Russell Dibble RES
James E. Brenchley SFSTF
Lampheres Salvage
James Zweidinger RES
Kenneth McGrath RES
Sigmund Winavsig Prop.
SRU JT School Sewer System STP
Eastern Milk Producers (1)
Eastern Milk Producers (2)
H. Rockwell & Sons Mfg.
Mt. Pisgah State Park (1)
Mt. Pisgah State Park (2)
Mt. Pisgah State Park (3)
Troy Borough Sewer System STP
Bradford County Landfill 2 (1)
Bradford County Landfill 2 (2)
Bradford County Landfill 2 (3)
Bradford County Landfill 2 (4)
Bradford County Landfill 2 (5)
Town & Country Estates
Demorgan Acres NHP
Grace & Truth Evan. Assn. Rock Mtn. Bible Camp
Burt L. Cleveland SFSTF
Sollick Mary SFR
Ames Lawn & Garden Tool Mfg.
Sherwood Retirement & Personal Care Housing
Troy's Suds Depot
John A Zbsel RES
Hodlofsig Health Club Healthy Habits SFTF
Judsons
Janet Bacon Subdivision

Water Quality – Non-Point Source Pollution

To better target current efforts in addressing non-point source water quality impacts, the following leading sources or contributors were identified as part of an implementation strategy to address such sources developed by the Bradford County Conservation District in 2005 as part of the Chesapeake Bay Program:

Agricultural Nutrient Management – encompass all aspects of livestock and crop operations involving manures and commercial fertilizers. Barnyard location and management, manure storage and application, livestock access to waters of the Commonwealth, and sound nutrient management are all part of the issues related to agricultural nutrient management.

Commercial Fertilizer Applications – are part of numerous non-agricultural operations as well as the on farm ones. Improper use on lawns, golf courses, schools and urban lawns can contribute significant amount of “N” and “P” to the surface and ground water.

Agricultural Tillage – Tillage of the soil to plant crops exposes unprotected soils to the erosive effects of precipitation, wind and stormwater drainage. The need for current, state of the art conservation planning and implementation remains a high priority. Conservation and no-till practices need to be better incorporated into the culture of the County’s farmer operations.

Timbering – Through improper construction and placement of roads and surface water controls, sediment leaves the site. The lack of buffers or setbacks from sensitive areas such as wetlands and streambanks create additional pollution potential.

Stream Channel and Bank Stability – Unstable stream banks and channels contribute literally hundreds of thousands of tons of sediment and their related nutrients on an annual basis according to documented inventories and measurements. Studies have shown as much as 25% of these sediments are reaching the Chesapeake Bay.

Rural Transportation Systems – Dirt and Gravel Roads that serve as the primary transportation system for rural municipalities can contribute sediments and other road related substances directly to surface waters via drainage systems, eroding road banks, and blockages of stream channels and floodplains.

Storm water – Storm water and changes to natural hydrology resulting from land use change creates considerable increases in uncontrolled runoff amounts along with nutrients and sediments to the County’s streams.

On-lot Septic Systems – Private septic systems are the primary source of sewage treatment in the County. Lack of maintenance and failing systems that are inadequate pollute both the ground water and surface waters of the County.

Additionally, on-lot systems, while effective in treating pathogens, do little to utilize the nutrients and simply pass them through to the ground water or to surface waters through movement in the soil.

Mines – Gas wells, sand & gravel, blue-stone and abandoned coal mines potentially contribute sediments and other mineral substances directly to surface waters having significant impact on water chemistry. Through earth disturbance and fractures they may pollute ground water.

Table 7.5 - Typical Non-point Source Pollution Loadings for Certain Land Uses
(lbs per acre per year typically produced nationally)

LAND USE	SEDIMENT	PHOSPHORUS	NITROGEN
*Cropland	1,424.00	0.53	8.90
*Pasture	356.00	0.27	4.45
*Forest	222.00	0.18	2.22
Residential	490.00	1.20	7.48
Urban	570.00	1.34	9.08

*Dominant Land Uses in Sugar Creek Watershed
Source: PADEP, 2000

Bradford County Cropland

Because of the large economic impact that agriculture has on Bradford County, soil conservation is an important resource. Of the total amount of cultivated cropland in the County, the USDA Natural Resources Inventory revealed about 51.9% of the row crops are eroding at a rate of 6.5 tons/acre, which is 3.5 tons/acre above the 3-ton/acre tolerable soil loss rate. Based on actual loss determinations in the 1989 study (*Bradford County Chesapeake Bay Watershed Study*), the following calculations from real data quantify the amount of topsoil and nutrients actually being lost annually to erosion of agricultural fields.

Susquehanna River Sub-Basin 4-C includes 285,095 acres consisting of Sugar and Towanda Creeks. Approximately 490 livestock operations were identified in sub-basin 4-C.

Non-point source pollution (Row crops)

Sub-Basin	Acres	NRI%	Excess loss	Tons lost/year
4-C	24,546	X 51.9%	X 3.5 T/A	44,587 tons

Given nutrient losses of 5.44 lbs of Nitrogen and 2 lbs of Phosphorus for each excessive ton of soil lost (*from Animal Waste Utilization on Cropland and Pastureland, US EPA – 600/2-79-059 page 48*) and presumably entering a waterway, total nutrient losses for each sub-basin are as follows:

Sub-Basin	Tons lost/year	N (5.44lbs/T)	P (2lbs/T)
4-C	44,587	242,553lbs/yr	89,174lbs/yr

Transportation

There are 1298 miles (937 miles in Towanda Creek and 361 miles in Sugar Creek) of roads in the watershed maintained by PennDOT or by local municipal authorities. Of these miles, there are 770 miles of paved roads and 528 miles of unpaved roads within the watershed. Of these, the majority of miles are located in Bradford County with 12.3 miles in Tioga County, 7.6 miles in Sullivan County, and 1.0 mile in Lycoming County.

Major roads that provide access to the watershed include Routes 6, 14, 220, and 514. The Bradford County Conservation District, as well as the Lycoming and Tioga Districts, conducted an inventory of the Watersheds's dirt and gravel roads in 1997-1998 and documented each site that impacts on water quality. That inventory revealed over 477 sites that were directly impacting water quality for a total road distance of 516,851 feet.

Resource Extraction

Historically, logging and the mining of coal have been the two primary anthropogenic activities impacting the Schrader Creek watershed. In 1903, the Central PA Lumber Company established the company town of Laquin along the banks of Schrader Creek as part of a logging operation. The operation continued until 1933. In all, the company logged 14,000 acres in the watershed.

From the 1850's through the early 1890's, several mining operations were underway in the area. A sixteen mile long railroad paralleled Towanda Creek from Towanda to the village of Powell (then known as Greenwood). The railroad then followed Schrader Creek from Powell to the settlement of Carbon Run. Inclined planes were built up the mountain parallel to Coal Run, Falls Creek, and Long Valley Run.

Numerous studies by the PA Fish and Boat Commission and DEP-Bureau of Abandoned Mine Reclamation (BAMR) indicate a number of tributaries in the middle portion of the Schrader Creek watershed are degraded by acid mine drainage (AMD). AMD emitted from these abandoned mine sites directly impact the water quality of many streams in the watershed, namely Falls Creek, Long Valley Run, Coal Run, and Carbon Run. Because AMD discharges to these tributaries have degraded water quality to levels that do not meet water quality standards, these four tributaries of Schrader Creek are currently included on the Commonwealth's List of Impaired Waters (303(d)). AMD contamination of these streams has led to impairment of the lower reaches of Schrader Creek, and has had a serious impact on the existing fishery in the watershed.

There are several sand, gravel and rock quarries in the western part of the watershed, but they have very limited impacts.

Current natural gas exploration and well development is anticipated to have considerable impact on all aspects of the watershed. The Marcellus shale gas deposits underlie the entire watershed. Gas development activities / issues potentially impacting natural resources:

Gas Drilling - Water quantity and quality issues within an aquifer and watershed.

1. Facilities and appurtenances -

- ⇒ The “footprint” or area required for drilling pads, pipelines, transfer stations, powerhouses, roadways, tanks, and other equipment.
- ⇒ Potential erosion and sedimentation during and after development.
- ⇒ Potential encroachment upon or destruction of wetlands
- ⇒ Reduction of viable forest and agricultural land
- ⇒ Fragmentation of forest tracts by extensive pipelines to connect wells

2. Transportation and logistics –

- ⇒ Road surface wear and tear
- ⇒ Variable ability of existing roads to take increased traffic (i.e water trucks for one well drilling equivalent to 3+ million cars)

3. Water withdrawal -

- ⇒ Estimated between 1 to 9 million gallons per well site
- ⇒ Impacts to surface waters and fisheries
- ⇒ Impacts to municipal water resources

4. Waste handling -

- ⇒ Disposition of large amounts of water used in the fracturing process. Water considered a “hazardous waste” (industry estimates 40%-60% of water used in fracturing returns to surface).
- ⇒ Application of brine on dirt and gravel roadways
- ⇒ Other by-products common to gas extraction

5. Treatment Plants –

- ⇒ Recent DEP inspections revealed used fracturing water is more hazardous than previously believed in this area. A warning on traditional sewage treatment plants accepting this waste has been issued by the State

6. Municipalities –

- ⇒ Many want the waste water (brine and hazardous) for dust suppression. Brine use can have adverse impacts for the streams.
- ⇒ What can Municipalities do as far as requiring at least as much information as the State and reserve inspection authority or assurance that State regulations are being met? DEP admittedly does not have the manpower.
- ⇒ Protection of roads for truck traffic impacts is a question being raised daily.

Sewer & Water Supply

Public Water Facilities and Services

Approximately 35 percent of municipalities within Bradford County are serviced by public water. The municipalities covered by water services are listed below.

- ⇒ Canton Borough
- ⇒ Monroe Borough
- ⇒ New Albany Borough (currently a private system, but will transfer to Towanda Municipal Authority)
- ⇒ North Towanda Township (partially served)
- ⇒ Towanda Borough
- ⇒ Troy Borough
- ⇒ Troy Township
- ⇒ Ulster Township
- ⇒ Village of Ulster (partially served)

Public Sewer Facilities and Services

The Pennsylvania Sewage Facilities Act of 1966 as amended, commonly referred to as "Act 537", is the primary law that controls individual and community sewage disposal systems. Act 537 requires that every municipality prepare and maintain a sewage facilities plan. Act 537 requires municipalities to review their official plans at five-year intervals and perform updates, as necessary. Municipalities can apply to the PADEP for up to 50 percent reimbursement of the cost of preparing an Act 537 plan. High growth municipalities are frequently performing updates to their Act 537 Plan. For stable or slow growth municipalities, 20 years or more may elapse between editions. Regardless of timing, such plans and PA Department of Environmental Protection approval are needed before any major sanitary sewer projects are eligible for funding by the State.

Wastewater is treated at treatment plants located in or near each municipality providing service. Each facility therefore, has its own capacities and point of treated discharge, usually an adjoining tributary. Each unit of local government or a Sewer Authority operates the various facilities.

Presently, public sewer service in Bradford County is provided to local residents by local municipalities at the township and borough levels of government. The following municipalities have public sewer facilities:

- ⇒ Canton Borough
- ⇒ Canton Township (partially served)
- ⇒ New Albany Borough
- ⇒ North Towanda Township (partially served, Rte. 6 / U.S. 220 to State Police Barracks and proposed to Vo-Tech)
- ⇒ Smithfield Township (planned or under construction, proposed in Village of East Smithfield)
- ⇒ Towanda Borough

- ⇒ Towanda Township (partially served and proposed extension along portion of US 220)
- ⇒ Troy Borough
- ⇒ Troy Township (partially served along Fallbrook Road and proposed extensions North on Rte. 14 to Cummings Lumber)
- ⇒ West Burlington Township (partially served – Bradford County Manor and Prison)

Additional proposed facilities and/or extensions of service:

- ⇒ Monroe Borough and Township (proposed Central Bradford Extension from Towanda)

Private Water Supplies

Maintaining groundwater recharge and wellhead protection areas are critical to protecting groundwater quality and supply because it is the predominant domestic water supply for both rural areas and developed communities in the County. One large aquifer underlies the Susquehanna River Valley and some of its tributaries in Bradford County. This sand and gravel aquifer, created by glacial outwash and alluvial deposits, stretches from the northwest part of the County to the southeast corner and into Wyoming County. Sand and gravel aquifers contain large quantities of water that can be easily withdrawn. They can commonly have well yields of 1,000 gallons per minute (gal/min). The natural quality of the water is good to excellent; however, areas of concern for contamination include road salt storage facilities, historic chemical spills, industrial sites, pesticide applications, above and underground storage tanks, landfills, hazardous waste sites, mining and mine drainage, pipelines and sewer lines, and spills.

There are no laws or regulations directly affecting well construction, tracking, or wellhead protection within the watershed. The Nutrient Management Act (Act 38) does provide for some protection in the way of manure setbacks when it is applied by mechanical equipment and not incorporated or worked into the ground. Similarly, the Sewage Facilities Act also requires setbacks for sewage/septage disposal facilities.

Surface waters are critical to human and wildlife communities. They provide drinking water for terrestrial creatures and habitat for aquatic species. Some surface waters serve public water supplies while others support recreation and tourism.

CHAPTER VIII - BIOLOGICAL RESOURCES

Aquatic

Macroinvertebrates

The most direct and effective measure of the integrity of a water body is the status of its living systems. One important way to determine the quality of water in a stream is to monitor aquatic macroinvertebrates (animals without backbones that live in aquatic environments and are large enough to be seen without the aid of a microscope or other magnification). Macroinvertebrates are valuable indicators of the health of aquatic environments, in part because they are benthic (meaning they are typically found on the bottom of a stream or lake) and they are for the most part sessile (do not move over great distances). Therefore, they cannot easily or quickly migrate away from pollution or environmental stress. Because various macroinvertebrate taxa react differently to environmental stressors, quantifying the diversity and density of different macroinvertebrate taxa at a given site can create a picture of the environmental conditions of that body of water.

If exposed to an environmental stressor (e.g., pollution, sediment loading, warming due to low flows, low dissolved oxygen due to algal blooms, etc.) those macroinvertebrates that are intolerant to that stress may die. Tolerant macroinvertebrates often inhabit the spaces left by the intolerant organisms, creating an entirely different population of organisms. A healthy body of water will typically contain a majority of macroinvertebrates that are intolerant of environmental stressors, such as mayflies, stoneflies and caddisflies. An impaired body of water may contain a majority of macroinvertebrates that are tolerant of these conditions such as leeches, tubifex worms and pouch snails. Bioassessments can provide benchmarks to which other waters may be compared and can also be used to define rehabilitation goals and to monitor trends.

A number of bio-assessments have been conducted in the watershed area by several public water quality agencies. Some of the results are included in the appendices and can be summarized as follows:

DEP Surface Waters Assessment – These assessments included all the surface waters within the watershed region. A “Rapid Bio-Assessment” was utilized to determine if habitat and macro-invertebrate species present were indicators of water quality that would support the designated uses of those waters. The map in the Appendix indicates those waters that did not meet those standards. Before 2005, field identification of macro-invertebrate to family level was utilized. After 2005 the Rapid Bio-Assessment Protocol II was utilized where samples were identified in a laboratory setting down to genus level. For the majority of waters in the watershed, quality was supportive of designated uses.

Mill Creek Watershed Assessment - During an evaluation of Mill Creek, its tributaries and Stephen Foster Lake as part of the Phase I EPA Clean Lake Project, BCCD interns conducted a macroinvertebrate study. The results of the full evaluation were compiled in a report entitled, “Mill Creek: A Stream Survey - A Study of Mill Creek and its Tributaries”. Through the study, some sensitive benthic macroinvertebrate taxa were found, indicating good water quality, but a great diversity of taxa was not found. Stoneflies, mayflies and caddisflies (many of which are somewhat sensitive to perturbation – were found at nearly every site. Using the Mercer County rating system, most of the sample sites were named only fair or good. The lower scores were mainly due to a lack of diversity. According to the rating system used by the Delaware Nature Education Society, however, it is the presence of sensitive taxa more so than diversity which is the most influential factor when determining overall stream health. Using this system, most of the sample sites were named good or excellent.

Susquehanna River Basin Commission – The following is directly taken from the SRBC 2002 Technical Report #222 –

“SUGAR CREEK WATERSHED (SRC) - There were three sites in the Sugar Creek Watershed, all located on the main stem of Sugar Creek, in Ecoregion 60 size medium reference category. The most upstream site (SRC 25.0) was rated as “lower” in water quality, contained a moderately impaired macroinvertebrate population, and had excellent habitat. SRC 16.4 had “middle” range water quality, a slightly impaired macroinvertebrate population, and excellent habitat. SRC 0.8 contained “middle” water quality, a moderately impaired macroinvertebrate community, and supporting habitat conditions. A municipal sewage treatment plant was upstream of SRC 25.0, which could explain the “lower” water quality at this site. The stream seemed to recover slightly around SRC 16.4, but then degraded at the mouth of the stream where the land use was more influenced by agriculture and industry.

TOWANDA CREEK WATERSHED (TWN) - All the sites within this watershed contained a slightly impaired macroinvertebrate population except STWN 0.1 (South Branch Towanda Creek), which harbored a nonimpaired community. All the sites had either supporting or excellent habitat. TWN 25.0, the most upstream site, was the only site to receive a “lower” water quality rating. TWN 25.0 also is listed on Table 2 for low dissolved oxygen. This sampling site was located in a more commercial and residential area, which could have attributed to the “lower” water quality rating. TWN 16.9 was rated “middle” water quality, and is listed on Table 2 for dissolved oxygen below 4.0 mg/l. This site was located in an agricultural area. Both sites on Schrader Creek were rated “higher” water quality. Schrader Creek is designated as EV and HQ-CWF (Table 3); however, it also is listed on Table 2 for dissolved oxygen below 4.0 mg/l. Also, the land use map (Figure 3) indicates that there are abandoned mine lands in the Schrader Creek Watershed. STWN 10.0 was rated “middle” quality and is listed on Table 2 for high total organic carbon. The two

remaining sites (STWN 0.1 and TWN 0.1) in this watershed were located in forested areas, and had “higher” water quality ratings.

Fisheries Management

Sugar Creek - The Pennsylvania Fish and Boat Commission’s Area 4 fisheries management office selected the Sugar Creek basin for investigation in 2000 because many of the streams in this relatively large drainage had never previously been surveyed and information on previously surveyed streams was fairly dated. The objectives of PFBC’s examination were: 1) to collect baseline data on those streams which had never been surveyed so that they could be assigned to a resource category and 2) to evaluate past management practices on previously surveyed streams and implement new management strategies where appropriate.

The PFBC conducted six previous surveys of Sugar Creek. The first three in 1933, 1953, and 1966 concerned stocking practices and contained little fisheries data. The first comprehensive PFBC biological survey of Sugar Creek was performed in 1980, when it was documented that Sugar Creek was essentially a warm water stream throughout its length and that the highest gamefish densities occurred downstream from the confluence with Mill Creek.

The results of all historical surveys in the Sugar Creek basin have led to the development of current DEP and PFBC management strategies for the drainage. The DEP classifies the entire Sugar Creek basin from the headwaters downstream to and including Tomjack Creek as a trout stocked fishery (TSF) in its Chapter 93 water quality standards. The DEP classifies the remainder of the Sugar Creek basin as a warm water fishery (WWF).

For the purpose of resource classification, the PFBC manages all of the streams in the Sugar Creek basin as a single section extending from the headwaters downstream to the mouth with the exceptions of Sugar Creek, the North Branch of Sugar Creek, and Mill Creek.

The PFBC manages all of the Sugar Creek basin streams with conventional, statewide angling regulations. Adult trout are stocked in Section 02 of Sugar Creek and Section 02 of the North Branch of Sugar Creek. Both streams currently receive a preseason and a single in-season stocking. The hatcheries are required to make in-season stockings before the end of April due to concerns regarding water temperatures and stream flows. The PFBC manages the remainder of the basin's streams for their natural fish populations.

The streams of the Sugar Creek basin generally possessed low to moderate gradients and flowed through rural areas. Chemically they were moderately fertile and possessed sufficient buffering capacity against the effects of acid precipitation. According to the criteria established in 1983, streams become vulnerable to acid

precipitation when total alkalinity drops below 10 mg/l. Total alkalinity values in the Sugar Creek basin, however, ranged from 18 to 96 mg/l. The basin's fertility results from its underlying geology in combination with agricultural and other human activities.

The PFBC documented the presence of 38 fish species in the Sugar Creek basin. Blacknose dace were the most common fish encountered as this species was captured at 35 of the 37 sites electrofished. The next most common species were creek chubs (32 sites), central stonerollers (31 sites), longnose dace (26 sites), white suckers (25 sites), and tessellated darters (22 sites). Conversely, satinfish shiners, swallowtail shiners, yellow bullheads, banded killifish, redbreast sunfish, black crappies, and fantail darters were quite rare. Each of these species was captured at two or fewer sites within the basin.

Smallmouth bass were the most common gamefish encountered in the Sugar Creek basin, as this species was captured at 13 of 37 electrofishing sites. With the exception of the lower end of Sugar Creek, however, smallmouth bass population density was too low to provide a substantial recreational fishery. This was mainly due to the low flows that the Sugar Creek basin streams generally experience during a typical summer, thus limiting habitat for adult fish. Low summer flows and seasonally warm water temperatures combined to limit wild trout populations in the basin. The only wild trout captured at the 37 electrofishing sites was a single individual at RM 0.88 on the South Branch of Sugar Creek.

Thirty-one of the 38 fish species collected in 2000 were present historically, but 7 were documented for the first time during this work. Those species present in 2000 but absent during historic surveys were swallowtail shiners, banded killifish, fantail darters, fathead minnows, black crappies, brook trout, and greenside darters. Swallowtail shiners, banded killifish, and fantail darters may have been present in the past but were not recorded until now because of low population densities and because previous surveys were targeted at individual streams while the 2000 work was more comprehensive. The fathead minnows may have been the result of a bait bucket introduction, the black crappies had originated from local lakes, and all of the brook trout were hatchery fish. The presence of greenside darters in the Sugar Creek basin, however, represented a range expansion for this species. Greenside darters have been expanding their range in the Susquehanna River drainage during recent years (Argent et al. 1997).

Historically PFBC had documented 37 fish species in the Sugar Creek basin. Those species present in the past but absent during the 2000 work were rainbow trout, golden shiners, yellow perch, American eel, walleye, and fallfish. The rainbow trout captured during historic surveys were hatchery fish and the golden shiners and yellow perch had likely originated from Stephen Foster Lake. The PFBC has only one occurrence record for American eels and walleyes in the Sugar Creek basin. The American eel was captured at RM 0.70 of Sugar Creek on July 23, 1980, and the walleye was captured at RM 16.70 of Sugar Creek on July 19, 1978. The absence of

fallfish from the Sugar Creek basin, however, was puzzling to PFBC. The 1980 study captured fallfish at 7 of the 12 sites electrofished on Sugar Creek, and the 1985 study captured fallfish at 5 of 6 electrofishing sites. The disappearance of fallfish from Sugar Creek may not be an isolated occurrence. Although anecdotal, evidence from recent basin surveys throughout the Area 4 fisheries management region suggests that fallfish are declining in many of the larger warm water streams.

Water quality and fish species occurrence varied among the Sugar Creek basin streams. Specific findings for each stream and section individually are discussed in the full PFBC Fisheries Management Report.

Towanda Creek – From a fisheries perspective, the PA Fish and Boat Commission manage the Towanda Creek Watershed as three major watersheds: Towanda Creek and its direct tributaries that comprise the northern portion of the basin; Schrader Creek; and the South Branch Towanda Creek and its drainages in the southern portion of the basin.

The physical and chemical characteristics of the **South Branch Towanda Creek** basin's tributary streams varied according to the physiographic provinces through which they flowed. Bowman Creek, French Creek, and Beaver Run, which resided in the Glaciated Low Plateau, generally passed through agricultural areas and possessed low to moderate gradients. Water quality in these tributaries was fertile, with total alkalinity values ranging from 56 to 68 mg/l and specific conductance values ranging from 92 to 144 umhos. In contrast, Fenner, Kent, and Satterlee Runs, which resided in the Glaciated High Plateau, generally passed through forested areas and possessed high gradients. Water quality in these tributaries was infertile, with total alkalinity values ranging from 12 to 16 mg/l and specific conductance values ranging from 33 to 51 umhos. The final named tributary, Ladds Creek, resided on the edge of the Glaciated Low and High Plateaus, and as such possessed intermediate physical and chemical characteristics.

The PA Fish and Boat Commission (PFBC) documented the presence of 21 fish species in the South Branch Towanda Creek basin. Blacknose dace *Rhinichthys atratulus* was the most common fish encountered, found at 10 of the 11 sites electrofished. The next most common species were creek chubs *Semotilus atromaculatus* (9 sites), longnose dace *Rhinichthys cataractae* (8 sites), and central stonerollers *Camptostoma anomalum*, white suckers *Catostomus commersoni*, and sculpins *Cottus* sp. (7 sites each). The gamefish species captured were brook trout *Salvelinus fontinalis* (4 sites), brown trout *Salmo trutta* (3 sites), and smallmouth bass *Micropterus dolomieu* (1 site). In general, transitional species dominated the fish populations in those tributaries that passed through the Glaciated Low Plateau, while coldwater species dominated the fish populations in those tributaries that passed through the Glaciated High Plateau. Wild brook trout were abundant enough at RM 0.84 of Ladds Creek, RM 1.24 of Satterlee Run, and RM 0.83 of Kent Run to conduct population estimates.

Historically the PFBC had documented the presence of 18 fish species in the South Branch Towanda Creek basin. Those species present historically but absent during the 2001 work were spotfin shiners *Cyprinella spiloptera* and shield darters *Percina peltata*. Those species present during the 2001 work but not documented historically were brook trout, redbreast dace *Clinostomus elongatus*, bluntnose minnows *Pimephales notatus*, greenside darters *Etheostoma blennioides*, and banded darters *Etheostoma zonale*. The presence of greenside and banded darters in the South Branch Towanda Creek basin represented a range expansion for these species.

Water quality, fish species occurrence, and wild trout abundance varied among the South Branch Towanda Creek basin streams.

PA Fish & Boat Commission – South Branch Towanda Creek Basin – July 2001

Streams in the **Northern Towanda Creek** Basin generally possessed moderate gradients. Gradients ranged from a low of 2.4 m/km for Towanda Creek Section 03 to a high of 72.1 m/km for Williams Hollow Section 01. Ownership was generally private, with most sections closed to public angling without landowner permission. The main stem of Towanda Creek, however, was an exception. The trout stocked and warmwater sections of Towanda Creek were almost entirely open to fishing. Human population density was rural for all stream sections.

The mean total physical habitat score for electrofishing sites in the Northern Towanda Creek Basin was 134.1, which fell into the sub-optimal range. This score was higher than mean total physical habitat scores in the Meshoppen Creek (99.2; Wnuk et al. 2006a) and Briar Creek (105.1; Wnuk et al. 2006b) Watersheds. Physical habitat in the Northern Towanda Creek Basin was generally good but low summer flows limited fish populations in many streams. Channel flow status was the category with the lowest mean physical habitat score (10.9). Larger tributaries such as North Branch Towanda Creek, a fourth order stream, consisted mainly of stagnant pools separated by dry riffles and runs. Many of the smaller tributaries examined were completely dry or nearly so, and even the lower end of Towanda Creek suffered from low summer flows.

Chemically, the Northern Towanda Creek Basin streams were generally fertile and well buffered against the effects of acid precipitation. Total alkalinity was only 8 mg/l at Gulf Brook River Mile (RM) 0.20 but exceeded 39 mg/l at all other sites. Total alkalinity exceeded 100 mg/l at two sites (Alba Creek RM 3.04 and Preacher Brook RM 0.94). Total hardness values ranged from 8 to 144 mg/l, specific conductance values ranged from 128 to 375 umhos, and pH values ranged from 7.0 to 8.4.

Total hardness values were often very similar or equal to total alkalinity values in the Northern Towanda Creek Basin. Further, total alkalinity exceeded total hardness at North Branch Towanda Creek RM 5.81. The ratio of total alkalinity to total hardness in the Northern Towanda Creek basin was similar to nearby drainages with comparable geology. Examples include the Snake Creek (Wnuk et al. 2003), Wysox Creek (Wnuk et al. 2005a), Wappasening Creek (Wnuk et al. 2005b), and

Meshoppen Creek (Wnuk 2006) Basins. Low total hardness can occur in combination with high total alkalinity when sodium bicarbonate is the major alkalinity component (Wurts and Durborow 1992). This situation may occur in the Northern Towanda Creek watershed because its underlying geology does not contain limestone.

The PFBC captured 32 fish species in the Northern Towanda Creek Basin in 2007. Longnose dace *Rhinichthys cataractae* was the most common fish, and was captured at 21 of the 22 electrofishing sites. The next most common species were central stoneroller *Campostoma anomalum* (20 sites), white sucker *Catostomus commersoni* (20 sites), cutlips minnow *Exoglossum maxillingua* (18 sites), creek chub *Semotilus atromaculatus* (18 sites), tessellated darter *Etheostoma olmstedii* (18 sites), and sculpin *Cottus* sp. (18 sites). Rare species included rainbow trout, golden shiner *Notemigonus crysoleucas*, comely shiner *Notropis amoenus*, brown bullhead *Ameiurus nebulosus*, pumpkinseed *Lepomis gibbosus*, bluegill *Lepomis macrochirus*, and walleye *Sander vitreus*. Each of these species was present at only one or two sites.

The PFBC had captured 31 species in Towanda Creek in all historic surveys combined. Those species present historically but absent in 2007 were American eel *Anguilla rostrata*, largemouth bass *Micropterus salmoides*, and shield darter *Percina peltata*. American eel and largemouth bass were never common in Towanda Creek, having been present at one and two sites, respectively. The eel was likely the result of an historic PFBC stocking program and the bass had likely escaped from local ponds. Shield darters were present at five sites on Towanda Creek in 1978, but have not been captured in the basin since that time. Comely shiner *Notropis amoenus*, swallowtail shiner *Notropis procne*, bluntnose minnow *Pimephales notatus*, and greenside darter *Etheostoma blennioides* were the species captured during the 2007 work that were not found historically.

Fallfish *Semotilus corporalis* have been present in Towanda Creek during each general inventory. Their numbers, however, appeared to have declined. The PFBC only captured fallfish at three of 15 electrofishing sites. The PFBC rated fallfish as Rare at RM 22.33, Present at RM 5.40, and Common at RM 0.74. The 1977/1978 general inventory (Daniels 1977, 1978a, 1978b, 1987) did not rate fallfish density, but captured fallfish at 11 of the 14 electrofishing sites. Fallfish were absent only from the three most upstream stations. The Area 4 Fisheries Management Office has documented similar declines of fallfish in Nine Partners Creek (Wnuk et al. 1999), Sugar Creek (Wnuk et al. 2000a), East Branch Wyalusing Creek (Wnuk et al. 2000b), North Branch Wyalusing Creek (Wnuk et al. 2000c), Mahoning Creek (Wnuk et al. 2001b), Snake Creek (Wnuk et al. 2003), and Schrader Creek (Wnuk et al. 2004).

The main sportfish species found in the Northern Towanda Creek Basin during the 2007 work were trout and smallmouth bass. Trout were present in the upper reaches of Towanda Creek, in Mill Creek, and in the lower portion of the North Branch Towanda Creek (Tables 9 and 10). Trout numbers in upper Towanda Creek and Mill

Creek were sufficient to provide a limited fishery, but the PFBC only captured a single hatchery brook trout *Salvelinus fontinalis* in the North Branch Towanda Creek. Smallmouth bass were more widespread than trout and provided anglers the opportunity to catch fair numbers of legal length fish in the lower portions of Towanda Creek. Although suckers were abundant at many sites, most of the suckers handled were young-of-the-year. Adult suckers were rare and did not provide much angling opportunity. Rock bass *Ambloplites rupestris* were present at 11 sites on Towanda Creek but their populations were never dense enough to attract anglers. Pumpkinseed, bluegill, and walleye were rare enough that they did not provide fisheries.

PA Fish & Boat Commission – Northern Towanda Creek Basin – Summer 2007

Schrader Creek and its tributaries possessed moderate to high gradients and most flowed at least partially through public lands. Public lands in the drainage included the Tiadaghton State Forest, State Game Lands Numbers 12 and 36, and Sunfish Pond County Park. All streams in the drainage exhibited rural human population densities.

Chemically, the entire Schrader Creek basin was acidic. Total alkalinity values ranged from 0 to 12 mg/l and pH values ranged from 4.0 to 7.0 standard units. Total alkalinity was < 10 mg/l at 35 (92%) of our 38 sites. Naturally, infertile geology, organic acids from headwater swamps, and inorganic acids from precipitation and mine drainage all combined to produce this situation (Copeland et al. 1995).

Basin wide, water chemistry in 2004 was generally more acidic than that documented in 1995. Comparisons of water quality results were difficult, however, due to climate conditions. Copeland et al. (1995) sampled during a drought while the PFBC sampled during a generally wet year. Climatic effects on water quality were especially pronounced during the August 2004 sampling when the PFBC rated stream flows as high. They rated stream flows the same as the 1995 investigators at only three sites, all of which were in the Millstone Creek watershed. Total alkalinity at these sites was generally higher in 2004, but pH was generally lower.

The PFBC documented 15 fish species at 27 electrofishing sites in the basin. Coldwater and transitional species dominated fish communities at most of the sites. Brook trout *Salvelinus fontinalis* was the most common fish encountered, captured at 20 of the 27 sites. Wild brook trout in the watershed ranged from length group 2 (25 - 49 mm) to length group 12 (275 - 299 mm). The next most common species were blacknose dace *Rhinichthys atratulus* (15 sites), sculpins *Cottus sp.* (15 sites), and longnose dace *Rhinichthys cataractae* (14 sites). In addition to brook trout, the gamefish species captured were brown trout *Salmo trutta* (9 sites) and chain pickerel *Esox niger* (1 site). With the exception of a single length group 11 (250 - 274 mm) individual at River Mile 8.36 on Schrader Creek, the PFBC judged all of the brown trout caught to be obvious hatchery fish. The lone chain pickerel found was at River

Mile 1.04 of Pine Swamp Run. This fish had likely escaped from a pond in the stream's headwaters.

Copeland et al. (1995) documented 22 fish species at 25 electrofishing sites in the basin. Those species present in 1995 but absent in 2004 were central stonerollers *Campostoma anomalum*, golden shiners *Notemigonus crysoleucas*, mimic shiners *Notropis volucellus*, fallfish *Semotilus corporalis*, pumpkinseeds *Lepomis gibbosus*, smallmouth bass *Micropterus dolomieu*, tessellated darters *Etheostoma olmstedii*, banded darters *Etheostoma zonale*, and yellow perch *Perca flavescens*. Conversely, the PFBC recorded chain pickerel and greenside darters *Etheostoma blennioides* in the watershed for the first time in 2004.

The PFBC can explain the absence of most of the species missing in 2004. The golden shiners, pumpkinseeds, and yellow perch had escaped from local ponds, mimic shiners and banded darters were rare in 1995, and fallfish have been declining throughout larger streams in the Area 4 Fisheries Management Region (Wnuk et al. 2000). Central stonerollers, smallmouth bass, and tessellated darters, however, should have been present. Their absence may reflect further acidification in the watershed related to the wet conditions we experienced in 2003 and 2004. The mean number of fish species captured at 23 paired electrofishing sites throughout the basin declined from 5.00 in 1995 to 3.87 in 2004. The decline in basin-wide species diversity, however, was not significant when analyzed by section width class.

The wet weather of 2003 and 2004 may also have impacted wild brook trout population densities in the Schrader Creek basin. Total wild brook trout biomass declined at 11 of 14 paired stream sections between 1995 and 2004. Mean section wild brook trout biomass was 20.68 kg/ha in 1995 but declined to 12.41 kg/ha in 2004. This difference was significant (t-test for correlated samples, $P = 0.027$). The estimated number of legal-size wild brook trout per hectare followed a similar pattern. This number declined at eight of the 14 paired sections, and remained at zero in four more. Legal size fish at the paired sections averaged 66.14/ha in 1995 but declined to 34.14/ha in 2004. This difference was also significant (t-test for correlated samples, $P = 0.0004$).

PA Fish & Boat Commission – Schrader Creek Basin – Summer 2004

Two of the three largest lakes and ponds in the County and within the watershed are identified as sites for warm water fishing in the watershed. Stephen Foster Lake and Sunfish Pond are fishing sites for catfish, perch, sunfish, and bass; trout can also be fished from Sunfish Pond.

Table 8.1 - Fishable Waterways – Sugar & Towanda Creeks Watershed

Waterway	Fish Species
Rivers and Streams	
Schrader Creek	Approved Trout; delayed harvest and artificial lures only between the Bull Run confluence and SGL#36; stocked in late fall
Sugar Creek (East Troy to confluence of South Branch of Sugar Creek)	Approved Trout
Sugar Creek North Branch (Mouth upstream to fairgrounds)	Approved Trout
Towanda Creek	Approved Trout; delayed harvest and artificial lures only from SR 3001 downstream to T-350
Towanda Creek - South Branch	Approved Trout
Lakes and Ponds	
Stephen Foster Lake	Catfish, Perch, Sunfish, Bass, etc.; ice fishing permitted
Sunfish Pond	Approved Trout, Catfish, Perch, Sunfish, Bass etc.

(Source: Bradford County; PA Fish and Boat Commission)

Terrestrial

Wildlife - Mammals

There are no important mammal areas in the County, according to the Important Mammal Areas Project (IMAP).

There are however, important mammal areas in the Northern Tier and Endless Mountains regions of which the watershed is included.

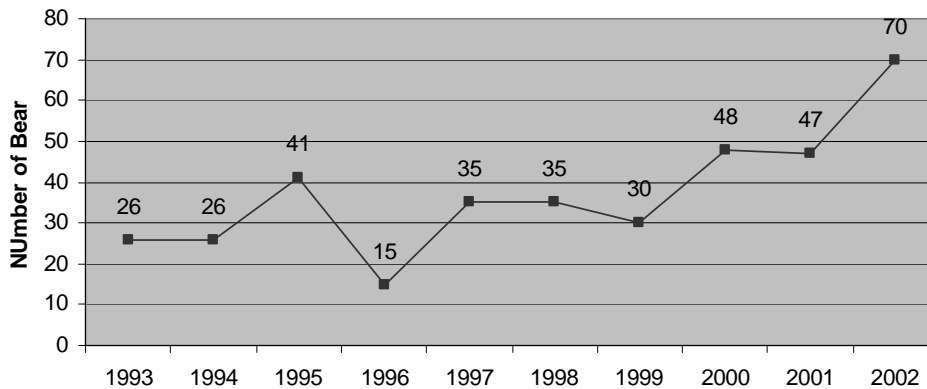
(IMAP #9) Hills Creek State Park

(IMAP #27) Wyoming State Forest

(IMAP #28) Ricketts Glen State Park/SGL 57, 13, 66

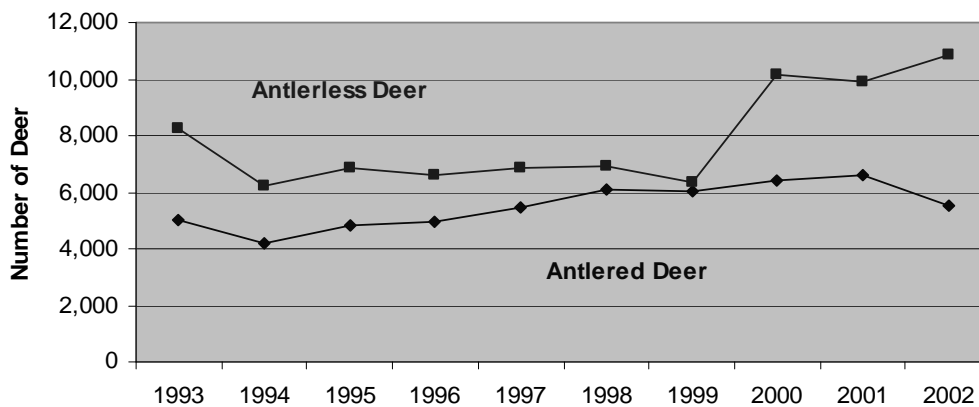
Both large game species of white tail deer and black bear play an important recreational role in the watershed and while no data was readily available for the watershed specific area, the following figures indicate the number of animals harvested in the County.

Figure 8.2 - Bear Harvest in Bradford County, 1993-2002



Source: Pennsylvania Game Commission

Figure 8.3 - Deer Harvest in Bradford County, 1993-2002



Source: Pennsylvania Game Commission

Wildlife - Birds

There are no important bird areas in the County, according to the Important Bird Area (IBA) program of Audubon Pennsylvania, the State chapter of the National Audubon Society. The IBA program is one of several priority initiatives of PA DCNR.

There are, however, important bird areas in the Northern Tier and Endless Mountains regions, which the watershed is part of.

The **Marsh Creek Wetlands** (IBA #27) “continue to provide critical habitat for thousands of migrating and nesting birds each year. Bald eagle and osprey...have been successfully reestablished here.

The **Pine Creek Gorge Natural Area** (IBA #28) contains extensive rock outcrops and secluded habitat for river mammals, such as the eastern wood rat and the river otter, as well as bird species, including eagles, belted kingfishers, common mergansers, wood ducks, green and great blue heron, hermit thrush, black-throated blue warbler, scarlet tanager, and pine and blackburnian warblers.

The **Wyoming State Forest and World's End State Park** (IBA #42) contain large areas of continuous forest covering that support rare forest-interior birds, such as black-throated green warbler and blackburnian warbler, among other species.

The **Dutch Mountains Wetland complex** (IBA #48) also contains habitat for forest-interior species; these include the barred owl, brown creeper, pileated woodpecker, scarlet tanager, and sharp-shinned hawk. "This area also may contain the State's largest population of yellow-bellied flycatcher, "and was the only confirmed breeding site of the blackpoll warblers in 1993.

In the **Creveling Lake Area of Rickett's Glen State Park** (IBA #49), similar forest-interior species are found, as well as the black-throated green warbler and black-throated blue warbler. The green-winged teal and the hooded merganser are locally breeding waterfowl.

Both game and non-game wildlife species are important in maintaining a diverse and stable ecosystem. Principal game species in the County are white-tailed deer, black bear, snowshoe hare, gray squirrel, cottontail rabbit, ruffed grouse, turkey, and waterfowl. Furbearers of importance include beaver, muskrat, mink, and red fox. Songbirds, reptiles, amphibians, and small mammals comprise non-game species within the County.

Vegetation

Important Habitats

There are three basic types of wildlife habitat in Bradford County: open land, woodland, and wetland, supporting game and non-game species.

Open land habitat of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and herbaceous plants. These types of open lands attract wildlife such as meadowlark, field sparrow, cottontail, and red fox.

Woodland habitat consists of areas of deciduous or coniferous plants or both, and associated grasses, legumes, and herbaceous plants. Wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear are present in woodland habitats.

Wetland habitat consists of open, marshy or swampy shallow areas. Wildlife that are attracted to this type of habitat include ducks, geese, shore birds, muskrat, and beaver, as well as migratory birds.

The abundance, distribution and connectivity of these various vegetative conditions have a significant impact on the rural character of Bradford County. If the vegetation, and the wildlife species that it supports, are considered valuable to the landscape and community character of the County, then land use decision-making should consider the vegetative patterns when allocating new uses to these areas.

As living natural resources, vegetation and wildlife perform critical ecological functions and support economic and community interests. Vegetation stabilizes soils, filters pollutants from waters, converts gases, transports minerals, and provides wildlife habitat - both food and shelter. Vegetation lies at the heart of the forest products industry and, in combination with wildlife, provides the environment for hunting and trapping and numerous passive recreation experiences, such as hiking, biking, and viewing from scenic vistas.

Forests

Forests are renewable resources (as opposed to perpetual resources like solar energy or non-renewable resources, such as fossil fuels). In Pennsylvania, it is estimated that timber is growing faster than it is being harvested, i.e., the annual harvest is less than the sustainable yield.

Forest Types

A forest is a community of many plant and animal species along with fungi, bacteria and other microorganisms interacting in complex ways with each other and their physical environment. Forest plant communities are, by definition dominated by one or more tree species.

Each forest site is unique. But for practical study, researchers sort the complicated diversity of nature into artificial categories called forest types. Different publications have delineated as few as five to over fifty Pennsylvania forest communities for different purposes. For our purposes, we will focus on three very general forest types: Northern hardwoods, (also called maple-beech-birch), oak-hickory and oak-pine. As the names imply, these types are based on the species of trees that form the majority of the highest canopy in a forested area. The following forest types are found in the watershed area:

Northern hardwoods (maple/beech/birch) are forests in which sugar maple, american beech, sweet birch and yellow birch, black cherry, and red maple, singly or in combination, make up most of the canopy. Other trees common, but found in smaller numbers include white ash, eastern hemlock, white pine, basswood, aspens, and northern red oak.

Common shrubs of the northern hardwood forest include rhododendron, moosewood, witch-hobble and mountain holly. Canada mayflower, starflower, and painted trillium bloom in the understory.

Black-throated blue warbler, northern saw-whet owl and solitary vireo prefer the northern hardwood forests. Emblematic mammals include snowshoe hare, northern flying squirrel and porcupine.

Oak / hickory forests are the most abundant types in Pennsylvania, making up about 46% of the total forested land. Oak forests cover rolling hills and ridges in most of the southern two-thirds of the Commonwealth and follow the North Branch of the Susquehanna and Allegheny River valleys north into New York. The dominant trees on the drier soils of the ridges are chestnut oak, scarlet oak and black oak mixed with pignut hickory, black gum, sugar maple and red maple. On moist lower slopes, northern red oak and white oak are more common with tuliptree, white pine, sweet birch, red maple, mockernut and shagbark hickories in significant numbers in many areas. Pines or eastern hemlock make up less than 25 percent of the canopy.

The shrub layer on drier upper slopes is commonly dominated by mountain laurel, huckleberries and blueberries. Viburnum species and spice bush are more common on moist sites.

The herbaceous layer is highly variable. Most of the wildflowers of this forest community bloom in the spring before the oaks leaf-out and shade the forest floor.

Wild turkey and bluejays, gray squirrels, chipmunks and many other creatures feed on the acorns and hickory nuts produced by the mixed oak forest.

Oak / pine forests are found on acidic sandy soils on ridge tops from 1200-2200 feet elevation, and dry southern exposures across the Ridge and Valley Physiographic Province and on the Pocono plateau. They make up only two percent of the State's forested land. Chestnut oak, scarlet oak and black oak are dominant canopy trees. Pitch pine, eastern white pine, and virginia pine sometimes with small numbers of table mountain pine, short-leaf and red pines contribute 25 to 50 percent of the canopy.

Scrub oaks and heaths often form the understory.

Pine warblers and prairie warblers favor these sites.

Factors Affecting Forest Cover Types

The interaction of three major factors determines the type of forest cover that develops on any particular site: temperature, precipitation and topography.

Temperature. For plant communities the most important temperature factors are the minimum winter temperatures and the length of the growing season between the last spring freezes and the first frosts of autumn. Plant biologists combine these factors into indices called plant hardiness zones. The Towanda / Sugar Creek watersheds are included in plant hardiness zone 5.

Note that conditions in the plant hardiness zones become harsher as one progresses further north in latitude or higher in elevation. These two elements combine to determine the extent of the various zones in Pennsylvania.

Precipitation. Pennsylvania averages about 42 inches of rain each year, which promotes forest growth Statewide. The prairie states of the Midwest average less than 35 inches per year. What happens to the precipitation as it interacts with soil and topography determines which species of trees dominate a site. Watershed precipitation is 38 inches annually.

Topography. Elevation, slope and the direction a slope faces all effect the microclimate for plants on any site. As discussed above, the height above sea-level will affect the temperature. Growing conditions also vary from the top of a hillside to the valleys surrounding it. The ridge top is exposed to drying winds and the soils are typically thinner and drier. Eroding soil and water both move down slope with gravity, so that soils will be deeper and moister at the base of the slope than further up. South facing slopes receive more direct sunlight than north facing ones and so are warmer and drier. As a result, chestnut oaks are more common on the upper slopes and south facing hillsides while hemlocks and birches are more typical of valley bottoms. In the valleys, depressions in the topography collect water leading to the formation of wetlands.

Other Ecological Processes that influence forestland:

- ⇒ **Succession and competition** among species: e.g., the northern red oak expands its crown to out-compete shade-intolerant white ash trees, and the black walnut emits a chemical from its roots that prevents growth of nearby trees.
- ⇒ **Grazing:** Deer browse on the twigs and leaves of young trees, inhibiting growth and forest regeneration. This also has a dramatic impact on wildlife habitat and species biodiversity.
- ⇒ **Disease and pests:** Chestnut blight (a fungus) eliminates chestnut trees, except for small rootstock and saplings. White pine blister root, dutch elm disease, hemlock wooly adelgid, cherry scallop shell moth, pear thrips, fall cankerworm, forest tent caterpillar, gypsy moth caterpillar and elm spanworm are all tree predators.
- ⇒ **Climate:** Wind, lightening (fire), drought, and rain.

Human influences in the forest:

- ⇒ **Clearing**, as in clearing for development
- ⇒ **Harvesting** for products
- ⇒ **Fire**: Humans cause most wildfires, with debris burning and arson now the most common causes.
- ⇒ **Taxes & Expenses**: The need to pay property taxes and other expenses influences landowner decisions regarding management or the sale of their land. Private landowners in Pennsylvania receive an estimated \$380 million a year from timber sales.

Over half of the County's existing land cover is forest and is predominantly owned and managed by private landowners. According to the Bradford-Sullivan Forest Landowners' Association, approximately 59 percent (433,000 acres) of the County is forested land. The woodland in Bradford County is 84 percent private, 3 percent industry, and 13 percent public owned.

The woodland consists of second and third growth trees. Predominant hardwood trees in the County are oak, maple and ash; predominant softwoods include hemlock, and pine.

Natural Areas Inventory

The Natural Areas Inventory (NAI) of Bradford County has inventoried the outstanding floral, faunal, and geologic features. Conducted in 2004-5 by the PA Science Office of the Nature Conservancy and funded by the DCNR Wild Resources Conservation Program, the inventory identifies features according to their species of concern, its global and state rank within the Pennsylvania Natural Heritage Program, its status as an endangered, threatened or rare species on state or federal listings, and the quality of the feature. The inventory also considers disturbances and threats to the features in order to rank their need for protection and management. Sites of statewide significance are designated for the protection of biological diversity in the County; these are presented in Table 8.4. Sites of local significance, which identify locations with diverse wildlife and plant life, water quality protection and/or recreational value, are presented in Table 8.5.

According to the Bradford County Natural Areas Inventory, human disturbances, such as certain farming and forestry practices and urbanization, have had profound effects on natural communities and individual species. Such development has isolated pockets of natural vegetation and habitat. Without physical connections to a larger habitat network, both vegetative and wildlife diversity decline and reduce the stability of species populations. Farming practices have drained wetlands, reducing the available habitat. In addition, non-native invasive species have out-competed native plant species crucial to the habitat of certain wildlife species.

Table 8.4 - NAI Sites of State Significance (Ranks 1-3) In the Sugar & Towanda Creek Watersheds

County Rank	Site Name	Municipality	PA Heritage Ranks and Site Importance
1	Carbon Run Wetlands	Franklin & Leroy Twps.	Several shrub swamps and artificially impounded ponds surrounded by forest are located at this site. Seven animal species of concern and five other aquatic species of concern can be found at this site and all use the wetland area.
1	Sugar Run Headwaters	Overton Twp.	At this site there exists a diverse wildflower population and one animal species of concern.
1	Susquehanna River (Middle Section)	Asylum, North Towanda, Standing Stone, Towanda & Wysox Twps.	Nesting Bald Eagles and four aquatic animal species have been documented in this area.
2	North Branch Sugar Creek Rookery	Columbia & Troy Twps.	This site contains a large nesting colony of one animal of concern.
3	Armenia Mountain Wetlands	Armenia Twp.	One plant species of concern has been documented at this site which is composed of boggy shrub thicket surrounded by a well-drained hardwood forest.
3	Lower Schrader Creek	Franklin, Leroy, Monroe & Overton Twps.	This site contains a rookery of one animal species of concern and a designated High Quality Cold Water Fishery from Coal Run to Towanda Creek by DEP.

Source: Bradford County Natural Areas Inventory, 2005.

**Table 8.5 - High Priority NAI Sites of Local Significance
In the Sugar & Towanda Creek Watersheds**

Site Name	Municipality	PA Heritage Ranks and Site Importance
Case Glen	Armenia & Troy Twps.	This site contains Case Glen, a hemlock-dominated ravine, where groundwater feeding into the headwaters originates from an artificially divided wetland where the southern portion is a modified dam and northern portion has been unaltered.
East Holcomb Pond Wetlands	Franklin & Leroy Twps.	This site is a wetland that contains a variety of habitat types and has had past or current beaver impoundments.
Falls Creek Wetlands	Franklin Twp.	Falls Creek drains southward into Schrader Creek creating a series of waterfalls and at the headwaters area there are a series of variously thick wetlands.
Little Schrader Creek Headwaters	Leroy Twp.	This site is a large, open, shrub,-swamp wetland that has experienced periodic flooding.
Overton Ponds	Overton Twp.	Four open water ponds and one pond with floating vegetation mats are contained at this site and all five could have beaver, human, or nature induced dams.
SGL #36 Reclaimed Strip Mine	Franklin Twp.	This site was a former strip mine that has been successfully reclaimed with a variety of grasses and low shrub plantings. This environment provides habitat for a diversity of bird species. According to the Nature Conservancy this site is the best example of a reclaimed strip mine in the County.
Swimming Dam Bog	Franklin Twp.	This site is a former bog that now has remnants of floating mats of vegetation buoyed by sphagnum moss.
Tamarack Swamp	Armenia & Troy Twps.	This site is a bog that has been modified by a man-made dam. This bog could contain a 90 year record of bog rosemary.
Wolf Run - Rollinson Run Wetlands	Leroy Twp.	Dense shrub swamps with many plant species are contained at this site.

Source: Bradford County Natural Areas Inventory, 2005.

CHAPTER IX - CULTURAL & RECREATIONAL RESOURCES

Cultural resources are the features of a community that make it socially and historically distinct from other communities. Such resources can foster a sense of unique identity, pride and connection within the community; they can also be a core resource for local tourism. Cultural resources typically include historic sites (and the people, stories and artifacts associated with them), museums, and community events, such as fairs and festivals. The Watershed is part of the Endless Mts. Heritage Region. The cultural resources inventoried below are illustrated on the Arts, History and Culture Map (Appendix).

Recreational resources of the community provide many of the quality of life elements that are so valued by the residents and visitors of the Watershed. These resources include the natural resources, physical facilities, public lands, social and cultural events and the opportunities they make possible.

Recreational

Public Recreation and Resource Lands in the Sugar & Towanda Creek Watersheds

Public recreation and resource lands are described and inventoried in extensive detail and depicted on the Park and Recreation Map and the Open Space Maps developed by the Bradford County Office of Community Planning and Grants in the **Bradford County Open Space, Greenways and Outdoor Recreation Plan**. The recreational value in the rural landscapes of the Watershed proves to be a significant social and economic value to the residents and visitors of the Watershed.

Public Lands

Federal Lands

There are no federal land holdings in the Watershed.

State Forest

The Tioga State Forest (District #16) extends into Armenia Township, Bradford County from Tioga County. Three out-parcels are located Albany, Asylum, and Monroe Townships in the southern portion of the County. Together these areas constitute approximately 4,500 acres.

State Park

Mount Pisgah State Park is located in West Burlington Township adjacent to the County's Mount Pisgah Park. The State park is approximately 1,300 acres in size and includes Stephen Foster Lake. The park offers boating, fishing, and swimming, ice fishing, and ice skating, sledding, 10 miles of trails, and an interpretive center. Portions of the trail network are open to cross-country skiers and snowmobilers.

State Gamelands

Four State Gamelands tracts are located throughout the Watershed: 12, 36, 142, and 289. The tracts are collectively managed as part of the Pennsylvania Game Commission's District #5. The largest tract is SGL 12 located on Barclay Mountain.

County Parks

Bradford County owns and operates three parks: Larnard-Hornbrook Park, Mount Pisgah Park, and Sunfish Pond. Two, Mount Pisgah and Sunfish Pond County Parks are located within the watershed area. Mount Pisgah Park is located adjacent to the Mount Pisgah State Park among the County's western uplands in West Burlington Township. Sunfish Pond is located within SGL 12 on Barclay Mountain in Leroy Township. Both of these parks offer numerous outdoor recreational activities, including camping.

Municipal Parks

There are 12 municipal parks in the Sugar and Towanda Creek Watersheds. These facilities include active recreation areas, such as ball fields and playgrounds; as well as passive recreation areas, such as lookouts, nature areas, and boat launches. See Table 9.3 for a listing.

Nature Based Recreation

The abundance and quality of natural resources in the area supports numerous recreational opportunities, and demand for nature-based recreation and tourism is increasing. State-provided facilities include access areas along the Susquehanna River, 35,000 acres of State Gamelands, 6,414 acres of State Forest, and 1,300 acres of State Park. In addition, there are numerous County, local, and private recreation destinations.

The Tioga State Forest (District #16) extends into Armenia Township, Bradford County from Tioga County. Three out-parcels are located in Albany, Asylum, and Monroe Townships in the southern portion of the County. Together these areas constitute approximately 4,500 acres. The Tioga State Forest includes portions of Pine Creek, a popular site for rafting and canoeing in the spring, in Tioga and Lycoming Counties. The State Forest also includes three natural areas and one wild area, all outside Bradford County. Hiking, fishing and hunting are popular throughout the year and these activities do occur on lands in the County.

The only public snowmobile trail system in the County is located in the Tioga State Forest on Armenia Mountain. This eastern portion of the State Forest offers designated snowmobile trails, just across the County line in Tioga County, and joint use trails on State Forest roads in Bradford and Tioga Counties.

Other State Forests in the Northern Tier and Endless Mountains regions include the Wyoming State Forest in Sullivan County, as well as the Tiadaghton State Forest

in Lycoming County, where additional public snowmobile trails are available. The Sullivan County and Eastern Lycoming County Snowmobile trail travels through the eastern section of the Tiadaghton State Forest in Lycoming County and into the Wyoming State Forest in Sullivan County. There are also snowmobile trails in Worlds End State Park. These trails are predominantly shared-use trails that are marked on State Forest and State Park roadways. Parking and rest facilities are available along these routes.

Mount Pisgah State Park (Sugar Creek Watershed) is located in West Burlington Township adjacent to the County's Mount Pisgah Park. The land for this 1302-acre park was obtained in 1969 and dedicated in 1979. Stephen Foster Lake, constructed in 1977 by an earth and rockfill dam on Mill Creek, has one of the best bass and panfish fisheries in the Pennsylvania State Park system and contains perch, bluegill, and crappie, as well. Lake regulations allow both non-motor and electric motor boats. The 75-acre lake has a boat-launching ramp, courtesy dock, restroom and parking on the northern shore. Mooring spaces can be rented on a seasonal basis. Adjacent to the causeway, boat rentals are available during the summer season from a concessionaire. Ice skating is permitted on Stephen Foster Lake; safety precautions are advised.

Passive recreation activities at the State Park include hiking trails around the lake, through wooded areas, old fields, open farmland or rugged terrain, as well as signed trails for snowmobilers (9 miles), trails for cross-country skiers and snowshoers.

About 1,100 acres are open to hunting, trapping and the training of dogs during established seasons. Common game species are deer, turkey, rabbit, grouse, pheasant, and squirrel. Hunting is permitted on adjacent State Game Land 289.

The Park also offers free swimming at the pool, a concession stand, and a day use building with restrooms, dressing rooms, showers, first-aid and lifeguard quarters. The main picnic area, located adjacent to the pool, includes barbecue grills and benches. Active recreation sites are provided for horseshoes and volleyball.

The Environmental Interpretive Center displays artifacts related to early farm life and the wildlife. A butterfly garden outside the center attracts the attention of winged and human visitors. The Park offers interpretive programs such as guided nature walks, night hikes, and slide programs on various environmental topics, including bears, snakes and owls; as well as day camps and environmental education classes for local school children and youth.

Other State Parks in the Northern Tier and Endless Mountains regions include:

- ⇒ Worlds End State Park in Sullivan County,
- ⇒ Salt Springs State Park in Susquehanna County,
- ⇒ Colton Point, Hills Creek, and Leonard Harrison State Parks in Tioga County.
- ⇒ Ricketts Glen State Park in Luzerne County is also a popular destination with residents.

Ten **State Gamelands** tracts are located throughout the County: 12, 36, 123, 142, 172, 219, 237, 239, 250, and 289. The tracts are collectively managed as part of the Pennsylvania Game Commission's District #5. The largest tract is SGL 12, located on Barclay Mountain; the smallest is SGL 237, a Susquehanna River island. Ten additional game lands tracts are managed in adjacent counties in the Endless Mountains region.

The management of State Game Lands is both utilitarian and recreation. Many people who hunt on the State Game Lands do so for the meat they acquire; others simply hunt for sport. Table 2-5 notes game species common to each of the State Game Lands tracts in the Watershed.

Table 9.1 Gamelands and Game Species In the Sugar & Towanda Creek Watersheds

#	Location	Game Species
12	Canton	Bear, Deer, Turkey
142	New Albany	Deer, Grouse, Rabbit
289	Burlington	Deer, Grouse, Squirrel, Turkey
36	Monroeton	Bear, Deer, Turkey

Source: Bradford County

But the Game Lands are also open to many passive recreation activities. Hiking and biking are permitted on designated trails through the Game Lands; five designated trails, totaling 23 miles, are located on three Game Lands tracts in the Sugar and Towanda Creek Watersheds:

SGL 12

1. A 7 mile route from SR 0154, near Wheelerville, east to a gate/parking area near Laquin.
2. A 3 mile route, in a semicircular route from a gate/parking area off of Township Route 419, just west of Camp Brule to a gate/parking area along the Quinlaintown Road.

SGL 36

3. Approximately 4 miles, from the gate/parking area on Hatch Hill north to where the designated route ends prior to the Game Lands boundary line near Satterlee Run.
4. Approximately 7 miles, from the gate/parking area along Weston Road, over the Long Valley Road to the Cash Pond Road to a gate/parking area along the Shrader Creek.

SGL 289

5. Approximately 2 miles, from a gate/parking area along the Berwick Turnpike west to a gate/parking area along the Steam Hollow Road.

Game hunting for bear, deer, squirrel, turkey, grouse, waterfowl, and woodcock is popular with residents and visitors on State and private lands in the respective seasons. Statistics from the Pennsylvania Game Commission indicate that more bear have been taken or harvested in recent years. Total deer harvests have also witnessed an increase, attributable to the increase in antlerless deer taken from 2000-2002.

There are no public shooting ranges in Bradford County or the region, though there are several sportsmen's clubs with private practice ranges throughout the County.

Bradford County owns and operates two County parks in the watersheds area that highlight the natural environment. The primary purpose of the parks is to provide county residents and tourists with a quality outdoor experience in the County.

Mount Pisgah Park is located adjacent to the Mount Pisgah State Park among the County's western uplands in West Burlington Township.

Sunfish Pond is a remote park located within SGL 12 on Barclay Mountain in Leroy Township. The pond is trout-stocked and offers great fishing.

The parks are maintained by the County Parks Director under the Public Works Department. Maintenance work is primarily a task (mowing and painting buildings) employing three part-time employees who receive on-the-job training. Funding for park maintenance comes from the County budget and has been steady in recent years.

There is no master plan for the County parks, although one is currently being developed. Improvements are made periodically, as recommended by the Parks Director and approved by the Commissioners. Unofficial improvement plans include upgrades to rest rooms at the three parks.

The County parks have no on-site staff or security. On-site camp managers/concessionaires provide informal monitoring of park use.

The campsites generate revenue from camping fees and pavilion rentals. Concessions are open during the day to take reservations and collect fees.

Water Access for fishing and boating

There are no established public fishing access areas to streams in the watersheds. However there are access points to the Scharader Creek from the trails listed above and fishing access to Stephen Foster Lake at Mount Pisgah State Park.

Camping

Camp sites are available in the watersheds, as shown in Table 9.3, including at all three of the County parks. These public camp sites can accommodate both tent and RV-based campers.

Seven private campgrounds are also available throughout the County, many with their own private water feature (a lake or pond) or access to the river. These campgrounds also offer a range of camp environments from tent sites to RV- hook-ups to cabins and cottages. Most provide toilets and showers. Many of these facilities offer additional recreational amenities such as ball fields, volleyball courts, swimming pools, and horseshoe pits.

Other private campgrounds in the Northern Tier and Endless Mountains regions include:

- ⇒ Almost Heaven Campground, Forksville, Sullivan County
- ⇒ April Valley Campsites/RV Park, Gibson, Susquehanna County
- ⇒ Buttermilk Falls, Shunk, Sullivan County
- ⇒ The Camp AS East Lake, New Milford, Susquehanna County
- ⇒ Day's End Campground, Rushboro, Wyoming County
- ⇒ Pioneer Campground, Laporte, Sullivan County
- ⇒ Shady Rest Campground, South Gibson, Susquehanna County
- ⇒ Shore Forest Campground, Hop Bottom, Wyoming County
- ⇒ Slumber Valley Campground, Meshoppen, Wyoming County
- ⇒ Sunrise Lake Family Campground, Nicholson, Wyoming County

Table 9.2 - Camping Facilities In the Sugar & Towanda Creek Watersheds

Campground	Location	Facilities
Armenia Mountain Campground	Mountain Avenue, Armenia Mountain	Showers, dump station, electric, trails, tent camping, on-site trailers
Mt. Pisgah County Park	SR 4015: Just past Mt. Pisgah State Park	Scenic views, trails, primitive camping, pavilion rentals, restrooms
Sunfish Pond County Park	Rte. 3010 off Rte. 414, Leroy	Boating, Fishing, ADA dock, Pavilions, Dump station, Bathrooms, Camp store, Designated ball playing and horseshoe pits

Source: Bradford County; Wyalusing Borough Comprehensive Plan, 1992.

Trails

Outside of public lands, there are no developed trails in the watershed area, although a number of efforts are in the organizational stage.

Other trails in the Northern Tier and Endless Mountains regions are listed below.

- ⇒ The 37-mile **Delaware and Hudson Rail Trail (D & H Rail Trail)** connects the Simpson Viaduct at Route 171 north through Lanesboro to the New York State border through Susquehanna County. The trail is open to walkers, bikers/mountain bikers, snowmobilers, cross-country skiers, and equestrian riders.
- ⇒ The Ontario and Western Rail Trail (**O&W Rail Trail**) travels 34 miles from Simpson to Hancock, NY and the Delaware River, paralleling the D&H rail trail for eight miles through Susquehanna, Lackawanna and Wayne Counties. The Lackawanna River often runs in between the two trails.
- ⇒ The **Endless Mountain Riding Trail** connects Alford to Montrose over a 14-mile route in Susquehanna County. The trail permits walking, horseback riding, snowmobiles, cross-country skiing, and mountain biking.
- ⇒ The **Loyalsock Trail** travels nearly 60 miles through Lycoming and Sullivan Counties. The route roughly parallels US 220.

Other ski trails in the Northern Tier and Endless Mountains regions are located at Calendar's Cross Country Ski, Thompson, Susquehanna County; and Elk Mountain Ski Resort Inc, Union Dale, Susquehanna County.

Scenic Observation

There are many scenic natural and cultural landscapes throughout the watersheds. Some are connected by corridors of history such as Route 6 and the Berwick Turnpike, and others are best viewed from designated vista. Most of the vistas are privately owned and managed, but open to the public.

As one of the most scenic highways in the country, **Route 6** traverses Bradford County from east to west following parts of the meandering Susquehanna River through high rock cuts and fertile farmland. Route 6 is considered a destination, as well as a travel way. Scenic areas in the watershed of noteworthiness include:

- ⇒ **Berwick Turnpike**
- ⇒ **Lamb's Lookout** offers views of the Canton area from Armenia Mountain.
- ⇒ **Mt. Pisgah County Park** has several view points to watch sunrises and sunsets over the farms and forests of the countryside. A spectacular view of fall foliage is another reason to visit the Park.
- ⇒ **SR 4014 from Columbia Cross Roads to East Smithfield** was also noted as a particularly scenic corridor with vistas just west of East Smithfield.

Other regional vistas include:

- ⇒ **Canyon Vista**, from which to view Loyalsock Creek Gorge and World End's State Park
- ⇒ **High Knob Overlook** south of Hillsgrove, with views of seven counties
- ⇒ **Wright's View**, just south of Laporte along US 220, with views that skim the mountains and peak into the rolling valleys

Facility Based Recreation

There are 12 municipal parks in communities within the watersheds. Table 9.3 presents the name, location, facilities, size and type of each municipal park. The larger communities tend to have multiple facilities (Towanda area), while smaller communities have a single facility.

Table 9.3 - Municipal Parks In the Sugar & Towanda Creek Watersheds

Municipal Park	Location	Facilities	Size (acres)	Type
Alba Community Park	Alba	Pavilion, Basketball court, restroom, grills, open field	1.21	Neighborhood Park
Alparon Community Park	Route 14 Troy	Swimming pool, Tennis courts, Roller skating rink, Horseshoe pits, Horse riding rings, Football field, Baseball fields, Community Events, Track	73.78	Community Park
Canton Fireman's Field	Canton	Community Events	6.46	Community Park
Monroe Borough Building	College Ave Monroeton	Playground Equipment, Baseball Field	1.56	Neighborhood Park
Monroeton Baseball Field	Monroeton	Community Events, can also be used at anytime by public	14.39	Special Use – Ballfield(s)
New Albany Park	Rte. 220 Follow signs by the library New Albany	Playground, Gazebo, Pavilions, Bathrooms, Areas for bikes or skateboards, Basketball ½ court	5.04	Neighborhood Park
North Towanda Playground	Old Mills Road North Towanda	Playground Equipment	1.89	Mini Park
Sylvania Baseball Field	Sylvania	Community Events (community baseball games), can also be used by public anytime	174.02	Special Use – Ballfield(s)
Tom Jack Park	Main Street East Smithfield	45 Acres of wooded and non-wooded area including Tom Jack Creek, Picnicking Pavilion, Horse Shoe Pits, Baseball Field, Walking Trail	46.19	Community Park
Towanda Borough Park	Towanda Borough		3.65	Community Park
Towanda Memorial Park	Memorial Park Road, Towanda	Baseball and Football fields, Playground, Picnic Pavilion	15.93	Neighborhood Park
War Memorial Pool	2 nd St. Canton	Swimming pool, Basketball courts, Tennis courts, Baseball field, Volleyball sand court, Playground, Pavilion	1.23	Community Park
Total			345.35	

Source: Bradford County

Table 9.4 - Other Facility-Based Recreation Sites In the Sugar & Towanda Creek Watersheds

Facility	Location	Type
Cedar Ledge Service	Rte. 14 Just out of Canton, PA	Mountain boards, Paintball
Rocky's Bicycle Shop	Rte. 414 Monroeton, PA	Skate Park, BMX Track, Paintball, Bike Shop, Bike rentals, Guided tours

Source: Bradford County

Other facility-based recreation is available to residents and visitors through the private market. These include the Towanda Country Club, miniature golf courses, a skate and bike park, and a drive-in theatre.

Other facility-based recreation in the Northern Tier and Endless Mountains regions includes golf courses, a riding stable, and a resort.

- ⇒ Deer Run Championship Golf Course, Great Bend
- ⇒ Mountain Maples Public Golf, Springville, Susquehanna County
- ⇒ Shadowbrook Inn and Resort in Tunhannock, Wyoming County
- ⇒ Spotted Horse Riding Stable, between Dushore and Forksville, Sullivan County
- ⇒ Stonehenge Golf Course in Tunhannock

Schools

The total acreage of school properties with significant recreational facilities in the watersheds is 150.21 acres.

Table 9.5 - Recreation Opportunities at School Sites In the Sugar & Towanda Creek Watersheds

School	Location	Facilities/Equipment	Size (acres)
Canton Schools	Canton	Baseball field, playground equipment, football field	65.89
Harriet Child Elementary	East Smithfield	Playground Equipment	27.62
J. Andrew Morrow Elementary	101 North Fourth St. Towanda	Playground Equipment	7.26
Monroe Franklin Elementary	Rte. 414 Monroeton	Playground Equipment, Open Fields	7.83
Springfield Elementary	Springfield	Playground Equipment	5.19
T.E.C.E Elementary	Leona Rd. East Troy	Playground Equipment, Soccer Fields, Baseball Fields	23.33
Troy Middle	King St. Troy	Basketball Court, Playground Equipment, Trails	2.85
W.R. Croman Elementary	Rte. 14 Troy	Playground Equipment	10.24
Total			150.21

Source: Bradford County

Table 9.6 - Non-public School Facilities In the Sugar & Towanda Creek Watersheds

Name	City	Religious Affiliation
Canton Country School	Canton	Amish
Son Shine Christian School	Canton	Christian

Source: PA Department of Education, <http://www.pde.state.pa.us/>

Libraries

The Watershed has 5 public libraries. The County library, located along Route 6 in West Burlington Township, is the hub for tourist information.

Table 9.7 - Libraries In the Sugar & Towanda Creek Watersheds

Library	Location
Allen F. Pierce Free Library	115 Center Street Troy
Bradford County Library	Rte. 6 West Burlington
Green Free Library	14 N Center St. Canton
Monroeton Public Library	College Ave. Monroeton
New Albany Community Library	Front St. New Albany

Source: Bradford County

Cultural

Historic Sites

The Watershed is home to four sites listed on the National Register of Historic Places, as shown in Table 9.8. An additional 6 sites are eligible for listing. The majority of these sites became eligible during the 1990s. These sites are predominantly located in the boroughs, though fifteen townships also represent significant history among the rural communities of the County.

Table 9.8 - Listed and Eligible Properties of the National Register of Historic Places In the Sugar & Towanda Creek Watersheds

Historic Name	Municipality	Status	Status Date
Canton Historic District	Canton Borough	Eligible	3/12/2000
Gregory-Parson House	Troy Borough	Eligible	5/17/1996
Jeremiah Taylor House	Granville Township	Eligible	2/24/1982
Knapp's Covered Bridge	Burlington Township	Listed	7/24/1980
Methodist Episcopal Church of Burlington	West Burlington Township	Listed	1/4/1990
Padget Property	North Towanda Township	Eligible	2/28/1995
Saint James Episcopal Church	Canton Borough	Eligible	4/27/1992
Troy Elementary & High School	Troy Borough	Listed	2/20/2002
Troy Historic District	Troy Borough	Eligible	12/14/1994
Van Dyne Civic Building	Troy Borough	Listed	1/21/1974

Source: Pennsylvania Historical Museum Commission Bureau for Historic Preservation, 2004.

Bradford County is also home to several national historical figures, memorialized through historic homes and State historic markers.

- ⇒ Towanda native David Wilmot (1814 - 1886), is the author of the Wilmot Proviso, suggesting no slavery in the lands seized from Mexico.

- ⇒ Stephen Foster was a songwriter who brought fame to the region in the Tioga Waltz and Gwine to Run All Night (Camptown Races), a song which celebrates a race from Camptown to Wyalusing.
- ⇒ Hymn writer Philip P. Bliss (1838-1876) wrote and published such songs as Let the Lower Lights Be Burning.
- ⇒ Lester Frank Ward is credited as the father of American sociology.

The Canton and Towanda Historic Districts are listed on the National Register. Eligible historic districts include Troy.

There are no Pennsylvania Historical Markers located throughout the Watershed.

There is one site of local historical significance identified in the Watershed as shown in Table 9.9.

Table 9.9 - Sites of Local Significance In the Sugar & Towanda Creek Watersheds

Site of Local Significance	Location	Significance
VanDyne Civic Building	CNN Bank building Troy	

Source: Bradford County

There is one covered bridge in the watersheds; Knapps Bridge. Additionally, there are other covered bridges in the Northern Tier and Endless Mountains regions in Forksville, Hillsgrove, New Milford, and Sonestown.

There are 17 Century Farms in the Sugar and Towanda Creek Watersheds, representing the County's long-standing agricultural history. Small clusters or concentrations of Century Farms are located in Troy (8), Canton (3), Columbia Cross Roads (3), New Albany (3). Farm names and community locations are shown in Table 9.10.

Table 9.10 - Century Farms In the Sugar & Towanda Creek Watersheds

Century Farm	Location	Century Farm	Location
Willard- Brown Farm	Troy	Norconk Farm	New Albany
Clark Farm	Troy	Packard Farm	Troy
Crawford-Allen Farm	New Albany	Smith Farm	Columbia Cross Roads
Hulslander Farm	Troy	Sullivan Farm	New Albany
Kinsman Farm	Troy	Tomlinson Farm	Canton
Krise Farm	Canton	Tyler Farm	Columbia Cross Roads
Loomis Farm	Troy	Ward Farm	Troy
Wolfe Farm	Troy	Warren Farm	Canton
		Watkins Farm	Columbia Cross Roads

Source: Bradford County

There are no monuments commemorating people and events in the watershed

Other Cultural Facilities and Events

There are 4 museums in the Watershed, as shown in Table 9.11. The museums offer educational and interpretive experiences for residents and tourists. They preserve the artifacts of the County's history and educate visitors about historic County events and lifestyles.

Other museums of regional significance include the Lehigh Valley Railroad Station and Valley Railroad Museum, recently purchased by Sayre Borough; and the Endless Mountains War Memorial Museum in Sonestown, Sullivan County.

Canton and Towanda each have historic theatres that have been restored and are still in use.

- ⇒ The Keystone Theatre was formerly the Hale Opera House (1886) and is a modern movie theater today (Towanda).
- ⇒ The Rialto Theatre is used for community events (Canton).

Table 9.11 - Museums In the Sugar & Towanda Creek Watersheds

Museum	Location
Bradford County Historical Society and Museum	109 Pine St. Towanda, PA
Farm Museum	Rte. 14 N; just out of Troy, PA
Gregory Mitchell House/Inn	Rte. 14 N; just out of Troy, PA
Sugar House	Rte. 14 N; just out of Troy, PA

Source: Bradford County

A number of **cultural events** are held in the watersheds each year to promote community heritage and contemporary products and culture. Many of these are held at Alparon Park in Troy, as shown in Table 9.12. Of course, all of these events offer food and entertainment to residents and visitors.

Table 9.12 - Annual Cultural Events In the Sugar & Towanda Creek Watersheds

Event	Location	Description
Annual Renaissance Faire	Alparon Park, Route 14 north, Troy	Benefits the Rainbow Riders in maintaining therapeutic riding program for disabled adults and children.
Maple Festival	Alparon Park, Route 14 north, Troy	Continuous pancake breakfast, maple syrup demos, flea market, craft show, children's activities including pedal tractor pull; coincides with season opening of Heritage Museum
Pennsylvania Apple and Cheese Festival	Manley-Bohlayer Farm, Canton	Crafts, food, entertainment, photo contest, dancers; traders and craftsmen; traditional drumming and dancing; food.
Riverfest	Held along the banks of the Susquehanna River, J.B. Merrill Parkway, Towanda	Live entertainment, carnival rides, boat rides, and food & craft vendors.
Troy Fair	Alparon Park, Route 14 north, Troy	Features livestock and agriculture

Source: Bradford County

Other annual cultural events in the Northern Tier and Endless Mountains regions include:

- ⇒ Kiwanis Endless Mountains Sled Dog Road and Winter Fest, Estella, Sullivan County
- ⇒ Sullivan County Winter Sleigh Rally, Forksville, Sullivan County
- ⇒ Native American Pow Wow, Forksville, Sullivan County
- ⇒ Laceyville Community Day, Laceyville, Wyoming County
- ⇒ Eagles Mere Summer Antique Market, Eagles Mere, Sullivan County
- ⇒ Eagles Mere Arts and Crafts Festival, Eagles Mere, Sullivan County
- ⇒ Sullivan County Fair, Forksville, Sullivan County
- ⇒ Lianis Wyoming County Fair, Meshoppen, Wyoming County
- ⇒ Eagles Mere Fall Antique Market, Eagles Mere, Sullivan County
- ⇒ Pennsylvania Bowhunter's Festival, Forksville, Sullivan County
- ⇒ Flaming Foliage Show and Sale, Forksville, Sullivan County
- ⇒ Fall Festival and Woodsmen's Competition, Forksville, Sullivan County
- ⇒ Fall Festival Antique Tour and Open House, Susquehanna County

CHAPTER X - WATERSHED COMMUNITY ASSOCIATIONS

Local watershed organizations are critical components to addressing watershed issues that cross municipal and County boundaries. They are in various stages of environmental inventory, assessment and planning of the Watershed's waterways; as well as land use and management practices. These inventories include technical information such as property losses from streambank erosion; proximity of streams to endangered buildings, roads, bridges and other facilities; water quality, and the probability of continued soil/streambank loss. As importantly, they also document community interests in the ecological, economic and recreational value of the watershed.

Sugar Creek Watershed Association

History

In 1999, the Bradford County Conservation District partnered with the Center for Chesapeake Bay Communities and Canaan Valley Institute to help organize the watershed association and sponsor a Coordinated Resource Meeting (CRM) involving all stakeholders in the watershed -- interested agencies, governmental entities and property owners. Participants were asked what they valued about Sugar Creek watershed, what they would like to change, what they perceived as resource issues and weak links, who else needs to be involved, what do they need to do to get started, and how will achievements be measured. This resulted in developing goals and a future vision of the Sugar Creek watershed.

Participants emphasized the importance of the creeks, natural beauty of the rural area, wildlife, open space, agriculture, woodlands and small communities, friendly people working together, and heritage/family history as the qualities they most liked of living in the Sugar Creek watershed. Participants were broken into smaller workgroups and asked what they felt were the most important resource issues facing the watershed. Repeatedly, the response was bank erosion, gravel bar removal, flooding, lack of education of land use practices, cooperation of all municipalities, residents, and need for support from politicians, and agencies in watershed, and funding.

Participants envisioned the future of the Sugar Creek watershed as being a stable, healthy environment being in balance with the social and economic concerns of the community. When asked who else needs to be involved, participants responded the businesses and Chambers of Commerce, PA Game Commission, Endless Mountain Tourism, PA Fish & Boat Commission, insurance companies, Ducks Unlimited, PennDOT, Trout Unlimited, utilities companies, Susquehanna River Basin Commission, Chesapeake Bay, other watershed groups, municipal officials, State,

federal and county officials, landowners/homeowners, youth groups such as Scouts and FFA, and service groups such as Rotary, Lions, etc.

The participants determined they needed the following to get started as a watershed association:

- ⇒ steering committee / leadership,
- ⇒ identification of problems & problem areas,
- ⇒ time and dollars,
- ⇒ source of funds and grants,
- ⇒ press coverage,
- ⇒ public meetings, information,
- ⇒ follow-ups,
- ⇒ enthusiasm,
- ⇒ common goals, vision,
- ⇒ technical guidance,
- ⇒ and a schedule of future events.

In 1998-99, U. S. Fish and Wildlife sponsored two Sugar Creek demonstration fluvial geomorphic stabilization sites in the Troy area.

The Sugar Creek Watershed Association began meeting in February 2002, became incorporated in 2004, and has applied for IRS recognition as a nonprofit 501(c)3. In 2002, the Watershed Association created a logo and uses it on ball caps, shirts, letterhead and signs.

The Watershed Association prepared an educational 2003 calendar featuring photographs of sites along Sugar Creek and its tributaries and describing watershed concepts.

In both 2002 and 2003, the main stem of Sugar Creek watershed was walked and assessed by volunteers from the Watershed Association.

In 2002 and 2004, the Watershed Association established a tree nursery and planted riparian buffer areas. Boy Scout Troops 4049 and 47 assisted watershed members to clear brush and plant 300 trees to create a riparian buffer on an erosion site in the Sugar Creek watershed.

In 2004, the Sugar Creek Watershed Association obtained \$125,000 in Growing Greener funds to conduct an environmental assessment. The Watershed Association hired BCCD to complete a fluvial geomorphic environmental assessment that includes longitudinal profile, cross-sections, scour chains data, bank erosion data, setup of permanent cross sections, initial data collection and data reduction, coordination with volunteers for additional data collection, and a written analysis of the data for the final assessment report. BCCD has installed permanent stream monitoring stations.

Canaan Valley Institute conducted a training workshop in the spring of 2004 to prepare the members to conduct interviews and compile information for the history. The Watershed Association members are preparing a compilation of historical sites along the main stem and tributaries that will eventually be published. The book will feature each site with a descriptive write-up and photo.

The Sugar Creek Watershed Association has developed a newsletter and is exploring various fund raising options. They are working on developing a speakers' bureau, and are also exploring the feasibility of developing an environmental education center in conjunction with a local school district.

Association Goals & Objectives

The Mission statement of the Sugar Creek Watershed Association is as follows:

“To build a culture of caring for the gift of our lands and streams through planning, education, public relations and hard work.”

Action Plan Objectives:

Water Quality:

Create a stable stream in dynamic equilibrium with watershed environment.

Recreational Fishing:

With better water quality and with improved habitat, recreational fishing will improve.

Education:

A widespread community outreach program to raise awareness/knowledge of watershed.

Watershed Association:

Build Association infrastructure that will withstand the test of time.

Towanda Creek Watershed Association

History

Towanda Creek Watershed Association (TWCA) informally met after the January 1996 flood. Concerned residents, farmers and municipal officials were determined to work together to address the problems caused by the flood. The focus of the group later evolved to address watershed-wide environmental issues. In March 1999, a two-day Coordinated Resource Meeting (CRM) was held involving all interested agencies, governmental entities and property owners. As a result of this meeting, it was decided that the group ought to be organized as a more structured organization.

Towanda – Sugar Creek Watershed Conservation Plan July 2009

In 2000, a \$1,000 PA Stream Re-Leaf Mini-Grant was obtained by the group to plant trees on a total of over 500 feet of stream bank at 4 different sites to act as a riparian buffer, and to create a temporary tree nursery at the Towanda Airport.

In 2000, a \$5,000 Canaan Valley Institute Grant was obtained to organize the volunteer group into a watershed association and to provide funding to develop a database of watershed residents, prepare two newsletters, and develop a watershed action plan. By the end of 2000, Towanda Creek Watershed Association volunteers had nearly completed a watershed-wide inventory. In addition, a rainfall monitoring network was established and a stream gauge network was being developed.

In 2001, the Bradford County Conservation District received a \$16,650 grant from the National Fish and Wildlife Foundation to identify priority areas for remediation work. The funds allowed BCCD to train watershed volunteers to inventory erosion problems, and develop a volunteer network for the collection of rainfall and stream stage data.

In September 2001, an Action Plan was developed through funding by the Fish and Wildlife Foundation and Chesapeake Bay Watershed Grant.

Volunteers and BCCD staff conducted an initial watershed inventory, walking 89.9 stream miles and identifying 408 sites. These sites accounted for 94,303 linear feet of eroding stream banks. One hundred and seventeen (117) of these erosion sites occur within 25 feet of a structure (home, road, garage, barn, bridge, culvert, etc.). A 'Stream Inventory and Evaluation Form' was prepared for each identified erosion site.

Volunteers also collected 150 flood damage reports, accounting for over \$9 million dollars in damages/losses due to storm events. Volunteers documented the loss of over 3,136,845 cubic feet of soil.

By the end of 2001, Towanda Creek Watershed Association had installed stream stage gauges, requested PA Growing Greener funding, created a logo, installed watershed signs, and produced placemats.

In 2002, Towanda Township was awarded \$120,000 through PA Growing Greener for an environmental assessment of the main stem and North and South Branches of Towanda Creek. Land and Mapping Services, Inc. was hired to take scaled photographs of the streams for digitized mapping, and GTS Technologies was hired to assess the channel corridor, document erosion areas, and determine a priority list for identified erosion sites in the watershed. Alternative concepts for remediation were developed and anticipated costs calculated for each impaired reach. The cumulative length of all identified impaired reaches totaled 17.14 miles.

In 2002, the Watershed Association expanded its vision statement to CPR -- Clean, Protect and Restore -- the Towanda Creek and its main tributaries through natural stream restoration efforts and better environmental management practices. A

watershed logo was designed and watershed road signs were placed in prominent locations.

A written history of the watershed was developed and printed. In 2003, the Watershed Association obtained \$50,000 from PA Growing Greener for Phase II of the environmental assessment. The contract was awarded to the Bradford County Conservation District. Early in 2003, the Watershed Association obtained an additional \$1,000 Chesapeake Bay Mini Educational Grant to design and print brochures about the Towanda Creek Watershed.

In 2003, Watershed Association volunteers began working with the staff of Canton Area School District to develop educational programs. The newly reinstated FFA class was able to attend the Youth Summit held in conjunction with the Watershed Conference with some financial assistance from the Towanda Creek Watershed Association, which also purchased two water testing kits for the school.

Association Goals & Objectives

Goal 1

Complete the identification, quantification and qualification of stream erosion and flooding in the Towanda Creek Watershed.

Short term actions:

1. Complete the visual inventory of all tributaries within the watershed for stream erosion. Enter data on GIS.
2. Develop, distribute, and complete a historic damage assessment of all properties immediately bordering streams.

Long term actions:

1. Develop and institute a centralized recording system for all flooding and stream erosion damages

Goal 2

Identify and implement a watershed restoration and management strategy.

Short term actions:

1. Prioritize all identified problem sites and stream segments.
2. Research various engineering sources of assistance and invite them to give educational presentation at watershed meetings on their approach to identified problem solutions
3. Solicit proposals from sources of engineering sources of assistance to address technical assessment of identified problems.
4. Actively seek funding to hire source of engineering assistance.
5. Select top ten identified problem sites and seek funding to correct as demonstration.

Long term actions:

1. Seek funding for design and implementation of restoration.

2. Seek support and funding for a stormwater management plan for the watershed
3. Seek support and funding for a riparian management plan for the watershed

Goal 3

Implement effective best management practices for watershed restoration and protection.

Short term actions:

1. Continue working with Chesapeake Bay Foundation, Natural Resources Conservation Service, Conservation District and others to establish riparian planting efforts.
2. Continue expansion of the micro-nursery concept in several locations in the watershed
3. Identify and implement other best management practices that can be used as demonstrations in the watershed

Long term actions:

1. Establish working relationships with agencies and other sources of assistance in identifying and implementing best management practices

Goal 4

Develop and implement an effective public education and implementation program.

Short term actions:

1. Seek funding and support for the continued publication of the watershed newsletter.
2. Participate in area schools' field days, etc.
3. Develop a stand alone display that can be utilized as part of area festivals, activities etc. that tells the "watershed story"
4. Develop a personal "watershed history" relating the importance of the stream and its historic connection to the people
5. Hold an annual watershed meeting
6. Develop a watershed logo

Long term actions:

1. Seek sustainable funding for watershed communications such as newsletter, etc.

Goal 5

Build a strong, viable watershed association.

Short term actions:

1. Continue regular watershed meetings.
2. Develop watershed community awareness through signs, displays, etc.
3. Develop an outreach plan to involve more community elements.
4. Establish and strengthen the association committees.

Long term actions:

1. Establish Watershed Association as a legal, structured independent entity.
2. Have named representation from each watershed municipality.
3. Collect and compile a historic account of the importance and role of Towanda Creek in the development of the communities in the watershed.

Goal 6

Continue building a strong community-run watershed monitoring network.

Short term actions:

1. Expand the rainfall and stream gauge network
2. Organize data collected by citizen monitors
3. Present the data in graphical format
4. Expand monitoring program to include water quality assessment

Long term actions:

1. Begin to utilize rainfall and stream data to model stream responses to rainfall
2. Establish a flood warning system

Schrader Creek Watershed Association

History

Schrader Creek Watershed Association started meeting in February 1992 as a group of dedicated trout fishermen that were concerned with acid mine drainage from the Barclay Mt. area. The group was incorporated in 1996 and became a tax-exempt 501c3 nonprofit through the IRS Jan. 1999. In 1994, the watershed association received a \$5,000 grant from DEP to create its first limestone diversion well on Falls Creek. In 1997, DEP invested \$1.2 million to create two vertical flow limestone beds. Two passive treatment systems were constructed, one on an AMD discharge to Falls Creek (approximately 60% of AMD load to Schrader Creek), and one on a discharge to Long Valley Run (approximately 20% of AMD load to Schrader Creek), as part of the 10% AML set-aside program – Program No. AMD 08(3295)101.1.

The Schrader Creek Watershed Association provided support in collecting background water quality, collecting property information, getting private landowner permission for wetland treatment system access, construction and land easements, and gaining public support and involvement for the project. The two AMD discharges constituted the majority of the AMD loading to Schrader Creek. The Long Valley Run project all but eliminated the water quality impacts of a 100 gpm AMD discharge. The Falls Creek project initially had some operational problems. The system is now operational under all flow conditions and the monitoring data indicates the system is removing greater than 90% of the AMD acidity in the Falls Creek tributary.

Schrader Creek Watershed Association received a Section 104(b)(3) National Pollutant discharge Elimination System Program Grant to demonstrate watershed rehabilitation through comprehensive mine reclamation from PA DEP, Bureau of Mining and Reclamation. The project involved the application of in-stream limestone sand (ILS) to address AMD loading and low pH conditions in Coal Run, Carbon Run, Falls Creek and Long Valley Run. The ILS technique was previously used to address AMD and acid deposition impacts in Pennsylvania and West Virginia waters to support trout stocked fisheries. All funding from the grant was used to purchase limestone sand. Members of Schrader Creek Watershed Association periodically add the limestone sand in upstream locations in each of these four streams. Schrader Creek Watershed Association provided all equipment (\$5,000), labor for the placement of limestone sand in the tributaries, and monitoring of the projects.

In 2000, Schrader Creek Watershed Association obtained \$328,459.00 from Growing Greener I for an assessment of Schrader Creek, placement of a diversion well on Coal Run and installation of an aerobic limestone basin (ALB) at Sunfish Pond. The ALB works to increase stream alkalinity and mitigate the effects of chronic and episodic acidification as a result of atmospheric deposition in Sunfish Pond. The project eliminated chronic acidification to Sunfish Pond and relieved the Schrader Creek Watershed Association members from spreading limestone on the ice at Sunfish Pond every other winter.

A 2001 watershed survey conducted by Penn State University indicates the headwaters of Schrader Creek and a number of tributaries do not comply with PA Water Quality Standards due to anthropogenic pollution, and should be considered impaired. The waters include main stem Schrader Creek (from headwaters to below Little Schrader Creek), Lye Run, Rollinson Run, Wolf Run, Thomas Run, Little Schrader Creek, Cash Mountain Run and numerous unnamed tributaries.

A second limestone diversion well became operational in May 2002 on Coal Run to double the output capacity of limestone added to Schrader Creek. This installation is grinding limestone adequately and has raised the pH of Coal Run. Both of the diversion wells are functioning properly and being maintained monthly by the Association members.

In the fall of 2002, Schrader Creek Watershed Association used \$120,000 of Growing Greener funds to complete a third buried limestone treatment facility. A pit was blasted, filled with limestone and buried. It is located alongside a small stream that feeds Sunfish Pond, a County Park in Leroy Township. This passive system treated water from the unnamed tributary prior to it reaching Sunfish Pond to help stabilize the pH balance in the pond and prevent the fish kills that have been a problem in the past. This project also made it unnecessary to spread agricultural limestone over the ice on the pond in the winter. The Schrader Creek Watershed Association had been providing materials and labor since 1994 for the yearly liming of Sunfish Pond. Professor Dean Arnold of Penn State University recommended liming when he was consulted after an acidic event associated with snowmelt (acidic deposition) resulted

in a major fish kill in the pond. The fish kill resulted in the PA Fish and Boat Commission temporarily removing Sunfish Pond from their approved trout waters list. This action was later rescinded after the Watershed Association initiated the liming program.

In August 2002, Schrader Creek Watershed Association obtained \$75,000.00 from Growing Greener III to address the problems of acid rain. Penn State University conducted an assessment study of the entire watershed, and it concluded acid rain is negatively impacting the upper Schrader Creek watershed. The study confirmed what fishermen in the watershed association have observed. There are fewer species of fish in the upper watershed. It was concluded that five anaerobic vertical flow wetland systems (AVFW) and/or aerobic limestone basins (ALB) are needed to increase stream alkalinity and mitigate the effects of chronic and episodic acidification as a result of atmospheric deposition in the Schrader Creek watershed (Bradford/Sullivan Counties). The project will eliminate chronic acidification and restore aquatic life in approximately 10 miles of headwater stream and tributaries. It will also increase downstream alkalinity in Schrader Creek and prevent periodic episodic acidification in approximately 5 to 10 miles of stream. Work began in the summer of 2003 on Phase1 (design, and permitting) of the restoration of atmospheric-related water quality impacts in Schrader Creek. A budget totaling \$75,000.00 was approved for Phase 1.

Susquehanna River Basin Commission, under contract with DEP, monitored Long Valley Run, Coal Run, and Falls Creek between November 2002 and August 2003 for acid mine drainage. The final report was submitted to PADEP in October 2003 and a copy is available in the Bradford County Conservation District office. Total iron, manganese, aluminum, acidity and alkalinity were the main parameters monitored; the data will be used in upcoming years for Total Maximum Daily Load (TMDL) development.

In 2003, Schrader Creek Watershed Association submitted a Growing Greener Grant for a limestone treatment system on the left branch of Long Valley Run, which was denied.

Traditionally, Schrader Creek and several tributaries support a valued sport fishery. Some areas in the watershed also support wild brook trout populations, although many of these areas contain limited number of fish due to water quality impacts. Other stream sections and tributaries contain high quality habitat but few, if any, fish due to water quality impacts related to AMD and Acidic Deposition. Due to the acidic water, trout could not live in the lower third of the stream, which is located in Monroe, Franklin and Overton Townships and which pass through State Game Lands. Currently, water quality in this area – a nine-mile section including six miles in State Game Lands – has improved as a result of the AMD remediation efforts in the watershed. The Schrader Creek watershed, as of 2003, has approximately 10 miles of stocked trout waters; a one mile section of which is delayed harvest. Trout

stocking in the lower section of Schrader Creek was a direct result of restoration efforts by the Watershed Association.

Association Goals & Objectives

1. Document the current water quality in the Schrader Creek Watershed.
2. Research AMD abatement/treatment technologies and their applicability to the watershed.
3. Implement AMD abatement/treatment technologies to restore water quality in the lower portion of Schrader Creek to a state which is sufficient to support a stable, healthy fish and aquatic insect population.
4. Preserve the remaining high quality water in the watershed by limiting future polluting influences.
5. Promote public awareness of the history and natural beauty of the watershed, and emphasize its uniqueness as a wilderness area.

CHAPTER XI - WATERSHED MANAGEMENT CHALLENGES AND STRATEGIES

In the process of developing the Rivers Conservation Plan for the Sugar and Towanda Creek Watersheds; challenges and strategies for the management, protection and enhancement of the watershed were identified. This was done through a series of public meetings held in each municipality in the watershed. Additionally, a steering committee, representing each of the municipalities and management agencies and organizations was created to provide input and review. Strategies were also incorporated from existing plans and programs to assure integration of the wider stakeholder group, avoid duplication of efforts, and maximize efficiency and economy of efforts.

Issues and challenges identified were sorted into 11 broader categories as follows:

- Agriculture
- Cultural
- Forestry
- Landowner
- Mining / Resource Extraction
- Municipal / Community
- Recreation
- Recycling / Waste
- Streams
- Transportation
- Wildlife

Agriculture

As seen in the previous section on land cover and use, over 50% of the watershed land is being utilized for agricultural purposes. Agriculture is the single largest activity impacting on the physical, social, and economic health of the watershed.

During 1989, the Bradford County Conservation District was given a grant to conduct watershed assessments, through the PA Conservation Commission under the PA Chesapeake Bay Program. The purpose of the grant was to assess the need for assistance in addressing potential non-point sources of pollution from agricultural enterprises in the targeted watersheds.

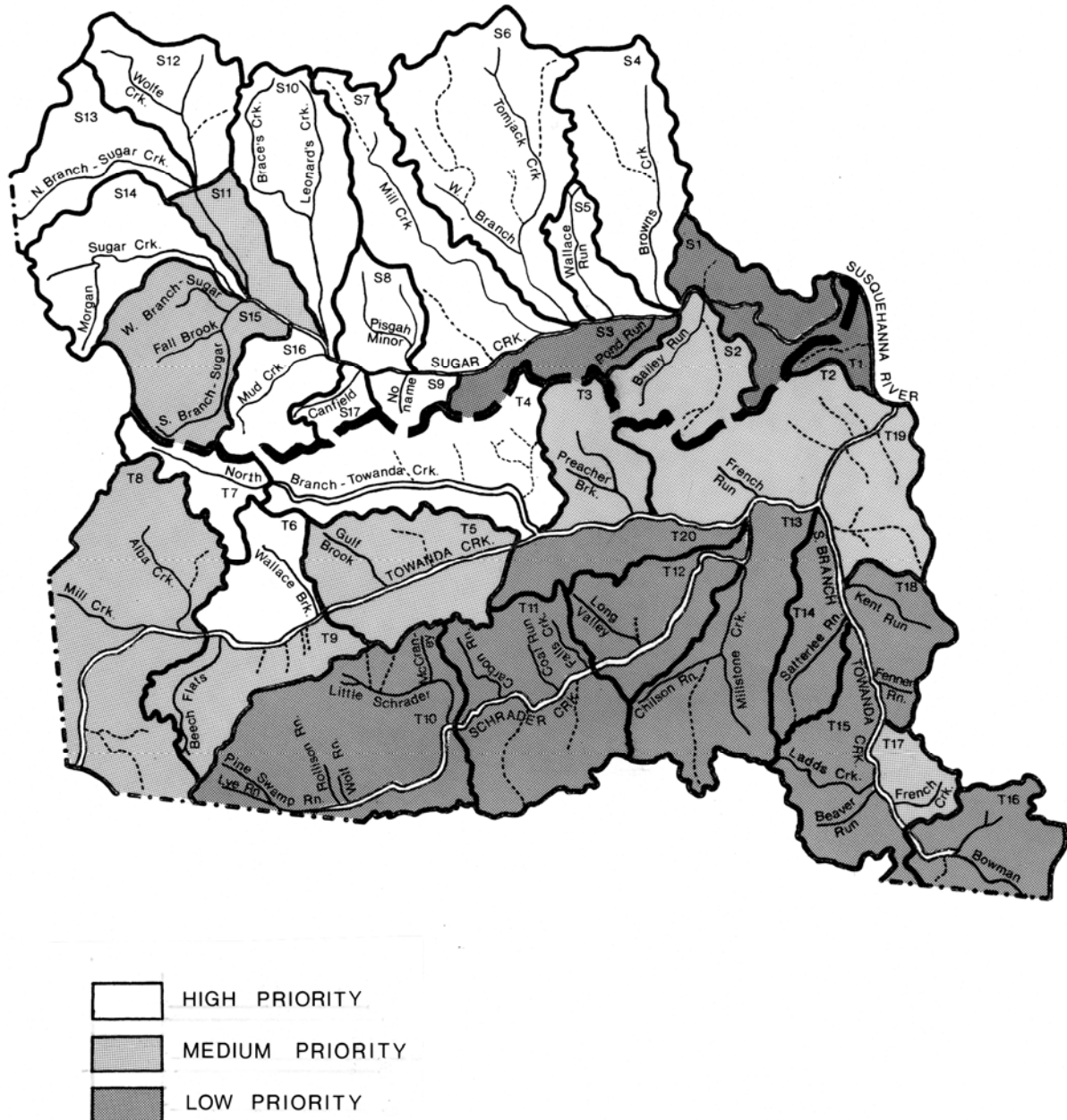
The watershed studies covered an area of 519,328 acres. This area included the Susquehanna River Sub-Basin 4-C, which included 285,095 acres consisting of Sugar and Towanda Creeks. Approximately 490 livestock operations were identified in sub-basin 4-C.

The watershed assessment team assembled detailed sets of maps and compiled data for the purpose of developing a Pollution Potential Index. This index was developed in order to set priorities based on elements directly contributing to potential sources of nutrient runoff associated with livestock and normal farming operations. These elements include information on: sub-watershed delineation; average slopes; amount of land in row crops; amount of land in hay and pasture; amount of land in urban/residential use; amount of area covered by water; amount of land in forest; soil erodibility; animal density; drainage density; and farm density. The results were the development of a priority system for addressing agricultural needs as the following table and figure show.

Table 11.1 - Chesapeake Bay Watershed Assessment PPI Priorities - Towanda Creek (T) and Sugar Creek (S) Watersheds

<i>Sub watershed</i>	<i>Avg. Slope</i>	<i>% Row Crop</i>	<i>% Hay/Pasture</i>	<i>Erodibility</i>	<i>Animal Density</i>	<i>Drain Density</i>	<i>Farm Density</i>	<i>P.P.I</i>
T-1	19.50	0.00	15.00	0.25	0.00	0.01	0.00	157.51
T-2	14.60	8.00	43.00	0.26	0.14	0.01	.00	1346.67
T-3	8.50	5.00	57.00	0.24	0.19	.00	.00	1116.87
T-4	12.50	9.00	57.00	0.24	0.31	.00	.00	1595.42
T-5	12.70	9.00	45.00	0.26	0.33	0.01	.00	1490.97
T-6	10.80	17.00	57.00	0.25	0.41	0.01	.00	2538.14
T-7	9.40	11.00	51.00	0.26	0.45	0.01	0.01	1784.19
T-8	16.60	7.00	43.00	0.27	0.37	0.01	.00	1244.53
T-9	13.00	6.00	37.00	0.27	0.56	0.01	0.01	1080.07
T-10	10.10	0.00	5.00	0.28	0.00	0.06	0.00	76.20
T-11	14.60	0.00	5.00	0.27	0.00	0.05	0.00	76.09
T-12	25.00	0.00	6.00	0.33	0.00	0.04	0.00	92.27
T-13	22.00	0.00	6.00	0.26	0.00	0.05	0.00	88.02
T-14	20.80	0.00	5.00	0.27	0.11	0.07	.00	94.46
T-15	25.40	3.00	29.00	0.27	0.16	0.01	.00	646.72
T-16	13.20	4.00	37.00	0.27	0.10	0.01	.00	823.04
T-17	10.80	7.00	55.00	0.28	0.27	0.01	.00	1342.27
T-18	22.00	0.00	6.00	0.28	0.07	.00	.00	87.26
T-19	12.60	7.00	35.00	0.27	0.28	0.01	.00	1166.33
T-20	24.10	2.00	27.00	0.28	0.46	0.01	.00	524.49
S-1	19.10	4.00	37.00	0.25	0.39	0.01	.00	839.50
S-2	15.40	7.00	41.00	0.23	0.38	0.01	.00	1222.73
S-3	15.30	4.00	45.00	0.25	0.00	0.01	0.00	887.75
S-4	14.40	9.00	57.00	0.24	0.23	.00	.00	1593.78
S-5	12.75	13.00	55.00	0.26	0.19	.00	.00	2045.22
S-6	12.10	9.00	54.00	0.24	0.64	.00	.00	1577.80
S-7	13.50	10.00	44.00	0.27	0.43	.00	.00	1604.65
S-8	16.60	11.00	46.00	0.27	0.36	.00	.00	1739.13
S-9	13.30	12.00	56.00	0.24	0.20	.00	0.01	1938.00
S-10	16.10	11.00	45.00	0.27	0.37	.00	.00	1728.87
S-11	15.00	7.00	51.00	0.29	0.23	.00	.00	1306.76
S-12	19.80	10.00	53.00	0.25	0.38	.00	.00	1683.68
S-13	18.50	10.00	53.00	0.25	0.47	.00	0.01	1688.74
S-14	16.30	11.00	48.00	0.27	0.41	.00	.00	1758.73
S-15	14.70	6.00	48.00	0.28	0.16	.00	.00	1158.42
S-16	14.30	12.00	56.00	0.26	0.14	.00	.00	1932.60
S-17	10.10	14.00	53.00	0.24	0.46	.00	.00	2152.60

Figure 11.1 – Priority Sub-basins of Sugar & Towanda Creek Watersheds for Ag Non-Point Source Pollution



Source – Bradford County Chesapeake Bay Watershed Assessment – Sept 1989

Personal interviews were conducted by randomly selecting individuals owning and/or operating agricultural lands in each of the sub-basins, in order to assess the needs and anticipated interest in the area of nutrient management on agricultural operations. In sub-basin 4-C, 60 (12%) individuals were interviewed in-person, with an additional 36 by phone.

Results of the interviews conducted revealed that only 35% of those interviewed had their soil tested in sub-basin 4-C. In the area of manure testing, only 5% tested in sub-basin 4-C. Manure storage was utilized by only 1% in sub-basin 4-C. 75% of those interviewed needed new or updated conservation plans in sub-basin 4-C.

A "cooperation expectancy" factor was created for each farmer interviewed. This factor is based on conservation needs expressed by the farmer, past history of government program participation and the attitudes of the farmer concerning the Chesapeake Bay Program. These factors were then averaged for each sub-basin to come up with an expected number of program participants.

A cooperation expectancy of 57% in sub-basin 4-C is estimated for the Chesapeake Bay Program.

Taking the extent of the needs documented in the study and adjusting that need by the cooperation expectancy, it was estimated that a total of \$14,248,570.00 (1989 costs) would be needed to address the structural and practice needs of the study area. This is combined Program and landowner contribution.

Educational program needs were demonstrated in the areas of general nutrient management, conservation leasing, addressing special non-resident conditions, and soil testing results follow-up.

Assuming that funding would be available for such a program, the primary limiting factor in any implementation plan was the shortage of technical personnel to engineer any structures required as part of the contracts to be developed with landowners. Based on 1989 estimates, utilizing current personnel in the most efficient manner would create a funding need of \$2,779,000.00 over 5 years, or \$570,120.00 a year.

Given the requested level of funding, it is anticipated at least a 6%, per year, annual reduction in losses of Nitrogen and Phosphorus to watershed waterways. At present, a calculated 70,400 tons of soil is leaving fields and entering Bradford County streams every year. With this soil goes 382,976 lbs. of Nitrogen and 140,800 lbs of Phosphorus.

The reduction strategy - assuming requested funding over the next five years - will reduce soil losses by 6% per year, or a total of 30% over 5 years. Nitrogen losses will also diminish by 6% per year (382,976 lbs. to 367,782 lbs. the first year and down an additional 25,782 lbs. each year thereafter). Phosphorus losses will move from 140,800 to 135,214 lbs. the first year and down by an additional 9310 lbs. every year thereafter.

Compiled Stakeholder Input

The following is a distillation of issues in the Sugar and Towanda Creek Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (GranvilleTwp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. –Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy.

Agricultural Issues Category I – *Resource Planning & Management*

With the prevalence of agricultural land and operations within the Watershed area, a critical need to address the planning and management level involved with these operations was identified. This is from a resource need, a regulatory perspective and the need for farmers to be more efficient and environmentally sensitive in their operations. Cited needs include the following:

- ✓ Soil conservation and nutrient management plans need to be developed and updated for all farming operations in the watershed.
 - The need for current, state of the art conservation planning remains a high priority. Conservation and no-till practices need to be better incorporated into the culture of the County's agricultural operations.
 - Conservation and Nutrient Management Plans need to be developed for the specific needs of farmers as well as achieving regulatory and resource management objectives.
 - Soils sensitive to disturbance need to be identified and protected through sound planning.
- ✓ Agricultural Best Management Practices (BMPs) identified in the conservation and nutrient management plans need to be implemented.
 - Technical and financial resources need to be made available for farmers to develop plans, design and implement BMPs.
 - Barnyard location and management, manure storage and application, livestock access to waters of the Commonwealth, and sound nutrient management are all part of the issues related to agricultural nutrient management.
 - Agricultural tillage can create soil loss problems – includes 24,546 row crop acres according to the 1989 Bradford County Chesapeake Bay Watershed Study. This equates to 44,587 tons of soil lost annually according to the USDA Natural Resources Inventory (Bradford County Chesapeake Bay Strategy, 2005).

- There are a lack of vegetative buffers and/or field borders (for agricultural and non-agriculture land uses).
- ✓ There are few local ordinances in place that protect the Watershed's resources.
- ✓ There is a need for accelerated efforts in Agricultural Nutrient Management – encompasses all aspects of livestock and crop operations involving manures and commercial fertilizers.
- ✓ There is a reluctance to do, or lack of, soil and manure testing as well as nutrient balancing and agronomic record keeping. There need to be incentives to perform these tests and incorporate the information into planning tools.

Agricultural Issues Category II – Environmental Impacts of Agriculture

As an industry, agriculture is intimately connected to the land and water resources that it depends upon. As such, agricultural operations have the potential to have impacts on those and related natural resources. Cited concerns in the Watershed include the following:

- ✓ Livestock need to be excluded from uncontrolled access to streams.
- ✓ There is a need to clean up existing and abandoned farm related dumps.
- ✓ Dead farm animals need to be disposed of properly.
- ✓ Animal waste (manure) is entering the streams on many farms.
- ✓ Large animal operations have odor impacts on neighboring residential properties.
- ✓ Diverted water from farming operations, entering the road drainage system is causing damage to the road system in many areas.
- ✓ Water is often indiscriminately directed onto agricultural operations from roads, development or other activities that alter land cover and drainage patterns; thus creating increasing water control concerns for the farmer.
- ✓ Erosion from farm fields create water quality problems and excessive sediment build up in streams and channels in many areas in the Watershed
- ✓ Groundwater needs to be protected from nutrients and agrichemicals.
- ✓ Commercial Fertilizer Applications – are part of numerous non-agricultural operations, as well as the on farm ones. Improper use on lawns, golf courses, schools properties, and commercial areas can contribute significant amounts of “N” and “P” to the surface and groundwater.
- ✓ Plastic waste from farms needs to be managed and disposed of properly.

Agricultural Issues Category III – *Agricultural Viability*

With Agriculture existing as one of the top land uses and income generators in the Watershed, all sources of input, listed the protection and maintenance of farms and farmlands as a top priority. Agriculture has formed the foundation for much of the

culture and heritage of the watershed. It assures both the rural nature and the scenic vistas identified as valuable in virtually all studies and surveys. Issues directly cited related to Agricultural Viability include the following:

- ✓ There needs to be specific and more extensive agricultural protection and preservation.
- ✓ Resources need to be found and provided to further the agricultural economy.
- ✓ Awareness of agriculture and its relationship with the public needs to be increased.
- ✓ Strategies need to be explored on how agriculture in the watershed can help address the energy crisis and enhance their sustainability.
- ✓ The historic and cultural heritage of agriculture needs to be preserved.
- ✓ The movement of Bradford County residents to more rural living is a potential threat to agricultural lands.
- ✓ The value of agriculture in providing scenic natural landscapes in the Watershed needs to be considered and protected.
- ✓ Portions of agricultural lands are reverting to forest and range lands.
- ✓ There is a loss of family farms in the watershed.
- ✓ Additional economic opportunities need to be found and/or created to enhance the viability of agriculture in the watershed.
 - There is an ongoing need to facilitate the education of agricultural operators in areas such as specialty crops, diversity, processing, crop rotations, and related cottage industries.
 - There is a need to retain agriculture and related manufacturing and support industries as part of the community economic base.
 - The economy of size (of farms) needs to be examined; smaller farms do not seem to be economically viable.
 - There is a gap between consumer prices and production costs.
 - Local and niche markets need to be developed for farm products.
- ✓ Strategies and their implementation need to address the development and retention of agriculture as a land use and component of economic and tourism base.
- ✓ There is a lack of willingness by the “next generation” to take over family farms.
- ✓ Real estate is the farmer’s “retirement”.
- ✓ Marketing efforts need to be made to lure outside farmers to available farms in the watershed.
- ✓ Farmers fear land use regulations such as “zoning” will hamper agriculture.
- ✓ Regulations and liabilities can hamper agricultural operations and specialty enhancements such as “agro-tourism”.
- ✓ Public infrastructure, such as roads and utility lines, can impacts negatively on agricultural lands.
- ✓ There is a need to provide more opportunities for farmers to interact with the public to emphasize operations, heritage, and cultural values of farming in the watershed.

- ✓ There need to be more creative financial incentives for the support of agriculture, such as Clean and Green and other tax incentives, low interest loans, grants, etc.

Agricultural Strategies

The following is a listing of strategies to address agricultural identified issues in the Sugar and Towanda Creek Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough); the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy.

Agricultural Strategies Category I – *Resource Planning & Management*

- Provide model ordinances, ordinance language or ordinance topics for municipal and multi-municipal considerations.
- Establish an Open Space Coordinator or similar County position to spearhead open space and agricultural viability, business, and preservation incentives.
- Establish a central agricultural resources clearinghouse to include real estate, property transfer assistance, employment / apprenticeships / internships, cooperative opportunities, equipment, etc
- Perform detailed natural resource inventories, to include vital and accurate agricultural and land use statistics; monitoring them over the long-term.
- Encourage the development of watershed management strategies that promote best management practices of mining, agriculture, and similar land uses.
- Find, or develop, economic and financial models or determinations that depict the benefits of established, designated and designed development and land use that recognizes agricultural land values.
- Encourage the use of best management practices in erosion control, nutrient management, and stormwater management for cost savings and environmental benefits through expanded technical and financial assistance programs.
- Provide the technical and financial assistance to provide current conservation plans for all farms in the watershed
- Provide the technical and financial assistance to provide current nutrient management plans for all farms in the watershed

- Protect the soil surface with a growing crop, stubble from the previous crop, or pasture.
- Control runoff before it is able to concentrate into an erosive force
- Assure runoff entering streams from crop fields does not contain excessive sediments and nutrients utilizing best management practices such as, but not only:
 - Riparian Cropland
 - Contour Strips
 - Permanent vegetative cover of critical areas
 - Waterway Systems
 - Diversion Systems
 - Conservation Tillage Systems
 - Protect the soil and tie up nutrients by planting fall cover crops.
 - No-till system support
 - Grazing system development and support
- Establish research and educational farm(s) in the watershed.
- Maintain a focused, effective multi agency agricultural assistance team and program priorities reflective of the watershed area's needs.
- Secure additional resources to address the documented agricultural need in the watershed.
- Provide Nutrient Management Plans for all livestock farms in the watershed through the inventory of all nutrient sources on a farm and account for how they will be managed. Practices include soil and manure testing; if not according to Nutrient Management Act (Act 38) standards, then a minimum standard in which planned farms may adhere to applicable environmental regulations.
- Provide and facilitate improved implementation and assistance toward getting agricultural operators to utilize and follow nutrient management plans.
- Use comprehensive assessments and planning as a basis for implementation and funding.
- Emphasize, establish, and provide educational and technical support and incentives for the creation and long-term maintenance of effective riparian buffers (both in agricultural and non-agricultural settings), including working (harvested crops, trees or shrubs) and non-working areas.
- Increase riparian zone fencing, which excludes cattle from streams to keep from disturbing banks and allows growth of vegetated buffers to filter runoff.
- Provide barnyard management systems where needed to address outdoor manure concentrations in confined areas. Practices we will consider include relocation to a less sensitive area, diverting clean surface water and roof water from manure, collection and filtration of runoff from barnyards, reinforcement to allow manure collection.
- Provide Animal Waste Management Systems where needed to address how manure will be handled and field applied. Practices we will consider include planning appropriate areas for winter manure application, identify proper areas in fields to temporarily stack manure, structures to stack solid manure, structures to contain manure as liquid. Manure storage facility type and size

must be planned to meet the unique needs of each farm's nutrient management plan.

- Publicize the benefit and purpose and need for routine soil and manure sampling; developing and offering incentives and assistance to improve participation.
- Prepare and plan for a resurgence in agriculture.
- Plan, support and facilitate a more local, independent, and secure food system.
- Use the land in accordance with its suitability.

Agricultural Strategies Category II – *Environmental Impacts of Agriculture*

- Strategies, and implementation of those strategies, are needed to address agricultural related odor issues.
 - Develop odor management plans for farms.
 - Educate farmers and general public on odor related management.
 - Research and implementation of odor management.
- Encourage stream buffers for their erosion and water quality and other benefits (to include active / productive land and field borders).
- Recognize, publicize, inform, and educate persons, regarding the correlation between water quality, on-lot sewer management, and sound manure management.
- Increase market / financial incentives and opportunities for better practices such as pollution credit / trading, local purchasing, etc.
- Provide a “safe” and trusted source of information, technical assistance and financial assistance for farmers with environmental concerns to come to.
- Conduct long-term monitoring for the effects of increased utilization of pesticides.
- Provide the engineering assistance necessary to allow landowners to implement planned Best Management Practices.
- Research, promote, and facilitate resource / waste recycling (plastic ag. bags, tires, containers, etc.).
- Participate in multi-agency, coordinated effort to promote sound composting strategies wherever feasible.
- Coordinate with enforcement agencies to try to correct and mediate local issues “in-house” whenever possible and appropriate.

Agricultural Strategies Category III – *Agricultural Viability*

- Expand data collection and analysis of farm productivity, operations, and acreage.
 - Monitor the area's agricultural land base, farm/non-farm conflicts, and other data on a continual basis.

- Monitor property tax receipts from farmland and residential, commercial and industrial development, together with the cost of local government services to each sector. Publicize analysis on a regular basis.
 - Track and publicize the impact of agriculture on the region's economic and environmental health, landscape, and heritage.
- Coordinate agricultural support agencies to conduct needed research into agricultural issues, including surveying farmers and other agribusiness owners.
- Insure that there is adequate business planning support for producers.
 - Encourage the formation of on-the-farm businesses within land use regulations to supplement incomes from farming.
 - Develop and expand effective programs to assist farmers with loans, technical aid, marketing assistance, development strategies, and diversification. Combine these with "whole farm" approaches to investment in environmental and economic sustainability.
 - Develop and expand effective programs to assist farm family members with loans, technical assistance, and information regarding the development of on-farm businesses (such as catering, crafts, etc.)
 - Develop and implement strategies and facilities to improve the economic viability of farms.
 - Work with the farming community, government agencies, and insurance providers to address liability concerns for farmers wishing to expand farm offerings to the public.
- Facilitate cooperative farming efforts among individual farmers.
- Preserve productive farmland for continued agricultural use, preservation of view sheds, and as a prime component of the economic and tourism base of the Watershed.
 - Develop a comprehensive plan to preserve agricultural communities beyond single farms.
 - Identify all organizations and programs that are involved in agricultural protection and support.
 - Investigate and secure new funding for the development of agricultural protection and support programs and opportunities.
 - Aim and attempt to improve legislation and funding of farmland preservation.
 - Orient land use regulatory techniques towards preservation and conservation of agricultural and open space lands.
 - Support up-to-date Agricultural Security Area programs and Agricultural Preservation Programs in harmony with agricultural areas.
 - Expand the use of mechanisms which secure agricultural conservation easements.
 - Support agricultural preservation and development efforts within the region, so that agriculture is maintained as a profitable land use, in support of local heritage. Seek ways to support farmers so that they need not sell the fabric or "remnants" from the farm: boards, stone walls, etc.

- Convene a representative group of various agricultural protection and support organizations and programs to investigate the development of a coalition for the future of farm communities in the watershed.
 - Develop a strategy in conjunction with those interested groups for the further enhancement of agricultural communities.
 - Organize the development of a regional “agricultural development roundtable” and agenda.
- Investigate the possibility of a summit (annual?), based in the County, on enhancement of farm communities.
- Establish cohesiveness between agricultural factions and operational labels (small/ family/ sustainable, organic, factory, corporate) toward a united effort to improve overall agricultural viability.
- Market preserved ag/forest land for ag/forest expansion.
- Balance the retention of the rural/agricultural base with the need for well-planned, designated, and designed development.
 - Lay the foundation for a Countywide Transfer of Development Rights program.
 - Consider the use of cluster development regulations to maximize preservation of farmlands and open space and maximize cost effective use of utility systems.
 - Promote agriculture as a viable use in suitable areas including floodplains.
 - Discourage land use development and development patterns which result in fragmentation of forest and agricultural lands.
 - Ensure that farm interests are represented in planning, development, and economic development circles.
 - Revitalize local involvement in agricultural development.
- Develop a program to link available farms to prospective farmers.
- Promote diversification in agriculture.
- Conduct a “summit” to review the status of agriculture in the region and options for improving its outlook.
- Preserve and conserve the rich agricultural history and heritage of the watershed.
 - Encourage and support the designation of Century Farms and Bi-centennial Farms in the watershed
 - Chronicle sections from a period diary (perhaps with a local family) in local media.
 - Create a traveling/ mobile exhibit of the area’s agricultural history.
 - Develop and sustain a working site to interpret and research land use history (depicting eras, tools, crops, machinery, architecture) and ecological science.
 - Identify surviving farms depicted in lithographs of County history and maps and stage a traveling photography exhibit or tour(s).
 - Interpret “Century Farms”, “Bicentennial Farms” and other farms of willing landowners.

- Sponsor farm-based tourism and workshops.
 - Expand agri-tourism (farmer's market, pick-your-own, hay rides, petting farms, farm stays, and barn tours for example).
 - Hold farm open houses and workshops presenting information on new and old agricultural techniques.
 - Enable farm owners to participate in heritage initiatives as a means to diversify their sources of income.
 - Convert an existing farm or farms to a working establishment for visitors
- Encourage regional programming and advocacy for the preservation of agriculture that capitalizes on the heritage of local leadership within and outside of the farming community.
- Increase community pride and public understanding and support of the business of farming, including its economic, historic and future role.
- Develop and implement strategies to protect family farms.
- Develop and implement strategies to encourage next generation farmers to stay on the farm.
 - A mentoring program between experienced and incoming farmers should be employed.
 - Continue the vocational agriculture program to foster new generations of farmers and provide them with skills to compete in the agricultural industry.
- Foster events that encourage farmer–public interaction.
 - Create “food and agriculture” theme tour.
 - Support and expand community-based agricultural education programs.
 - Continue to improve awards, recognition, and media of agriculture related achievements, events, ingenuity, and innovation.
 - Ensure that agriculture fairs and related activities publicize the role of agriculture in the regional context.
 - Create pedestrian links to willing farmers regarding trials, direct sales, interpretation, overnight accommodations, etc.
 - Develop and implement strategies to educate the general public as to the value and connection of food and agriculture to the community.
 - Encourage the development of demonstration, farm-stay, and “working farms” as educational attractions.
- Establish and support a demonstration Community Supported Agriculture Site (CSA).
- Establish and continue an event highlighting locally produced, processed and prepared foods (such as a Bradford County Buffet, picnic, or feast)
- Emphasize the need for and increase local food security.
- Develop and implement means to insure that every citizen is knowledgeable of and literate in agricultural and food system basics
- Develop and implement strategies to engage farmers in alternative energy production.
 - Encourage the use of marginal farmland for production of crops for use as bio-energy – i.e. grasses, use of CRP land, etc.
 - Facilitate development of local markets for bio-energy from local crops.

- Emphasize the need for and increase local energy security.
- Educate farming community (citizens, public officials, businesses, agencies, etc) in the value of
 - land use planning .
 - global marketing
 - public relations
 - ecological services provided by agricultural lands and open space / natural areas
- Develop and implement strategies to reinforce farm service industries.
- Develop and enhance existing property tax incentives for farmers.
- Market the County's natural resource production to broader product industries.
- Assist in identification and marketing of specialty/niche markets for agriculture and forest products.
- Develop and maintain farmers' markets.
 - Encourage and support participation in local agricultural marketing through "Buy Fresh, Buy Local in the Northern Tier" Program and other similarly focused strategies.
- Research and expand local aquaculture opportunities and enterprise.
- Aim and attempt to relay regional needs and considerations in State and federal policy and legislative circles.
- Ensure that effective and profitable forest management becomes a priority among farm owners.
- Work to make the development of Bed and Breakfast custom lodging operations and farms compatible with Clean and Green reductions of farm property taxes.
- Work with local educational institutions and Penn State Extension to develop regularly offered seminars on estate planning for farmers and owners of larger open-space parcels.
- Establish a USDA certified processing facility for collective and cooperative use in developing and processing agriculture, specialty, and value added products.
- Develop and sustain formal educational opportunities at the grade school and college / adult educational level.
 - Establish an agricultural technical college or satellite establishment for existing universities that offer agricultural classes and degrees.
 - Establish increased agriculture-based curricula in the grade-school classroom.
- Develop and implement means to insure that every grade school student is knowledgeable of, and literate in, agricultural and food system basics. Further support Future Farmers of America, 4-H, and other youth initiatives focusing on agriculture.

Cultural

A Region or Watershed's history – its culture, is what provides the foundation for that community's values and its way of life. Decisions and values are influenced by our culture and the principles by which management decisions are made. The values of the Watershed region have been reconfirmed in a number of forums and studies that have involved the watershed community groups, local and County comprehensive planning efforts and in peoples daily lives. Some of the values expressed in the Watershed include:

- ⇒ Strong sense of community / small town atmosphere
- ⇒ Good environment for raising a family
- ⇒ Successful public and private partnerships
- ⇒ Quality of industry
- ⇒ Active agriculture
- ⇒ Affordable housing
- ⇒ Small friendly towns, schools, and neighborhoods
- ⇒ Open lands and forests
- ⇒ High activism for water quality
- ⇒ Beautiful scenery
- ⇒ Active community volunteers
- ⇒ Rural character

Compiled Stakeholder Input

The following is a distillation of issues in the Sugar and Towanda Creek Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy.

Cultural Issues Category I - Identification / Documentation and Designation

The key need to managing the area's cultural and historic resources is to have suitable baseline information. It is needed for understanding the scope and nature of work, aids in the identifying priorities, and is paramount to measuring and monitoring change. Resource inventories and evaluations also determine whether a site or resource feature qualifies for particular designations, protections, incentives, funding or other benefit.

- ✓ There is a need to initiate or continue resource inventories, documentation, compilations which including but not limited to the following citations:
 - The need to document the many cultural landmarks throughout Bradford County.
 - There is a need to perform detailed natural and scenic resource inventories.
 - There are historically significant and largely rural characteristics to note with many beautiful vistas, particularly of the Susquehanna River.
 - Further documentation and cataloging of important sites and themes is important related to the agricultural, dairy, and creamery heritage of Troy.
 - Further documentation and cataloging of important sites and themes related to the westward migration of the population reflected in the settlement is important.
 - Further documentation of the Warrior Road heritage related to the Yankee-Pennamite War and the Civil War is needed.
 - Further documentation of the “Natural Opportunities” heritage related to agriculture and agricultural advances, including the existence and continuation of the Troy Fair, is needed.
 - Further documentation of the “New Beginnings and Safe Havens” heritage related to early settlement and escaping slaves is needed.
 - Further documentation of the “Visionaries, Achievers and Social Entrepreneurs” heritage related to Henry B. Van Dyne and Martha Lloyd is needed.
 - Further documentation of the “Outdoor Enthusiasts Paradise” heritage related to fishing, hiking, cycling, and other outdoor activities is needed.
 - There was a silent movie that was filmed in Canton, but cannot be located.
 - Saymon Road folklore – perhaps assemble and publish or promote.
- ✓ Encourage industries to document and present their heritage to the general public, e.g. on site museums.
- ✓ There is the need to identify threatened structures, and identify feasible adaptive reuse solutions.
- ✓ People are visually oriented...there is a need to develop video histories.
- ✓ A comprehensive inventory of historic structures needs to be done, encouragement given to preserving them, then submitting the inventory information to the Pennsylvania Historic and Museum Commission.
- ✓ Much work is needed with regard to historic districts.
 - Several of the river communities have existing and proposed historic districts that are not finished.
 - Consider the designation of new historic districts.
 - Identification, application, and ultimate designation of a National Register Historic District are needed.
 - Continuing the work on signage in historic district is needed.
 - Industrial sites in our historic district should be identified.

- ✓ Acknowledge and/ or designate notable cultural and historic resources:
 - Mining Towns are important to history: Ralston, McIntyre, Red Run, Barclay, and Laquin, among others.
 - The underground railroad is an important story to tell.

Cultural Issues Category II - Restoration, Maintenance and Preservation

Time, weather, neglect, and general wear-and-tear take their toll on our architecture and developments. A challenge to enabling current and future generations' experience of tangible evidence and first-hand experience, understanding, and appreciation of our culture and history is to renovate, refurbish, replicate, and maintain artifacts, structures, and sites of cultural and historic significance. Once attaining some stable, accurate, or working condition, it is uncertain whether future generations will have access to the value of these assets unless the means to provide long-term commitment to maintenance, conservation, or preservation is established.

Note: the terms surrounding the continuance or perpetuation of cultural / historic resources are often used interchangeably by the general public. The word "preservation" may be used by some respondents to mean "fixing up" a feature, to others, ensuring that it stays visible or is maintained, and others yet, placed under regulatory or legal protection. It is worth consideration that the implied intent of an issue below may extend beyond the single category it was attributed to.

- ✓ Improvement in the form of stabilization, renovation, or refurbishment to the physical, cultural, and historical integrity of many features and sites are needed.
 - Municipal building / community building / historic structure improvements desired.
 - Grange Hall (over 100 years old) in Granville Center has significant history and would be worth fixing up and protecting.
 - Historical buildings – Township building and Wetona Church, school house in Big Pond, and toll house on the Berwick Turnpike (while some of these are not located within the boundary, they have significance to the Springfield residents) – the desire is to maintain and enhance the historical integrity and awareness of these cultural/historic landmarks.
 - Historic barn preservation.
 - Covered Bridge preservation.
 - The Lee Circus is a historic resource, but only a barn remains.
 - Water and stream mills are important in Canton's history and as local landmarks.
 - The former Canton railroad station also is a critical (but perhaps overlooked) remnant of the rail, industrial, and commerce heritage.
 - Former road houses and carriage stops in Baileys Crossing and Granville are important.

- ✓ Effective and economical mechanisms for sustaining the maintenance, integrity and value of cultural and historic features is needed, including, but not limited to:
 - Taylor House – oldest house in the township.
 - Two houses named that have particularly rich history – one in Granville Center across from the church building and one at Baileys Corners.
 - Williams and Brennan properties have historical value.
 - Grange Halls are important in relation to village and agricultural history.
 - Local history is reflected in the cemeteries.
 - A recognized historic site is the wooden bridge over the former railroad ROW near Granville Summit.
- ✓ Measures to improve and increase both conservation and preservation of notable cultural and historic features are needed, including:
 - It was felt that the river is the County's outstanding feature, and should be protected in some way -- a Scenic River designation is possible, but potential conflict with private property owners would need to be addressed.
 - School House in township that could be preserved.
 - Buttermilk Falls.
 - Preserve and conserve the rich agricultural and commerce history and heritage resources of the Troy Area.
 - Assistance for the Farm Museum in preservation of the Parsons homestead is needed.
 - There is a need and desire to preserve and enhance areas identified as being of local significance, including Mt. Pisgah, Middle School trail, Cases and Fallbrook Glens, the fish hatchery, Route 6 corridor, Armenia Mountain, Dr. Browns' property, and Farmers Valley.
 - There is a need and desire to preserve the environmentally sensitive land such as floodplains, wetlands, and steeply sloping areas; historic, architecturally significant and heritage resources; passive open and sporting areas; and natural resources and sensitive areas from inappropriate development.
 - We should support preservation and retention of architectural integrity of stately and historic structures.
 - Preserving and enhancing areas identified as being of local significance, including Minnequa Springs, Canton Lake, local houses of worship, Manley-Bohlayer Farm, and good and/or active agricultural land is important to Canton residents.

Cultural Issues Category III - Community Facilities, Gathering and Focal Points.

Community facilities and gathering places are often focal points around which people gather to stay connected, debate, celebrate, market goods and services, or bring honor or order to the citizenry. They often serve as markers to one's sense of place and notably contribute to local identity. Such places are underutilized and increasingly needed due to our trends toward individual lifestyles, increased transience, and sprawling development away from urban centers.

- ✓ Finding ways to support the efforts to locate, develop, and maintain community buildings and facilities is imperative to the well-being and collective energy of a community. Cited issues include, but are not limited to:
 - Need a community center/building.
 - Need for community building and community park/playground.
 - Assistance is needed toward communities in the development of specialty parks and facilities for public use.
 - Support toward maintaining and enhancing the County library system is needed.
 - Defining landmarks which provide a sense of place – Alparon Park, the Troy Fair, Martha Lloyd School, Citizens and Northern Bank, Mt. Pisgah, Troy Area High School, the gazebo and green, Borough building / library.
 - Township residents are more likely to identify the Fair, the farms and fields of the region.
 - Leroy General Store
 - Local Churches
 - Manley Bohlayer Farm
 - Rialto Theater and Acorn gas station are viewed as popular “public places”
 - Maintain community centers and parks for recreation and cultural activities.
 - Mount Pisgah
 - Rialto Theatre
 - Minnequa Springs
 - Farmlands and fields
 - Wildlife and other rural/ countryside characteristics
- ✓ An Arts and the River celebration has been stated as a need.
- ✓ Watershed groups need to be more involved in recreational planning & implementation.
- ✓ The Steering Committee suggested a variety of projects that include creating walking tours of historical areas.
- ✓ Defining attributes of a sense of place
- ✓ Apple and cheese festival
- ✓ Develop fairs, festivals, farmers markets and community events.

Cultural Issues Category IV – *Land Use and Development*

The watershed has seen a sharp increase in random development which appears as incremental and somewhat subtle changes that avoid notable attention until it reaches a critical point when much of the area is negatively affected. Regulation or zoning is met with much skepticism and resistance. Limited focus and resources are put toward furthering historic / cultural features, with emphasis heavily skewed toward “bigger”, more modern development.

- ✓ Bradford County residents are choosing suburban and rural living over that found in the County's boroughs.
- ✓ There are few local ordinances in place that protect the County's natural, cultural, and historic resources.
- ✓ The abundance and quality of natural resources in the area provides numerous recreational opportunities for both residents and visitors, and demand for nature-based recreation and tourism is increasing and needs to be planned for.
- ✓ A significant percentage of the County's open space land is owned by State and County entities.
- ✓ It is proposed that a floodplain district be established to prevent development in areas unfit by reason of flooding. The proposed open space district would include present community school areas and three existing cemeteries. Open space lands in the future should include dedicated park lands. The purpose of the open space district should be to provide permanent open space areas primarily for recreational or historical purposes.
- ✓ Respect local community character in new construction needs to be considered.
- ✓ Development of historic district guidelines and exploring the application of a Historic Architectural Review Board (HARB) District in the Borough is needed.
- ✓ Scattered growth in outlying areas has the real potential of harming the resources.

Cultural Issues Category V – Cooperation, Partnership and Networking

There are many folk adages portraying the wisdom of cooperation, teamwork, neighborliness; "two heads..." "many hands...". Today there is still much room and reason for entities to improve their endeavors through sharing resources, skills, and knowledge.

- ✓ One concern was a lack of timely State cooperation and support, with a slow and complicated grant process.
- ✓ The regional projects should be coordinated with the Endless Mountain Visitors Bureau and the Endless Mountain Heritage Region.
- ✓ There is much to be gained from the older folks within the community, which is soon destined to be lost unless it is recorded or shared.
- ✓ Multi-disciplined agencies need to coordinate efforts and work together to better achieve the community's visions.

Cultural Issues Category VI – Education, Outreach, and Interpretation

Maintaining the community's interest in its cultural identity, heritage and historic sites is as intricate as maintaining its tangible assets. As awareness, understanding, and initiative waxes or wanes, it directly effects the commitment or complacency toward our history and heritage.

- ✓ More efforts and focus on youth education is needed.
 - There is a need for a local heritage course in high schools focusing on history, sense of place, and image.
 - We need to engage young people.
 - There is not an efficient or effective way to get materials, resources, programs, funding options, or networking opportunities to interested teachers and groups.
 - It is difficult to fit in cultural and historic studies when the emphasis is on Math and English test scores
- ✓ There is a need to develop a community awareness of our culture and heritage.
 - The defining characteristics and common understanding of the terms “traditional, rural, and local” are needed as well as those governing cultural perpetuation, such as renovation, conservation and preservation.
 - Other concerns expressed were a lack of knowledge by landowners around the river.
 - I’m not sure what is out there to see and do.
 - People just don’t know what they have until it’s gone.
- ✓ More programming support and interpretation of sites are needed.
 - Provide information on the historic sites.
 - Preserving and enhancing historical aspects of the communities would provide educational opportunities and is needed.
 - A project to create and install appropriate signage to better identify river access points for the entire study corridor is needed.
 - Municipal and community leaders serve limited terms and are often unaware of cultural historic resources, opportunities, and what activities can help or harm them.
 - Need better and more self-guided opportunities.
 - There is a need to invest in community kiosks for publicizing events and/or selling space to advertisers.
 - Gateway sites need to be identified and developed.
- ✓ Programs seem to be perennial or short lasting, not enough to have an impact.

Cultural Issues Category VII – Economic Development and Tourism

The Watershed is rich in cultural history, dating back to pre-colonial times. That culture was, and continues to exist with deep ties to the natural resources of the area. As development and changes, in the people and physical places in the watershed occur, the “cultural roots” risk becoming more and more obscure. The general feelings of the community in the watershed were that more effort is needed in both identifying and developing the cultural uniqueness of the region for both economic and tourism purposes.

- ✓ Focus on the interrelationship between Route 6 and the agricultural, commerce, migration, and manufacturing heritage of Troy is needed.

- ✓ Interconnecting the County's chambers of commerce is needed.
- ✓ Hosting an annual conference on growing Bradford County business and industry is called for.
- ✓ Assistance is needed in identification and marketing of specialty/niche markets for agricultural and forest products.
- ✓ One of the greater needs is to market preserved ag/forest land for ag/forest expansion.
- ✓ We are at a pivotal point where we need to preserve productive farmland for continued agricultural use; preserve forestland for continued forest use.
- ✓ Task economic developers or chambers with researching the retail and service purchase patterns of Bradford County residents and businesses.
- ✓ We would benefit from the creation and maintenance of a database of available storefronts for small business
- ✓ Assistance to communities is needed in the development of specialty parks and facilities for public use.
- ✓ Eco-tourism opportunities abound.
 - There is a need to preserve and enhance historical aspects of the communities that would bring economic opportunities to the region through the development of eco-tourism.
 - The Steering Committee believed that preserving and enhancing historical aspects of the communities would bring economic opportunities to the region through the development of eco-tourism.
 - The Steering Committee recognized early on in the project that eco-tourism currently benefits the region and could be greatly enhanced.
 - Increased coordination would benefit the Farm / County Heritage Museum for agri-tourism and events
- ✓ Emphasis on promoting local events is needed.
- ✓ Promoting the viability of Towanda's Central Business District as the focal point of the region is needed.
- ✓ There is no money in this area to do a lot of work.
- ✓ We need to recognize the importance and improve the visibility of the Troy Bradford County Heritage Museum (AKA the Farm Museum).
- ✓ Sites and routing are unorganized and scattered throughout the area.
- ✓ There needs to be an economic basis and incentive to support cultural improvements.
- ✓ The tourist and visitor support services and infrastructure are not present: restaurants, lodging, signage, professionalism, etc.
- ✓ There needs to be a few "spectacular" places to see or things to do; other sites and opportunities will likely follow.
- ✓ There are a lot of empty store fronts and possible business space.
- ✓ Many places of historic interest are vacant or run-down.
- ✓ We need to encourage or provide incentives for "cottage" industry.
- ✓ A diversity of products and services is lacking.
- ✓ The "middle man" ends up taking a lions' share of the profit.

Cultural Issues Category VIII – Perpetuation of Traditional Arts, Crafts, Tools, and Trades

Many of the “traditional” skills, knowledge and trades that were core to the heritage of the region are felt to be disappearing as those that are intimately familiar with them begin to age and disappear. Numerous comments were received that called for strategies and mechanisms that would help preserve and pass these essential cultural elements on.

- ✓ The knowledge of the old ways of doing things is being lost.
- ✓ We live in a throw-away society where all our possessions come from a mega store.
- ✓ There’s no indication of where or from whom to get goods and services.
- ✓ It’s difficult to market products.
- ✓ People want diversity, a lot of things to choose from.
- ✓ People want one-stop shopping.
- ✓ There needs to be help to producers, artists, and craftsmen in areas of business and marketing.

Cultural Strategies

The following is a listing of Strategies in the Sugar and Towanda Creek Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy.

Cultural Strategies Category I - Identification / Documentation and Designation

- Conduct a comprehensive inventory of historic structures and landmarks, encouragement given to preserving them, and then submit the inventory information to the Pennsylvania Historic and Museum Commission.
- Consider the designation of new historic districts, sites, farms and landmarks.
- Continuing the work on signage in Historic District, identified sites, farms and landmarks.
- Develop a long-term inventory program in cooperation with local resources and groups; address historic resources, folk life resources, and natural and scenic resources.

- Sponsor research by historical organizations and interests toward producing a modern history of the region that integrates current conditions and themes with long-term elements.
- Publish a guide of folk traditions.
- Further a comprehensive cultural inventory of the region and organize the collected information using a computerized database that can aid in the development of interpretation.
- Identify non-staffed interpretive sites to be included in interpretive programs.
- Initiate an ethnographic study of the region to identify and document extant cultural influences within the region that can be incorporated in the interpretive program. Such a program would include the collection of regional oral history.
- Develop a “registry” program to initiate cooperative relationships with owners of historic, agricultural, and natural properties.
- Work with historic home, farm, and business owners to research and write brief histories on the buildings, persons that occupied them, and their place in the community.
- Where appropriate, develop maps and other publications for the public that identify significant historic and cultural structures and landmarks.
- Collect, organize, and publish oral and video histories of the region.

Cultural Strategies Category II - Restoration, Maintenance and Preservation

- Create a preservation revolving fund to lend funds to owners and cooperating groups to buy or stabilize endangered historic structures (could include easements for other purposes).
- Provide technical and financial assistance to improve and maintain historic buildings and structures.
- Encourage targeted beautification campaigns based on cultural and historic themes identified.
- Assist regional museums and historic sites to secure funding to develop or enhance on-site interpretation and programming in order to address current gaps.

Cultural Strategies Category III - Community Facilities, Gathering and Focal Points

- Create, maintain, and enhance community centers and parks for recreation and cultural activities.
- Create and support local stakeholder groups to be more involved in cultural, social, and recreational planning & implementation
- Develop fairs, festivals, farmers markets and community events.
- Establish a system of hospitality training and quality standards and role of regional interpretation to insure positive traveler experience.
- Identify, develop, and promote potential community heritage centers.

- Design and install prototype indoor and outdoor kiosks.
- Work with regional cultural organizations to establish the organizational structure for an arts cooperative in the heritage center.
- Develop a line of Endless Mountains Heritage Region retail products.
- Convert an existing farm(s) to a working farm(s) for the purpose of promoting agri-tourism.
- Build an amphitheater as the summer home for a band, play, or other entertainment company, or to host special events, concerts, etc.
- Develop a high-quality spa or retreat center.
- Promote Points of Welcome, Heritage Sites, Heritage Anchor Sites (staffed), Community and Regional Heritage Centers (broad depiction).
- Frame interpretation in three forms: thematic structure (living on the land, Cultivating Agriculture and Rich in Resources, Building Community, Over Hill and Dale (handcrafted), periods of development (Native American Era, Early Settlement, Agriculture Development, Onset of Industry), and thematic questions (How was land used and what impacts exist?, How have landforms, geology, etc. influenced peoples activities?, How has the region's economy evolved?).
- Encourage the development of more antique tours and events, combined with interpretation, traditional arts and crafts where feasible.
- Support the development of bikeway and walking trails.
- Publish an interpretive map that illustrates key cultural and heritage sites within regional context. Include interpretive signing and historical markers at the sites.
- Establish linkages between historic sites and conduct joint interpretation and marketing.
- Develop walking tours and interpretive information for the historic portion of towns and villages.

Cultural Strategies Category IV – *Land Use and Development*

- Provide an outline and assistance for preparing a local zoning ordinance
- Provide model ordinances, ordinance language or ordinance topics for municipal and multi-municipal consideration.
- Assist municipalities in the drafting of local municipal and/or multi-municipal comprehensive plans.
- Promote community values through the use of lamppost banners, slogans, etc. Market these images to new business prospects, land developers and realtors.
- Acknowledge good development, redevelopment and community initiatives through a County award program.
- Provide protection of priority scenic areas through zoning and easement incentives.

- Lay foundation for a countywide Transfer of Development Rights (TDR) program.
- Utilize zoning (potentially with overlay districts) to manage land use development along the US 6 and Susquehanna River.
- Develop a flood plain district to prevent development in areas unfit by reason of flooding. The proposed open space district would include present community school areas and three existing cemeteries. Open space lands in the future would include dedicated park lands. The purpose of the open space district would be to provide permanent open space areas primarily for recreational or historical purposes.
- Respect local community character in new construction.
- Develop historic district guidelines and explore the application of a Historic Architectural Review Board (HARB) District in the Borough
- Provide resources to work with development and planning organizations on a regular basis regarding the heritage goals and activities.
- Enact land use controls to guide appropriate development and preserve land values.
- Provide incentives and resources to increase voluntary conservation and historic preservation.
- Enhance community pride and self-knowledge.
- Use heritage to raise awareness about such important current issues such as sustainable agriculture, forestry and environmental stewardship.
- Endeavor to interpret archeological excavations and information collection during the execution of federal projects under Section 601 of the National Historic Preservation Act.
- Encourage communities to support the inclusion of an archeological component in excavation for new development.
- Design growth which reinforces historic cores rather than detracting from it.

Cultural Strategies Category V – Cooperation, Partnership and Networking

- Work with the EMHR and Pennsylvania Route 6 Heritage Coalition and further recognize the importance and improve the visibility of US Route 6 in telling the story of the heritage of Troy.
- Encourage the EMHR to use the Bradford County Farm Museum as its major portal for visitors seeking the agricultural heritage experience.
- Assist the Bradford County Farm Museum in fundraising efforts, physical expansion, preservation of the Parsons homestead, and operation.
- Develop links among the Bradford County Farm Museum, the EMHR, the Endless Mountains Visitors Bureau, and local farmers interested in hosting agricultural heritage tours.
- Coordinate with the Bradford County Farm Museum for agri-tourism and events.

- Work with PennDOT concerning removal of negative image signage (related to tourism).
- Support organizations that provide services which further the community culture and heritage, including but not limited to school organizations, recreation programs, senior citizens, daycare, libraries, hospitals, ambulance, and fire companies.
- Cultivate ongoing relationships with educational institutions throughout the region that are interested in contributing to and participating in a range of interpretive programs.
- Encourage residents to participate actively in presenting their history and provide them with a forum in which they can share their knowledge.
- Encourage cooperative efforts among various groups, sites, and entities around interpretation of regional themes.
- Form a regional network of sites with an interest in heritage interpretation; with their primary goals being: develop a means of sharing resources, create calendar of heritage programs, brainstorm joint marketing strategies, develop low-cost tourist-season newsletter.
- Create a permanent, integrated, and engaging system of interpretation using authentic historic resources.
- Reinforce and interconnect efforts undertaken by museums and other historic sites to interpret regional history.
- Undertake temporary interpretation of additional resources through guided mini-tours, workshops, and lecture series, special events, and festivals.
- Work with historical societies and local chambers of commerce to develop graphic-based exhibits on community history for use in villages and store fronts.
- Explore opportunities to commission public art that would convey aspects of themes important to the history of the region.
- Work with community groups to continue expanding interpretive programs, such as thematic tours, traveling exhibits, business promotion, and special events.
- Develop a region-wide group to pursue civic and governmental historic and open space preservation initiatives.
- Convene a summit (a “day of listening”) for all educators in the region to create and pursue an agenda to expand environmental, cultural and historic education opportunities for students, travelers, and general public.
- Conduct a series of meetings and training sessions to educate governmental, civic, and business leaders and property owners about land conservation and land trust actions; expand this constituency supporting inventories, planning and preservation in the region.
- Provide resources to build on existing programs and efforts.
- Partner with universities and clubs.
- Examine the evolving relationship between residents of the Endless Mountains and the landscape that surrounds them by relating stories of the natural landscape, the evolution of the region’s agricultural landscape, and

the evolution of natural resource management (including trapping, lumbering, tanning, quarrying, mining, manufacturing, and tourism).

- Support partners in the development and operation of cultural and art centers, especially in presently overlooked or underserved areas.

Cultural Strategies Category VI – Education, Outreach, and Interpretation

- Develop a local game, similar to Monopoly, which could be educational while promoting and improving self image.
- Encourage environmental, cultural, and historical education activities to be incorporated into existing and new festivals, special events, etc.
- Tell the story of the evolution of transportation systems and the associated industrial development of Towanda.
- Encourage historically significant industries to document and present their heritage to the general public, e.g. on-site museums.
- Provide resources that add/enhance industrial theme at Bradford County Historical Society Museum.
- Employ municipal newsletters as a communications tool and to promote a sense of community.
- Encourage interest in history and local heritage.
- Promote participation in youth and adult leadership through the development of programs.
- Utilize interpretive themes in establishing a clear identity for the region.
- Develop a regional interpretive network and database of existing model programs made available to teachers and facilitators.
- Work with a panel of educational consultants to develop heritage curricula and discovery trunks for classroom use on a range of thematic topics relating to the history of the Endless Mountains.
- Work with historical societies to develop graphic-based traveling exhibits on different topics that can tour local schools.
- Work with the region's Intermediate Unit to sponsor heritage-related teacher training workshops.
- Establish a resource center where teachers will be able to access a variety of heritage-related project ideas and resource materials.
- Work to cultivate and strengthen relationships between the region's schools and heritage organizations.
- Develop methods, strategies and tools to aid in the integration of local cultural and historical studies into other subject areas.
 - Work with educational and cultural organizations to both expand audiences for their current events and lecture series and diversify their offerings to cover a broad spectrum of heritage-related topics.
 - Offer a series of educational lectures and on-site tours to understand historic and natural resources.

- Develop a series of historic preservation and open space preservation workshops, trainings, or courses, for the public, civil officials, business owners, real-estate agents, etc.
- Reach out to teachers and educational organizations in the region to encourage them to teach local history in context with regional and natural history. Offer special awards and prizes for innovative and long-standing programs.
- Establish school tours and career nights for school students to learn about their community and potential employers.
- Work with local teachers to integrate heritage resources into local curricula.
- Develop interpretive maps that will profile key heritage resources and present the interpretive framework within the region.
- Assist partners in developing side trip brochures that reinforce the region's interpretive history.
- Secure funding for a comprehensive, illustrated regional guidebook.
- Develop and facilitate appropriate interpretive signage, identify locations for additional scenic pull-offs, and have them placed within the plan of the road's regulatory authority.
 - Design a location plan and install regional way-finding and interpretive signage.
 - Install designed way-finding signage along major routes identifying sites participating in a heritage trail (perhaps using thematic icons).
 - Prepare design guidelines for heritage region publications, signage, and exhibits, to establish consistent character.
- Examine the feasibility of securing funding to publish a lavishly illustrated regional history in a "coffee-table book" format.
- Keep the public aware of all heritage activities through regular press, video, public service, and other media.
- Integrate interpretive framework into local marketing strategies.
 - Encourage local businesses to participate in interpreting or portraying local heritage.
- Develop mobile interpretive displays to be used for educational and promotion purposes.
- Encourage joint promotion among sites in order to broaden market appeal, raise public awareness of their offerings, and increase visitation.
- Work with community leaders to develop regular thematic tours.
- Cultivate human and financial resources needed to launch an area-wide heritage celebration.
- Launch a full-blown heritage week with appropriate activities and offerings.
- Enhance the sense of thematic continuity.
- Create common understanding of "traditional, rural, and local" character.
- Preserve and present the oral history of early history and agriculture.
- Develop method to convey mining, forestry, agriculture, and other industrial histories.

- Promote agriculture, traditional crafts, artistic, and community heritage events.
- Engage people in exploring the region.
- Structure programs to deepen over time.
- Involve local residents and attract outsiders.
- Employ interpretation utilizing a variety of media to provide travelers with a clear picture of Native American life, the appearance and organization of their settlements, and their cultural traditions.
 - Pursue satellite exhibits of selected Native American artifacts.
 - Create traveling “discovery trunks” with Native American, Colonial era, environmental awareness, etc. curriculum ideas, activities, hands-on artifacts, and books for classroom use.
 - Facilitate a Native American story telling series.
 - Facilitate a lecture series, or university sponsored conference, presenting current research on Native American culture, trends, and issues.
 - Develop a brochure and map of important Native American sites.
 - Facilitate a guided tour highlighting Native American spiritual and cultural attitudes toward nature – by auto or canoe.
 - Integrate Native American context into river events.
 - Develop and sign local Native American trails.
- Install interpretive waysides.
- Develop elements to interpret the history of river transportation.
- Document the region’s earliest surviving homesteads and mills, and work with owners to develop appropriate commemorative plaques and interpretive signage.
- Sponsor a settlers day dinner featuring local game and edibles, regional recipes.
- Host a celebration of the concept of “village green”, featuring colonial era entertainment.
- Develop a traveling heritage promotion trailer (perhaps using a horse-drawn vehicle).
- Host historic turnpike rally featuring various modes of travel – horseback, carriages, foot race...
- Increase the availability of information about the region.
- Promote the development of a private for-profit receptive operator to conduct bus tours throughout the area highlighting local heritage.
- Develop and evaluate a marketing plan and strategy for promoting local heritage.
- Develop and administer questionnaires to develop a profile of the current visitors to the region.
- Research appropriate and effective means to inform target audiences of the region’s heritage.
- Develop logos for promotional use and site identification.
- Develop a regional tour which invites journalists and travel writers to the area.

- Encourage joint marketing ventures.
- Develop audio tapes, based on oral histories and using music and narration.
- Develop a historic and cultural awareness program for local officials.
- Work with local organizations to define and establish an understanding of the terms of “traditional”, “rural”, “local”, “renovation”, “conservation”, and “preservation” in a historic and cultural context.

Cultural Strategies Category VII – *Economic Development and Tourism*

- Promote community values through the use of lamppost banners, slogans, etc. Market these images to new business prospects, land developers and realtors.
- Create and maintain a database of available storefronts for small business
- Involve watershed groups in recreational planning & implementation more.
- Create walking tours of historical areas.
- Invest in community kiosks for publicizing events and/or selling space to advertisers.
- Determine the feasibility of a series of plant tours to showcase the value of the region's heritage to large employers.
- Build partners among the region's economic entities to help promote the region.
- Consider developing a community leadership training seminar.
- Promote outfitter activities, environmental activities, group activities, an outfitter training center and / or executive retreat center.
- Support catalysts for small business development.
- Provide opportunities for major business employers to strengthen their role in the community and for the community to support major employers.
- Nurture entrepreneurial potential and identify heritage-related small business opportunities.
- Promote the region as a desirable place to grow a “cottage industry” to targeted groups such as outdoor sporting, craftsman, value-added wood products, etc.
- Encourage tourism to support businesses near heritage attractions.
- Designate or devise an entity to participate or create programs to create and retain small businesses.
- Develop and support a watershed based organization to coordinate with regional tourism entities and advocate the historic, cultural, recreational and eco-tourism opportunities of the watershed.

Cultural Strategies Category VIII– Perpetuation of Traditional Arts, Crafts, Tools, and Trades

- Create craft apprenticeship programs.
- Provide year-round venue where craftspeople can show and sell their work.
- Create community, heirloom, or theme gardens.
- Work with high-school students to research prominent local families, origin, ethnicity, and demographics of the area.
- Develop a harvest or winter festival.
- Develop railroad based interpretation and events.
- Undertake folk-life programs documenting cultural traditions, ethnic groups and trades.
- Develop a “Tall Tales” lumberjack storytelling festival.
- Create an exhibit presenting the historic evolution of tourism.
- Hold an antique car rally along Route 6 (or 414)
- Strengthen regional agricultural economy and land base by encouraging targeted, innovative, and effective local and regional programs.
- Encourage retailers that specialize in unique or indigenous products, and encourage them for form linkages and joint marketing.
- Support crafts persons, and encourage them to form alliances and mechanisms for marketing.
- Establish central locations, perhaps on a cooperative basis, to show and sell local products.
- Encourage the perpetuation of traditional arts and crafts by expanding venues for performance, creation and sales.

Forestry

Forest cover in the watersheds is as extensive as that of agriculture, covering nearly 43% of the land area. A vast majority of this land is privately owned and managed. This creates a critical need for education and outreach, as well as sound technical support, to those landowners. Organizations like the Bradford / Sullivan Forest Landowners, the DCNR Bureau of Forestry and Penn State Cooperative Extension are vital in delivering those educational efforts and services.

Forest cover provides the basis for many of the values local watershed residents hold high. They also provide critical wildlife habitat, water quality functions, and scenic and recreational needs. The economic value of the forest related products derived from the watersheds area and the County is of major import currently and historically.

Compiled Stakeholder Input

The following is a listing of issues in the Sugar and Towanda Creeks Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy and the Bradford-Sullivan Forest Landowners Association..

Forestry Issues Category I – *Resource Planning*

The key to any comprehensive resource management is a good resource based management plan that considers the multiple uses and objectives that are important both to the landowner, as well as the watershed. A plan should contain an inventory of the resource, objectives, and achievable goals that are integrated into a working document.

- ✓ There is a lack of sustainable forestry management.
- ✓ There are few local ordinances, policies, plans, and strategies in place that protect the County's natural resources.
- ✓ Plans that do express the values of forest resources rarely result in action or attempt to reach a tangible result.
- ✓ The issues driving fragmentation and parcelization are not being addressed.

- ✓ There is a lack of regulatory oversight, governance, incentives, etc (show economic benefits of forested land use, services, taxes, etc.)
- ✓ Model ordinances are needed.
- ✓ Code enforcement and workshops / strategies on forest / road interface are needed.
- ✓ Lack of funding and grants and slow or lacking government and agency response for cost-share / incentives is a concern.
- ✓ There is difficulty in keeping recreational areas maintained and safe (public, private, hunt clubs, etc).
- ✓ There is a need to aim for multiple use yet balance uses and reduce conflicts.
- ✓ Fragmentation and parcelization (create a threshold of loss) of forest land is a concern.
- ✓ Maintaining the abundant and diverse forest recreation and tourism opportunities is needed.
- ✓ Protecting forested wetlands is needed.
- ✓ Maintaining rural character and scenic qualities is a priority.
- ✓ There is a need to show / relay the economic benefit of sustainable forestry and use of professional consultants (with clarity of what constitutes professional / forester).
- ✓ Maintaining forest industry viability is important.
- ✓ There is a need to do much more with regard to urban forestry.
- ✓ There is much needed progress to be made regarding river and riparian corridor, and greenway establishment and management.
- ✓ Planning and implementation is rarely done on a watershed level.
- ✓ For the private landowner and improved public benefit, access and liability issues need to be clarified, well-documented, and widely understood.
- ✓ With a looming energy crisis, there needs to be preparation, planning, and implementation / action to meet local energy and heating needs while consideration of the building pressure on, and limited capacities of, the forest resources.
- ✓ There is a need for strategies, technical and planning assistance, and financial assistance to increase number of acres under forestry stewardship plans.

Forestry Issues Category II – Private Forestry / Forest Land Stewardship

Private landowners own and control the vast majority of forest acres in the watershed. Information and education delivered to this target group are critical to achieving the vitality of the forest resources in the watershed.

- ✓ The need for Forestry Stewardship on private lands is an issue.
- ✓ Tree / Forest establishment – Heath Hill is needed.
- ✓ There should be far more tree and windbreak establishment along roadsides.
- ✓ There is a need for resources and means to address and maintain driveways and logging road interface with township roads.

- ✓ Gaining stewardship, sustainability, and Best Management Practices (BMP's) is a challenge.
- ✓ Logging techniques – show landowner is responsible for water quality, not just logger.
- ✓ There is a lack of understanding of assistance and resources available to the landowner, group or government (consultants, Conservation District, Service Forester, Extension, etc.).
- ✓ There are needs for more examples and outreach regarding ways showing how sound forestry can be economically sustainable.
- ✓ Sufficient and consistent funding resources are needed to support and sustain sound forest stewardship planning and practices.
- ✓ Ways need to be developed to compensate landowners for the natural services provided by well-maintained forests.

Forestry Issues Category III – *Environmental Impacts*

Logging and timber harvesting without long term objectives, consideration of invasive plants, wildlife influences, all have resulting environmental impacts on the watershed's forest.

- ✓ Poor logging techniques – roads and landings are problems.
- ✓ Curbing soil loss and water quality impacts is needed.
- ✓ Maintaining natural services of forests (recharge, soil stability along steep slopes and waterways, carbon sequestration) needs to be considered.
- ✓ Forest and tree establishment for function (windbreak, shade, energy, buffers, visual, sound, odor) is needed, as well as further agricultural and non-ag. buffers along streams.
- ✓ Poor riparian forest management impacts on aquatic life.
- ✓ There is a lack of control of invasive species.

Forestry Issues Category IV – *Education & Information*

- ✓ Education and outreach is needed to develop public perceptions of what is good or bad.
- ✓ Media briefs and releases related to forestry are needed.
- ✓ There is a need for forest demonstration areas, museums, centers, and other educational venues.
- ✓ There needs to be much more support for public forestry educators.
- ✓ Need to develop and offer forestry and stewardship education to public officials.
- ✓ There is a need for funding a public forester for private landowners.

Forestry Strategies

The following is a listing of strategies to address forestry identified issues in the Sugar and Towanda Creek Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy and the Bradford-Sullivan Forest Landowners Association.

Forestry Strategies Category I – *Resource Planning*

- Create and insure limits of acceptable forestland change and loss.
- Code enforcement and workshops / strategies, and examples of forest / road interface need to be developed and furthered to tangible results.
- Aim for multiple use, yet balance uses and reduce conflicts.
- Develop and implement protection strategies for forested wetlands.
- Provide protection of priority scenic areas through zoning and easement incentives.
- Lay foundation for a Countywide Transfer of Development Rights (TDR) program.
- Develop and implement strategies, opportunities, and incentives to reduce fragmentation and parcelization.
- Perform detailed natural and scenic resource inventories.
- Encourage municipalities to develop and implement forest management plans.
- Assist municipalities in the drafting of local municipal and/or multi-municipal comprehensive plans.
- Provide model ordinances, ordinance language or ordinance topics for municipal and multi-municipal consideration.
- Review local ordinances to preserve, measure, encourage, and ensure that zoning protects sensitive resource areas.
- Assist communities in the development of specialty parks and facilities for public use that incorporate forest resources.
- Create a property tax structure that encourages the maintaining of forest land.
- Encourage the development of watershed management strategies that promote best management practices for mining, agriculture, forestry and other land uses.

- Include watershed organizations in planning and implementation of forestry protection plans.
- Involve watershed groups and citizens in recreational planning & implementation
- Market the County's natural resource production to broader products and services.
- Develop and implement strategies to maintaining forest industry viability.
- Assist in identification, facilitation, and marketing of specialty/niche markets for agricultural and forest products.
- Market preserved ag./forest land for ag./forest expansion.
- Preserve forestland for continued forest use.
- Implement the Countywide greenways and recreation plan, municipal County and regional comprehensive plans, and other similar plans.
- Develop riverfront trails to connect riverfront parks and communities.
- Develop trailheads, parking facilities and trail user services on public lands.
- Do not develop excessive land use controls for agriculture and forestry; regulations should be clearly tied to community health, welfare and safety benefits.
- Discourage land use and development patterns which result in the fragmentation of forest and agricultural lands.
- Create, promote, and maintain demonstration areas that exhibit sound forest development and management.
- Promote the management of forest land for multiple benefits including timber resources, wildlife and land conservation.
- Promote diversification within agriculture and wood products industries.
- Compile, develop, and use tools and means that foster clear objectives within the planning process.
- Promote and implement planning at the watershed level / scale.
- Develop multiple use matrices within plans to understand, reduce conflict and maximize use and diversity.

Forestry Strategies Category II – Private Forestry / Forest Land Stewardship

- Increase stewardship, sustainability, and Best Management Practices (BMP's) through landowner educational programs.
- Identify and develop demonstration areas for forestry best management practices (Mt. Pisgah County Park, among others).
- Increase and develop sustainable sources of technical and financial assistance to develop and implement forestry stewardship plans.
- Logging techniques – show landowner is responsible for water quality, not just loggers.
- Promote the management of woodlands as a renewable resource for wood products, wildlife, recreation uses, and ecological / social services.

- Encourage timber harvesting in conjunction with sound forest stewardship and best management practices.
- Support and enhance the activities of the Bradford / Sullivan Forest Landowners Association.
- Research and find ways to educate, encourage, and enable access and use on private lands brought about by liability issues.

Forestry Strategies Category III – *Environmental Impacts*

- Develop incentives and technical assistance for forest and tree establishment for function (windbreak, shade, energy, buffers (visual, sound, odor).
- Encourage and further agricultural and non-agricultural forested riparian areas and other buffers.
- Protect the forests, steep slopes and other environmentally sensitive areas.
- Encourage the preservation of working forests as a manageable resource for timbering, water quality, recreation and wildlife benefits.
- Develop incentives, technical assistance, and information regarding forested riparian areas.
- Continue and expand efforts to provide environmentally sensitive forestry management programs for landowners and professional timber harvestors.

Forestry Strategies Category IV – *Education & Information*

- Support and enhance the activities of the Bradford / Sullivan Forest Landowners Association.
- Organize and hold annual forest management workshops, conferences and demonstrations.
- Support Green Career Day and similar activities that relay natural resource career paths.

Landowners

Private landownership is the driving consideration when developing, implementing, and maintaining any strategy or practices relating to environmental, cultural and historic resources. Landowners make the management planning decisions and support local planning and regulatory efforts. The knowledge base, perceptions, and the culture norms themselves all affect how the residents of the watershed will receive and respond to issues and strategies. This becomes especially true in more rural landscapes where government services are at a minimum.

Compiled Stakeholder Input

The following is a distillation of landowner related issues in the Sugar and Towanda Creek Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy.

Landowner Issues Category I – *Miscellaneous*

- ✓ Overuse / misuse of fertilizers by business, homeowners, etc. (non-farm) is a concern.
- ✓ High landowner matches for government cost share programs related to stream management are often unachievable.
- ✓ Bradford County residents are choosing suburban and rural living over that found in the County's boroughs.
- ✓ Residents' reliance on the personal automobile reflects Bradford County's dependence on the State and local roadway network.
- ✓ There are issues arising out of conflicting use, such as ATV users on trails also used by hikers.
- ✓ There is a lack of knowledge by landowners concerning the watershed issues, possible solutions and natural resource management.
- ✓ Many landowners resist the concepts of stormwater, riparian and watershed management and protection.
- ✓ There are no programs to recognize good landowner management.
- ✓ People moving into the watershed area from urban areas often have unreasonable expectations as to roads, farm odors and rural infrastructure.

- ✓ Homeowners generally do not know how to properly maintain on-lot septic systems.
- ✓ Homeowners generally do not know the quality of the groundwater (well water) that they drink.
- ✓ Landowners along streams generally see them as liabilities rather than assets.
- ✓ Many younger landowners are not aware of the cultural and historic roots of communities in the watershed.
- ✓ It is difficult to get the public involved in local government and regional efforts.

Landowner Strategies

The following is a list of recommended strategies to address landowner issues in the Sugar and Towanda Creek Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy.

Landowner Strategies Category I – *Miscellaneous*

- Develop an informational outreach program for people moving into the watershed to educate them as to the qualities and values of the rural aspects of the region.
- Develop a recreational plan that considers and addresses conflicting uses, such as ATV users of trails also used by hikers.
- Provide educational programming for landowners on watershed issues.
- Promote community values through the use of lamppost banners, slogans, etc. Market these images to new business prospects, land developers and realtors.
- Acknowledge good development, redevelopment, and community initiatives through a County award program.
- Continue providing financial assistance to Endless Mts. Transportation System (EMTA).
- Develop a project to create and install appropriate signage to better identify stream access points for the entire Watershed.
- Create a program that provides technical and permitting assistance and public education for homeowners on proper on-lot septic system development and maintenance.

- Hold a series of workshops for homeowners on issues identified in the watersheds.
- Offer financial incentives for maintenance “pump outs” of on-lot septic systems.
- Develop programs, initiatives and incentives that support proper utilization of septage materials.
- Create a program that provides technical, financial assistance, and public education for homeowners on proper drinking water well development and maintenance.
 - Develop a program that provides technical and educational assistance to homeowners on water well citing, construction, testing and maintenance.
 - Expand on the Master Well Owners program run by Penn State Extension.
- Develop regulations/ordinances for proper well water installation.
- Develop a program that provides technical and financial assistance and public education for homeowners on proper driveway and driveway drainage development and maintenance.
- Develop a program that provides technical and educational assistance to homeowners on proper fertilizer and pesticide use.
- Hold a series of workshops for homeowners on related watershed issues.
- Provide incentives for soil testing.
- Incorporate commercial fertilizer dealer cooperation in education and outreach of homeowners and businesses.
- Develop a mini-nutrient management plan format for homeowners.
- Develop outreach efforts targeting landowner education on stormwater management.
- Seek opportunities for installing stormwater management demonstration best management practices.
- Hold informational workshops on watershed issues.
- Explore the concept of “community stormwater educators”.
- Build an awareness of the cultural and historic values of the Watershed.
- Involve landowners in opportunities, such as fairs, museums, etc., in exploring the culture and history of the region.
- Provide more opportunities for historic and cultural interpretation.
- Encourage residents to participate actively in presenting their history and provide them with a forum in which they can share their knowledge.
- Encourage cooperative efforts among various groups, sites, and entities around interpretation of regional themes.
- Work with local teachers to integrate heritage resources into local curricula.
- Develop a public involvement strategy and campaign aimed at increasing participation of landowners in local government, watershed groups, historic and cultural efforts, etc.

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- Encourage volunteer efforts to maintain and clean up the land, provide financial support, and demonstrate best management practices for private landowners.
- Develop a personal "watershed history" relating the importance of the stream and its historic connection to the people.
- Collect and compile a historic account of the importance and role of Sugar and Towanda Creek in the development of the communities in the watershed.

Mining / Resource Extraction

Mining, in the past and present, holds a significant role in the environmental, historic and cultural aspects of the watersheds. Early coal mining provided an attractive source of employment but also left impacts on the landscape. Today, sand and gravel is mined in the watersheds. Energy prices of the future may create new demands for the remaining coal reserves, as well as the newly accessible gas resources. The current exploration and extraction efforts related to the Marcellus Shale gas deposits are just beginning to have their impact on the watershed area. Costs of heating fuels potentially could have impacts on our forestry resource management.

Compiled Stakeholder Input

The following is a distillation of issues in the Sugar and Towanda Creek Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy.

Mining Issues Category I – *Miscellaneous*

- ✓ Non-coal mining (sediment/sand & gravel) can create sediment problems.
- ✓ Coal mining runoff (AMD) is impacting on water quality.
- ✓ Protecting groundwater supply and quality is critical.
- ✓ There are few local ordinances in place that protect the County's natural resources.
- ✓ Mining in Bradford County takes place in the glacial outwash deposits for materials such as sand and gravel.
- ✓ Mineral resources extraction has significantly increased over the past 25 years.
- ✓ There is a need to establish standards for quarrying and surface mining through municipal zoning controls in order to minimize the visual and environmental impacts from mineral resource development while recognizing the importance of such resources to the overall community.
- ✓ There needs to be an inventory of potential and existing mining sites, especially in the Barclay mountain area.

- ✓ There needs to be recognition of the historic role mining has played in the watersheds.
- ✓ One concern expressed was a lack of timely State cooperation and support, with a slow and complicated grant process in addressing AMD and other issues.
- ✓ Blue Stone and other types of quarries are an on-going threat to the watershed.
- ✓ There are few local controls, proposals or remedies to address the impacts of gas wells in the watersheds.

Mining Issues Category II – Gas Wells

- ✓ There are many water quality concerns related to gas drilling
 - How will mining affect drinking water?
- ✓ What are the waste by-products of mining and how are they to be treated?
 - How is water used in fracturing process going to be treated?
- ✓ Increased truck traffic will have adverse impacts on local roads and ultimately water quality.
 - Many local roads were not built for year round intense truck traffic.
 - Wear and tear on roads is a concern.
 - Stress infrastructure – bridges will take place.
 - Infrastructure – roads and bridges will be impacted.
- ✓ Safety concerns over access for residents while trucks are servicing wells is a concern.
- ✓ There are many water quantity concerns related to gas drilling.
 - What are the impacts to local streams and rivers with large withdrawals?
 - What are the impacts to ground water supplies?
- ✓ Environmental Impacts of drilling facilities (access road, drilling pads, pipelines) is a concern.
- ✓ What are the impacts on wetlands and streams?
- ✓ Use of brine as dust suppressant on local roads can be a water quality impact?
- ✓ Erosion and sediment pollution from earth disturbance is possible?
- ✓ Numerous pipelines could fragment forests and other environments.
- ✓ Impacts on local municipalities need to be determined.
- ✓ Adverse impacts on counties are possible.
- ✓ Issues of tax values and escalating land prices are a concern.
- ✓ New safety challenges for first responders (fire, ambulance, chemical spills) are created.
- ✓ How do local industries compete for jobs?
- ✓ Landowners need to be educated to rights and legal issues pertaining to leases.

Mining Strategies

The following are the identified strategies addressing mining related issues in the Sugar and Towanda Creek Watersheds to address mining issues. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (GranvilleTwp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy.

Mining Strategies Category I – *Miscellaneous*

- Develop a strategy and outreach program to preserve historic and cultural connection to mining in the watersheds.
- Develop a comprehensive plan for the protection of our groundwater supply and quality.
- Develop model local ordinances, proposals and strategies that address mining and its impacts on the quality of ground and surface water, and scenic areas in the watersheds.
- Develop an inventory of past, existing, and potential mining locations.
- Develop a GIS mapping inventory of potential natural resources considered high value for mining operations.
- Establish standards for quarrying and surface mining through municipal zoning controls in order to minimize the visual and environmental impacts from mineral resource development while recognizing the importance of such resources to the overall community.
- Provide a comprehensive program for assisting local municipalities with planning and land use ordinance preparation and administration.
- Assist municipalities in the drafting of local municipal and/or multi-municipal comprehensive plans.
- Provide an outline and assistance for preparing a local zoning ordinance.
- Provide model ordinances, ordinance language or ordinance topics for municipal and multi-municipal consideration.
- Develop wellhead protection areas through strategies and/or ordinances.
- Perform a County water resources study and develop a plan for County water resources protection.
- Develop programs to improve water quality – mine and landfill run-off.
- Inventory scenic and geologic resources and develop strategies for their protection.

- Develop a data base on GIS to include past and current mining activities, as well as potential mineral resource locations.

Mining Strategies Category II – *Gas Wells*

- Fully support the efforts of the Bradford County Gas Task Force.
- Work to educate the public on gas well drilling and landowner rights related to drilling.
- Develop and maintain a database / mapping system of gas wells and pipelines.
- Seek to develop legislation at the State level to provide resources to local communities being impacted by gas well production.
- Work with gas well industry to assure a minimized environmental impact through cooperative efforts.
- Provide the technical and regulatory staff needed to assure minimized environmental impacts.
- Develop and implement a strategy for minimizing negative or unwanted social, cultural, environmental and economic impacts on the watersheds.
- Provide coordination and education to the community to best realize employment and business opportunities related to development of the area's gas industry.

Municipal / Community

In the Commonwealth of Pennsylvania, it is the municipalities and communities that have the ultimate authority to shape the direction they move in. Comprehensive plans, local ordinances, and even the community service organizations all contribute to preserving and enhancing the cultural and environmental values of the community. The community, made up of the landowners, businesses, schools, churches and service organizations, has a vital role in making any watershed management plan a reality. Their needs and priorities are critical components of any plan.

Compiled Stakeholder Input

The following is a distillation of municipal / community related issues in the Sugar and Towanda Creeks Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (GranvilleTwp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy.

Municipal / Community Issues Category I – *Fire Protection*

Fire protection in the rural areas of the watersheds is a critical issue for homeowners, farmers and businesses. Limited capabilities of the fire companies and long distances between them, as well as to sources of accessible water, make this one of the more critical issues in the watersheds.

- ✓ There is a need for more strategically placed dry hydrants.
 - Dry hydrants – find resources to install them (some are already identified).
 - Identify sites and install dry hydrants (Sunfish Pond possible site).
 - There is limited access to stream for fire (need dry hydrants).
- ✓ Need a new fire hall.
- ✓ Training facility for fireman, fire police, and EMS personal is needed.

Municipal / Community Issues Category II – *Floodplains*

Topography, geology, and the flashy nature of the watersheds' hydrology all combine to exacerbate flooding issues. The pattern of historic land use and development along stream corridors, especially floodplains, place much of the infrastructure and homes in harms way. The lack of controls and need for education and increased capability at the local level, are all identified in a number of studies and initiatives.

- ✓ There is a lack of floodplain management / flood damage.
- ✓ More efforts are needed for flooding prevention and mitigation.
- ✓ Strategies for flood protection are needed.
- ✓ Funding to purchase property that is in floodplain is needed.
- ✓ There is a need to increase the knowledge and capability of local municipal officials.
- ✓ Better floodplain delineation and mapping is needed at the local level.
- ✓ There is a need for technical assistance in managing floodplains.
- ✓ There is a need for education and awareness of general public.
- ✓ Floodplain zoning must be incorporated into the overall zoning ordinance.
- ✓ Preserve 100-year floodplain and wetland areas so that they can perform their natural functions.
- ✓ Need to stop loss of property and homes from floods.
- ✓ Rapid response to flood emergencies is needed.
- ✓ Examine and address building / development proximity to streams and water bodies (resources needed, planning, and land use guidance).
- ✓ There are no flood hazard mitigation plans developed for areas in the watersheds.
- ✓ There is a need for programs and funding to move homes and businesses out of flood hazard areas.
- ✓ Development in floodplains should be prohibited.

Municipal / Community Issues Category III – *Stormwater / Drainage*

Stormwater management is an essential component to managing both the flooding issues and the stream stability issues. Uncontrolled stormwater adversely impacts property and road drainage systems. Stormwater also has direct water quality impacts.

- ✓ There is no active stormwater management plan in the watersheds area.
- ✓ There is a need for Act 167 planning and implementation throughout the watersheds.
- ✓ Better stormwater detention in developed areas is needed.
- ✓ Stormwater management planning and methods to address damage are desired.
- ✓ The general public, as well as decision makers, need to understand the concepts and importance of stormwater management.

- ✓ Community stormwater educators/coordinators need to be part of the building permit system.
- ✓ There needs to be demonstration sites of best management practices for stormwater management in the watersheds.

Municipal / Community Issues Category IV – Planning

Local municipal governments in the watersheds are at the front line in planning for the use, management and protection of the resources within their jurisdiction.

- ✓ Municipalities need to cooperate across jurisdictional boundaries in the management of natural, cultural, historic, and recreational resources.
- ✓ There needs to be planning efforts directed at the abundance and quality of natural resources in the area that provide numerous recreational opportunities for both residents and visitors, and demand for nature-based recreation and tourism is increasing
- ✓ There are many scenic natural landscapes throughout Bradford County that need protection.
- ✓ More coordinated efforts are needed between State, County and local governments in establishing bike/pedestrian routes.
- ✓ Need to encourage the concept of joint zoning, administration and enforcement.
- ✓ More collaborative efforts are needed.
- ✓ Land use planning and land use guiding options are desired.
- ✓ There is too much unrestricted development in the watersheds.
- ✓ Bradford County residents are choosing suburban and rural living over that found in the County's boroughs.
- ✓ Open space and urban sprawl issues have impacted, or are beginning to impact, the communities in the watersheds.
- ✓ We need to encourage development in existing built-up areas and identified growth centers.
- ✓ There is a desire to preserve historic and cultural resources throughout the watersheds.
- ✓ There are few local ordinances in place that protect the watersheds' natural resources.
- ✓ Current and future water quality and adequate sewage systems need to be addressed.
- ✓ We need to provide water supplies and facilities of adequate quantity and quality to meet short and long range needs.
- ✓ Develop long range plans for the development of adequate supplies of water.
- ✓ Implement existing plans to renovate the reservoir in Troy.
- ✓ Unless there are strict controls placed on development, this area will be the victim of environmental degradation, economic turmoil, high taxes, overburdened public utilities, loss of valuable farmland, and many other disadvantages.

- ✓ Residents overwhelmingly favor the open space and rural nature of the watershed communities.
- ✓ Need to control problems with noise, uncontrolled burning, lack of maintenance, junk accumulations, and substandard building practices that would degrade the natural environment.
- ✓ Need whole plan – not just band-aid approach toward development and resource management.
- ✓ More involvement of watershed organizations is needed in municipal and County planning.
- ✓ Watershed organizations need more organizational, financial and technical assistance.
- ✓ There are too many agencies involved in regulation and land use controls.
- ✓ There needs to be a balance between natural resources and social and economic needs.

Municipal / Community Issues Category V – *Municipal Capabilities / Support*

Elected municipal officials in the Watershed are largely not professional government officials and have varying degrees of expertise. The capabilities and knowledge of these officials directly impacts on the management of the resources under their jurisdiction.

- ✓ There is a lack of maintenance / illegal septic systems.
- ✓ Spring development at bottom of Meas Hill – bring up to public drinking standards, conduct testing, landowner is willing to secure with easement, it is a historic / cultural resource for the community.
- ✓ The township supervisors voiced some concern about difficulty in keeping track of grants.
- ✓ Dollars to help township with repairs are needed.
- ✓ We need to have whole community involved and educated on local and County government, community development, cultural and historic resources, recreation and tourism and natural resource planning.
- ✓ There is a lack of participation and involvement by the general public.
- ✓ We need an exchange of ideas, work together with open minds.
- ✓ There is a need to change the perception of planning.
- ✓ There is a lack of local education and training available to municipal officials.
- ✓ There is a lack of adequate finances for municipal government.
- ✓ A centralized directory of support services and information for municipalities is needed.
- ✓ There needs to be a more centralized system of regulation and planning.
- ✓ We need to keep energetic, intelligent leaders at the local level.
- ✓ There is a need for better communications with legislators to keep them informed of issues and needs.

Municipal / Community Strategies

The following is a distillation of strategies for the Sugar and Towanda Creeks Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville-Canton Borough-Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy.

Municipal / Community Strategies Category I – *Fire Protection*

- Create and implement a rural fire protection plan for the Watershed area.
- Conduct inventory and assessment of current fire protection.
- Map and assess existing water sources for fire protection.
- Develop and implement a plan for the installation and maintenance of a dry hydrant system in the Watershed.
- Fund and install dry hydrants as indicated in a fire protection plan.

Municipal / Community Strategies Category II – *Flood Plains*

- Flood hazard mitigation plans need to be developed for all the Watershed's municipalities.
- Provide technical, planning and financial support for the County Hazard Mitigation plan implementation.
- Develop a rapid warning and response system for flood potential.
- Identify mapped and historic flood plains.
- Identify properties/homes/businesses threatened by flooding.
- Develop a watershed-wide water resources plan.
- Develop and implement a comprehensive set of flood plain management tools for the Watershed and individual municipalities within the Watershed and maintain a strong flood plain management program to prevent future damage.
- Flood plain zoning must be incorporated into the overall zoning ordinance.
- Undertake mitigation of existing flood damage problems and minimization of future flood damages.
- Establish new ordinances to aid in flood plain management.
- Establish preservation strategies for 100-year floodplain and wetland areas so that they can perform their natural functions.
- It is proposed that a floodplain district be established to prevent development in areas unfit by reason of flooding.
- Protect areas with severe floodplain impacts from development uses.

- Promote agricultural production as a viable use in suitable areas, including floodplains.
- Enforce controls which result in stream buffers and avoid development in floodplain areas.
- Recognize that our streams are a great natural resource with scenic, recreational, and environmental benefits that can be utilized and enjoyed; provided that we respect the periodic threat from flooding and educate official and the public regarding these values.
- Increase beautification of stream banks or riverbanks.
- Develop flood proof access points to streams for recreational use.
- Visit every municipality to discuss and review floodplain ordinances, uses and problems.
- Develop and hold an ongoing series of educational outreach efforts on an annual basis to educate the public on the value of floodplains and their management.
- Develop and implement riparian corridor management plans that include floodplain protection.

Municipal / Community Strategies Category III– *Stormwater / Drainage*

- Develop additional Act 167 Stormwater Management Plans for the County's watersheds.
- Encourage the use of stormwater best management practices.
- Identify, design, and install demonstrations of stormwater BMPs throughout the watersheds.
- Provide a source of technical and financial assistance for stormwater management.
- Encourage the development of watershed management strategies that promote best management practices for mining, agriculture and other land use.
- Consider the development of local “community storm water coordinators” to assist in education for homeowners and developers.

Municipal / Community Strategies Category IV – *Planning*

- Develop and implement a plan to preserve historical and cultural resources throughout the watersheds.
 - Encourage local governments to include review of historic resources where subdivision review is required.
 - Encourage local governments to require basic maintenance by owners of buildings more than 50 years old.
 - Encourage local government units to review plans to demolish structures older than 50 years, allowing for appropriate review and evaluation.

- Fund the development of a recreational and tourism strategy for the watersheds region: considering the abundance and quality of natural resources in the area; the numerous recreational opportunities for both residents and visitors; the increasing demand for nature-based recreation and tourism; and the many scenic natural landscapes throughout the watersheds.
 - Complete a more extensive survey of recreational and scenic opportunities within the watersheds area.
 - Provide protection of priority scenic areas through zoning and easement incentives.
- Develop and plan a maintenance (roadway) program at the local level.
- The development of a plan, coordinating efforts between State, County and local governments in establishing bike/pedestrian routes.
- Provide comprehensive planning and administrative support for municipalities.
 - Provide an outline and assistance for preparing a local zoning ordinance.
 - Provide model ordinances, ordinance language, or ordinance topics for municipal and multi-municipal consideration.
 - Assist municipalities in the drafting of local municipal and/or multi-municipal comprehensive plans.
 - Provide a directory that helps identify where to get assistance / information.
 - Encourage and facilitate cross municipality/agency planning efforts.
- Coordinate zoning with designated growth areas.
 - Consider the use of joint municipal zoning as a means of directing higher density development to areas best suited for such development.
- Lay foundation for a Countywide Transfer of Development Rights (TDR) program.
- Utilize zoning (potentially with overlay districts) to manage landuse development along the US 6.
 - Carefully plan and implement a land use development strategy along Route 6 corridor, which builds upon the heritage, natural and locational assets, and conforming to the natural limiting factors.
- Support the development of a Northern Tier Regional Recreation Coordinator.
- Support the Countywide Greenways, Open Space and Recreation plan.
- Assist communities in the development of specialty parks and facilities for public use.
- Involve watersheds in recreational planning & implementation.
- Develop / update all municipal comprehensive plans, ordinances and development tools.
- Discourage future “strip” or linear development along major highways and encourage “in-fill” development within or directly adjacent to the existing built-up areas and development concentrations.
 - Discourage future “strip” or linear development, especially along Routes 14 and 414; and in consideration of natural resources, sensitive areas and other pertinent and unique factors.

- Encourage the preparation, enactment, and enforcement of local subdivision and land development ordinances.
- Encourage and pursue the land development concepts of growth centers, transitional growth centers, village centers, "walkable communities", "smart growth", and in-fill development.
- Prioritize the use of existing developed land and vacant structures.
- Promote harmony between the development, future development, and the natural environment in concert with local natural resources and sensitive areas, physiographic characteristics and constraints.
- Utilize the Bradford County Natural Resource Inventory to identify unique or sensitive environments and to protect them from degradation.
- Maintain and enhance recreational opportunities and preserve open space for use by existing and future residents.
- Encourage the creation of environmentally neutral businesses and industry.
- Enact or revise local land use ordinances.
- Ensure orderly, appropriate and compatible growth that will result in well-planned and efficient development.
- Encourage balanced development among the various land uses, in concert with the rural and passive open space orientation which is prevalent.
- Encourage the revision, enactment, and enforcement of a revised land use ordinance while preserving certain community physical, environmental, and historic assets; including enactment of local subdivision and land development ordinances, stormwater management.
- Encourage "cluster" development, traditional neighborhood development, incorporation of public open spaces, plazas and commons, aesthetic design, walkways, trails and passages, and attention to vistas and view sheds.
- A particular consideration to keep in mind is the preservation of adequate open space land so that development is not encouraged to an extent that will deprive the Borough of its valuable rural character.
- Develop supplement land use controls for air quality, odor, sound and light pollution in land use regulations.
- Encourage higher density development potential through mixed-use, clustered and Traditional Neighborhood Development and transit-oriented development techniques
- Develop supplement land use controls for air quality, odor, sound and light pollution in land use regulations.
- Employ nuisance regulations to control problems with noise, uncontrolled burning, lack of property maintenance, junk accumulations, and substandard building practices that would degrade the natural environment.
- The land use controls should not be overly complex, provided that they achieve the desired goals.
- Utilize conservation development techniques, including cluster subdivision and conservation design guidelines or regulations, to achieve appropriate development densities while avoiding impacts to environmentally sensitive lands.

- Recognize the community, recreational, cultural, and aesthetic value of public land and park resources to the regional community.
- Develop a Subdivision and Land Development and Storm Water Management regulatory capacity with water quality provisions to protect the water resources of the region.
- Assure that any comprehensive planning addresses historical, cultural, agricultural, and open space preservation, and scenic considerations and consider a wide array of tools available to achieve protection and investment in these resources.
- Utilize the Bradford County Open Space, Greenways and Outdoor Recreation Plan as a strategic plan for natural and cultural resource conservation and outdoor recreation for the region.
 - Designate active and passive greenways plans for the watersheds.
 - Protect and manage sensitive natural features and diverse habitats, particularly those in designated greenway corridors.
 - Conserve and interpret historic features, particularly those in active greenway corridors.
 - Conserve scenic view sheds and corridors.
 - Maintain safe outdoor recreational facilities.
 - Expand the functions and quality of public recreation areas.
 - Design, construct, and maintain trails for leisure walking and bicycling and for hiking and backpacking.
 - Promote and explain the County's policy on greenways and open space.
- Maintain working open space lands for agriculture, forestry, and other resource-based uses.
- Expand recreational programs to include recreational and leisure activities for all age groups.
- Create and fund a position for a full-time recreation and greenway coordinator.
- Create and expand partnerships between school districts, municipalities and other community organizations to provide outdoor recreational facilities and services.
- Communicate objectives and coordinate efforts among public and non-governmental organizations working in the areas of conservation and recreation.
- Encourage volunteer efforts to maintain and clean up the land, provide financial support, and demonstrate best management practices.
- Encourage the use of innovative designs for rural subdivisions.
- Enhance marketing of recreation sites and corridors and cultural destinations.
- Develop and maintain close ties with natural resource agencies (Bureau of Forestry, Bradford County Conservation District, Fish Commission, and Game Commission, USDA, PA DCNR, PADEP, etc.) for their educational and program benefits.
- Establish standards for quarrying and surface mining through municipal zoning controls in order to minimize the visual and environmental impacts

from mineral resource development while recognizing the importance of such resources to the overall community.

- Keep GIS maps up-to-date and available to the public to encourage sound land use decisions.
- Develop GIS capabilities of local municipalities through education and support for hardware and software.
 - Purchase GIS hardware and software for municipalities.
 - Organize and hold a training program on GIS for municipal officials.
 - Encourage the use of the preferential tax assessment for rural landowners, Act 319 – Clean and Green Program.
 - Create a “regional design committee” to lead community discussions about what is “traditional, local, and rural”.
 - Develop general, illustrated guidelines encouraging “traditional, local and rural” design, incorporating photos and explanations of actual properties and items in the region.
 - Emphasize the importance of regional design to heritage trail participants and those who participate in other interpretive activities.
- Enlarge the availability of Main Street programs and technical assistance to commercial enterprises in small communities....maybe through a circuit rider program, or cluster leadership.
- Encourage municipalities to identify their outer boundaries on major roadways with signs and plantings.

Municipal / Community Strategies Category V– *Municipal Capabilities / Support*

- Acknowledge good development, redevelopment and community initiatives through a County award program.
- Initiate an awards program to reinforce “traditional, local, and rural” design (crafts, buildings, landscaping, signs, etc).
- Provide model ordinances, model overlay districts or ordinance topics for municipal and multi-municipal consideration.
- Provide a review mechanism of local ordinances to ensure that zoning protects sensitive resource area.
- Develop circuit rider programs for specialized municipal staff.
- Encourage preparation, enactment and enforcement of a land use ordinance.
- Encourage the concept of joint zoning, administration, and enforcement.
- Build a strong, viable watershed association.
 - Short term actions:
 - Continue regular watershed meetings.
 - Develop a watershed community awareness through signs, displays, etc.
 - Develop an outreach plan to involve more community elements.
 - Establish and strengthen the association committees.
 - Develop objectives and a working business plan for the future of the associations.

- Long term actions:
 - Establish watershed association as a legal, structured independent entity.
 - Have named representation from each watershed municipality.
 - Collect and compile a historic account of the importance and role of Sugar and Towanda Creeks in the development of the communities in the watersheds.
 - Assist the watershed groups in developing watershed specific strategic and business plans.
- Continue building a strong community run watershed monitoring network.
 - Short term actions:
 - Expand the rainfall and stream gauge network.
 - Organize data collected by citizen monitors.
 - Present the data in graphical format.
 - Expand monitoring program to include water quality assessment.
 - Long term actions:
 - Begin to utilize rainfall and stream data to model stream responses to rainfall.
 - Establish a flood warning system.
 - Develop and implement plans to increase the participation of landowners in local government that include training, recognition, and ongoing support
 - Develop and conduct more education / information efforts on watershed issues.
 - Seek and develop more organization support in the watersheds.
- Identify sources of funding to assist municipalities in the watersheds.
- Promote education programs to assist property owners in making informed decisions about activities that affect land and water resources.
- Provide training to governmental and civic officials and others about design and community development.
- Create a resource library, “traveling trunks”, or both, on community design issues.
- Publish a directory of local artists and designers who are willing to work with businesses and property owners on improving their properties.
- Encourage property owners to work voluntarily with the regional design committee on their plans for new construction and rehabilitation of older structures.
- Develop a local training program for municipal officials that includes environmental, cultural, historic, recreational and natural resource management elements.

Recreation

Two of the elements contained within the Vision for Open Space, Greenways and Outdoor Recreation in Bradford County are as follows:

..."residents and visitors experience the many facets of the natural environment through outdoor recreational opportunities."

..."public and private partners work together to protect open space, manage natural resources, and meet recreation needs."

The Sugar and Towanda Creek Watersheds contain some of the finest outdoor recreational opportunities the County and region can provide. These opportunities were cited by the stakeholders in meeting after meeting and their values quoted in a multitude of forums and manners.

Compiled Stakeholder Input

The following is a distillation of issues in the Sugar and Towanda Creek Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy.

Recreation Category I – *Trails*

- ✓ There is a need for more public trails.
- ✓ Construct a recreational trail along Sugar Creek.
- ✓ There is a need for hiking trails.
- ✓ James St. to Church Hill walkway along river and existing locks could connect to walkway in Towanda Borough.
- ✓ There is a need for recreation opportunities closer to the area (i.e. – ATV trails, bike trails, hiking trails).
- ✓ More coordinated efforts are needed between State, County and local governments in establishing bike/pedestrian routes.

Recreation Category II – Fishing / Boating / Stream Access

- ✓ Public Fishing Access – more are needed.

- ✓ There is a need for stream, recreational, and fishing access (perhaps rail to trail projects) while considering private property owner rights and concerns. This should tie in with Schrader Creek corridor and game land resources.
- ✓ Better fishing access is needed for areas of the Towanda Creek Watershed that are stocked with trout.
- ✓ More boat access is needed.
- ✓ There is an insufficient access to the river throughout the Bradford County corridor.
- ✓ There is a feeling that the river is the County's outstanding feature, and should be protected in some way -- a scenic river designation is possible, but potential conflict with private property owners would need to be addressed.
- ✓ Fishing in the river and major streams has suffered with the introduction of non-native species and the disappearance of pan fish, grass and clams.

Recreation Category III– Community Parks and Facilities

- ✓ There is a need for more community based recreational facilities.
- ✓ There is a need for community building and community park/playground.
- ✓ There is a need for recreation opportunities closer to the area (i.e. – Golf Course).
- ✓ There is a need for a community park/playground; there is possible land available for the Borough to purchase nearby.
- ✓ Work on the Park is needed.
- ✓ The abundance and quality of natural resources in the area provides numerous recreational opportunities for both residents and visitors, and demand for nature-based recreation and tourism is increasing.
- ✓ Demand for recreational facilities is increasing, particularly in natural settings.
- ✓ The committee also struggled with recreational resources, noting that while they enhance a community, rural areas often struggle to keep recreational areas maintained and safe. Ways to settle issues arising out of conflicting use, such as ATV users on trails also used by hikers, were also addressed.
- ✓ One concern was a lack of timely State cooperation and support, with a slow and complicated grant process.
- ✓ There are a number of issues facing area youth: more activities for young people are needed; many are poorly planned and developed.
- ✓ Nobody is organizing community activities.

Recreation Category IV – *Tourism*

- ✓ The natural resources and scenic beauty of the area are not being utilized effectively to capture the tourism business.
- ✓ The agricultural lands provide a real draw for tourism that is not being considered.

Recreational Strategies

The following is a listing of Strategies to address agricultural identified Issues in the Sugar and Towanda Creeks Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (GranvilleTwp. – Canton Borough -Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough); the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy.

Recreation Category I – *Trails*

- Encourage higher density development potential through mixed-use, clustered and Traditional Neighborhood Development and transit-oriented development techniques.
- Develop riverfront and streamside trails to connect riverfront parks and communities.
- Develop trailheads, parking facilities and trail user services on public lands.
- Complete the sidewalk / trail link between the Troy business district and Alparon Park.
- Develop trail systems that offer opportunities for cultural and historic interpretation.
- Formally request shoulder widening, surface improvements, pedestrian crossings and intersection improvements along major highways.
- Shoulder improvements on PA 414 between Canton and Monroeton.
- Encouragement of a mixed use / pedestrian scale development.
- Secure funding to analyze the potential for trail linkages.
- Develop off-road trail mapping.
 - Develop, survey, classify, and create publications / maps of trails guided by the formation of a steering committee.
 - Promote biking use of trails along the streams, bike rental.
 - Promote river and trail access with signage, including historical river theme.
- Develop off-road trail / greenways.
 - Develop off-road trail mapping for use by residents and cyclists visiting the region, using local and regional planning resources and the County Bicycle/ Pedestrian Committee.
- Improve pedestrian facilities within the region's more relatively densely populated boroughs.

- Administer “walking audits” to determine how community performs at the pedestrian level – examining such features as crosswalks, traffic calming needs, engineering and design, intersection geometry, pedestrian signals, signs and markings, sidewalks and pathways, grade separation, ADA compliance, and maintenance.
- Expand the Merrill Parkway Trail into a regional trail network.
- Expand trails and bikeways for recreation and fitness benefits.
- Reduce the impact of the car and promote walkability.
- Support and carry out a scenic corridor inventory and plan.

Recreation Category II – Fishing / Boating / Stream Access

- Inventory existing riverfront and streamside public access, determine needs, plan and create new points of access as needed.
- Improve boat launches and fishing access areas, e.g. docks, more picnic areas, boat rentals.
- Encourage better tourism through kayaking.

Recreation Category III – Community Parks and Facilities

- Assist municipalities in the drafting of local municipal and/or multi-municipal comprehensive plans.
- Encourage higher density development potential through mixed-use, clustered and Traditional Neighborhood Development and transit-oriented development techniques.
- Perform detailed natural and scenic resource inventories.
- Provide protection of priority scenic areas through zoning and easement incentives.
- Provide model ordinances, model overlay districts or ordinance topics for municipal and multi-municipal consideration.
- Lay foundation for a Countywide Transfer of Development Rights (TDR) program.
- Support the development of a Northern Tier Regional Recreation Coordinator.
- Develop circuit rider programs for specialized municipal staff.
- Support the implementation of the County-wide greenways and recreation plan.
- Assist communities in the development of specialty parks and facilities for public use.
 - Maintain and enhance assets such as: small community park on the corner of Carson and Troy Street; the community park and pool bounded by South Washington, Montague, First and Second Streets, school park along East Union Street, and school site and athletic facilities adjacent to the Jr / Sr. High and Elementary Schools.

- One suggestion was the creation of a fitness trail around the perimeter of Canton Borough which would be suitable for all age groups.
- Conduct a study of places needed for active (baseball, tennis) and passive (nature study) recreation.
- Make swimming pool accessible to the handicapped/ improve pool safety.
- Determine the needs of a year-round recreational program.
- Improve the softball backstop and facilities.
- Improve existing tennis courts (including re-surfacing and lighting).
- Landscape the playground.
- Consider portable bleachers.
- Build picnic tables and barbeque grills.
- Purchase playground equipment to satisfy various age groups.
- Involve watersheds in recreational planning & implementation.
- Regional recreational plans and facilities should be shared with the Endless Mts. Tourism Bureau.
- Further document the Outdoor Enthusiasts Paradise heritage related to fishing, hiking, cycling, and other outdoor activities.
- Improve downtown landscaping and benches.
- Maintain and enhance recreational opportunities and preserve open space for use by existing and future residents.
- Improve or enhance year-round activities, filling the mid-November to February gap.
- There are precipitous cliffs facing the river valley which, with the alternating meadow, make it exceptionally beautiful. It is felt that the mountains, streams, forests, and overall scenic beauty create the potential for year-round recreation industry, thereby providing new jobs and enterprises.
- Other recreational highlights that need to be planned for are: fishing, swimming, boating, picnicking, camping, hiking, and snowmobiling.
- “Out of the box” thinking needed on “things to do”, such as an amusement park, camping...to create a place to “get away”.
- Maintain and enhance recreational opportunities.
- Improvements to sidewalks and other pedestrian amenities can also help to increase the success of revitalization efforts.
- Promote the management of woodlands as a renewable resource for wood products, wildlife and recreation uses.
- Maintain suitable recreation facilities and programs for residents.
- Provide watershed-wide marketing, promotion, and education support integrating parks and trails and similar facilities to promote health, wellness, fitness, and cohesion with local culture.

Recreation Category IV – *Tourism*

- Develop Agri-tourism and develop strategy to address liability and insurance.
- Seasonal home development is an important component of the tourism segment; given the available land, natural beauty, etc.
- Key tourism on natural resources (i.e. ecotourism) – birding / outdoors.
- Improve infrastructure, such as lodging, to make the area more “visitor friendly”.
- Support the tourism and recreation industry recognizing that it brings “outside dollars” to Bradford County without a large investment cost.
- Develop and pursue specific tourism themes for the Susquehanna River Corridor.

Recycling / Waste

The Northern Tier Solid Waste Authority (NTSWA) is the leading agency in the watersheds for solid waste disposal and recycling efforts. Recycling efforts exceed the target goals for the State and for the most part, solid waste is being adequately handled. As in most rural areas though, litter, illegal dumping, especially along streams, is a prevalent problem.

Compiled Stakeholder Input

The following is a distillation of issues in the Sugar and Towanda Creeks Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (GranvilleTwp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy

Recycling / Waste Category I – *Improper Disposal*

- ✓ Junk cars need to be addressed.
 - There are abandoned vehicles in fields.
- ✓ There is a potential management/use/recycling of plastic waste on farms.
- ✓ Used tire disposal and reuse is a challenge.
- ✓ Solid waste / dump-site clean-up (including streamside areas) – haven't the resources to conduct them.
- ✓ There is an old dump site on East Rd.
- ✓ There is a dump site on Hanks Rd.
- ✓ Clean up trash throughout the watershed.
- ✓ Removal of trash in the stream throughout the watershed is needed.
- ✓ A possible junk ordinance was talked about. Limiting the number of junk cars & other junk piles allowed on the premises.
- ✓ There are few local ordinances in place that protect the County's natural resources.
- ✓ Find ways to implement the County-adopted on-lot septage management plan.

Recycling / Waste Disposal Strategies

The following are the strategies identified to address the solid waste disposal and recycling issues in the Sugar and Towanda Creeks Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy

Recycling / Waste Disposal Category I – *Improper Disposal*

- Provide model ordinances, ordinance language or ordinance topics for municipal and multi-municipal consideration.
- Provide an outline and assistance for preparing a local zoning ordinance.
- Perform a utility service coverage study to identify service gaps.
- Update the County's solid waste management plan.
- Employ nuisance regulations to control problems with noise, uncontrolled burning, lack of maintenance, junk accumulations, and substandard building practices that would degrade the natural environment.
- Provide a strategy with incentives to provide adequate waste disposal and recycling for the watersheds.
- Facilitate coordinated efforts among communities and groups to address waste issues.

Recycling / Waste Disposal Category II – *Recycling*

- Develop tax, procedural review and other incentives to make brownfields more attractive to new development (than rural greenfield areas).
- Carefully consider the location impact of sewer and water utility systems on quality farmland and on other unique lands.
- Work with the DEP and the Bradford County Sanitation Committee to determine the feasibility of utilizing innovative or alternate on-lot systems. Such systems make it feasible to utilize poorer soil type locations for on-lot sewer systems in low density development; thereby reducing the dependency on higher quality farmland soils, including floodplain areas, for development sites. In order to utilize this technology, DEP will likely require the implementation of an on-lot sewer system management program. A typical program would involve septic tank pumping on a regular scheduled basis.

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- Establish or maintain community recycling based on need and the availability of program resources. Program options include curbside collection, drop-off centers, and the periodic collection of junk and appliances.
- Conduct and maintain waste stream inventories.
- Work with experts, partners, officials, etc. to determine where waste can be converted, combined, enhanced or redirected to become a resource.
- Work to promote widespread, effective, and environmentally sound composting of organic materials.
- Examine, publicize, and provide education regarding the effects of rural burn barrel allowances.

Streams

Pennsylvania's streams are often one of the largest unmeasured sources of non-point source pollution. Sedimentation due to bed and bank erosion alters flow patterns, changes channel dimensions, and affects lotic habitats. Sugar and Towanda Creek Watersheds contain hundreds of miles of streams, which affect thousands of watershed residents. Unfortunately, due to the extent of this network, we (people) have altered these systems to 'fit' our ideal vision or lifestyle. Such actions that continue to act upon our precious resource include: land cover alterations, riparian vegetation removal, gravel removal, channel alterations, etc. This traditional thinking has led to degraded stream eco-systems and increased bank erosion/channel migration. Changes in land use have resulted in changed hydrology, which in turn destabilizes stream channels and increases flooding.

Compiled Stakeholder Input

The following is a distillation of issues in the Sugar and Towanda Creek Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy.

Streams Category I – Stream Channel and Bank Instability

- ✓ Human impacts, along with the sensitive geology and “flashy” hydrology of the watershed area have destabilized as much as 25% of some of the watershed areas. This, in turn, has threatened property, transportation systems, utilities and even human life, along with considerable impacts on water quality and habitat.
- ✓ Stream bank erosion, and finding feasible and economic methods of correcting it, are vitally needed.
 - Stream-bank erosion along Lynch Road.
 - Stream bank erosion on small streams – 4 sites in particular identified: residence near Baileys Corners, South Center Road, Gulf Road, Ira Brown Road.
 - Stream Bank erosion on the main stem of North Branch Towanda Creek.
 - Excessive stream erosion along Bonnie Rd Bridge.

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- Mill Creek stream-bank erosion.
- Landowner concerned about backyard erosion – right next to old Baptist Church building in Bailey Corners.
- Ladds Creek entering the borough (SR 3002).
- South Branch Towanda Creek behind the elementary school
- Cummiskey Road.
- Heath Hill Road.
- ✓ Finding sustainable, adequate technical, financial and informational stream bank stabilization assistance is critical.
- ✓ Too much regulation. Ease of maintenance needs to be improved. Too hard for landowners to maintain stream to keep under control.
- ✓ Stream bank and channel erosion related to bridges and culverts is a serious problem due to inadequate sizing of structures, stabilization of inlets or outlets, or lack of maintenance.
 - Bridge abutment erosion along Wallace Run behind Cole's machinery.
 - Johnson Property west of Granville Center – drainage way erosion from culvert outlet under Rt. 514 – threatening shed and house foundation corner.
 - Cease Rd. angle of stream to bridge causing bank instability.
 - Enlarge bridge opening on Berwick turnpike south of Burlington.
 - Twin bridges on Schrader Creek – erosion/maintenance.
 - Bridge abutment erosion on Tube Drive – chronic problem.
 - Gulf road – eroding north side of road about 2 miles up from Granville Center.
 - Gulf Road – eroding downstream side of bridge near south end of Gulf Rd. near Granville Center.
 - South Center Road – 100 yards south of intersection in Granville Center – eroding east side of road.
 - Bridge abutment erosion on Rte. 6 – chronic problem.
 - Bridge abutment erosion on Tennessee Gas Rd.
 - Bridge erosion at Carman cross road.
- ✓ Reservoir in Valley on Smeads Creek is needed for emergencies. The capacity has been reduced due to siltation and eutrophication has set in. There are several farms and an orchard that contribute undesirable pollutants into the reservoir.
- ✓ Regarding the two parcels totaling around 150 acres at the edge of Tamarack Swamp, the dam is part earth and part concrete. There are pieces of concrete broken and erosion is evident in parts of the earth dam
- ✓ There is a lack of understanding (or disinterest) of municipal officials, contractors and landowners as to how to properly manage streams.
- ✓ There is a lack of resources to address the problems – funding, labor, technical.
- ✓ There is a lack of an organized approach and plan.

Stream Category II – *Debris / Gravel*

One result of unstable streams is that thousands of tons of sediment, not to mention what is being carried with it, is transported throughout the watershed and ultimately downstream to the Susquehanna River and the Chesapeake Bay.

The presence of sediment is a natural and necessary part of a healthy stream. The addition of excess sediment, however, can cause great harm to the aquatic ecosystem. Here are some of the effects of excess sediment:

- Disruption of natural stream order and flow.
- Damage to fish species through direct abrasion to body and gills.
- Loss of fish spawning areas due to fine sediment filling in gaps in streambed gravel (embeddedness).
- A breakdown in the aquatic food chain as sediment suffocates small organisms living in the streambed.
- Accelerated filling in of dams and reservoirs.
- A change in the water composition in the Chesapeake Bay and other estuaries.
- ✓ There is a need for stream maintenance and management (including gravel bars).
 - Specifically below Minnequa Rd.
 - Yost property – flooding low spot on Rt. 414 caused by gravel bar – chronic problem.
- ✓ Debris and gravel bar removal throughout the Watershed is needed.
- ✓ Ease regulations to remove excess sediment (gravel bars) is needed.
- ✓ Debris jams (debris dams – those that alter flow patterns and negatively effect stream stability and habitat) are a problem.
- ✓ There is some negative opinion directed toward DEP about the procedures involved in issuing a permit.
- ✓ There is a need for in-stream maintenance, management, and planning.
- ✓ Stream debris around the borough park area was also a concern.
- ✓ Flooding debris clean-up (within agricultural fields and river corridor) is needed.
- ✓ There is a need to educate municipal officials, landowners and contractors as to the proper methods of stream channel maintenance.

Stream Category III – *Riparian Areas*

Riparian areas are critical components to a stream corridor system. Riparian vegetation helps stabilize banks, provides water quality benefits and crucial wildlife habitat. Stream riparian corridors also provide excellent greenways and potential recreational uses.

- ✓ Riparian (streamside) planting of trees and shrubs is needed for buffer establishment.

- ✓ Invasive vegetation species in and along streams (i.e. Japanese knotweed) are a growing problem.
- ✓ Stream and stream-side clean-up of trash and other garbage are needed.
- ✓ A method of permanently protecting riparian areas is needed.
- ✓ Enforce controls which result in stream buffers and avoid development in floodplain areas.
- ✓ Encourage stream buffers for their erosion control and water quality benefits.

Stream Category IV – Stream Flooding & Floodplains

Streams are flooding and negatively impacting the watersheds at an increasing rate due to changes in land use (i.e. roads, development, and drainage patterns). Flooding impacts infrastructure and lives alike; this, in turn, causes millions of dollars of documented damage in the watersheds.

- ✓ Flooding of streams and valleys is a growing problem.
- ✓ Small stream flooding – storm runoff control at the top of the watershed is a concern.
- ✓ There is a need for better mapping of flooding areas.
- ✓ Flooding debris clean-up is needed.
- ✓ Municipal officials need more education and guidance in managing floodplains.
- ✓ There is a need to preserve 100-year floodplains and wetland areas so that they can perform their natural functions.
- ✓ Drainage issues occurring on Troy and Center Streets (Canton) are a concern.

Stream Category V – *Water Quality Related*

While water quality was not identified in many of the public meetings as being a high concern in the watershed areas, it should be noted that DEP has identified some segments of streams as impaired (see maps in Appendix).

- ✓ Mercury in Sugar Creek is a concern.
- ✓ Water quality monitoring and improvement is needed.
- ✓ Resources are desired to monitor water quality.
- ✓ There are water quality issues related to farm runoff on Tomjack Creek, includes discussion on E. Coli.
- ✓ Private water supply and sewage disposal systems serve the majority of County residents and can be a problem if mismanaged.
- ✓ Surface waters across the County have been impacted by soil erosion and deposition.

Stream Category VI – *Watershed Related*

The public awareness of watersheds, and all the components that contribute to watershed health, is increasing in the Towanda/Sugar Creek watersheds; due largely to efforts of the two active watershed groups, the Conservation District and DEP.

- ✓ Watershed education and issues awareness needs to be increased with the general public and decision makers.
- ✓ There is a need for increased public participation and sessions / activities in watershed management.
- ✓ Making residents aware of possible programs/funding to help in addressing environmental issues is needed.
- ✓ There are few local ordinances in place that protect the County's natural resources.
- ✓ One concern was a lack of timely State cooperation and support, with a slow and complicated grant process.
- ✓ More resources and support need to be provided to watershed associations to make them more sustainable.
- ✓ Encouraging the continuation of watershed groups to perform targeted enhancements to streams and watersheds is needed.
- ✓ There is a perceived lack of inter-municipal cooperation.

Stream Strategies

The following is a list of strategies to address identified Issues in the Sugar and Towanda Creek Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough); the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy.

Stream Category I - Stream Channel and Bank Erosion

- Develop a County program to provide local matching monies for road and bridge improvements where they impact streams.
- Encourage the use of best management practices in erosion control and storm water management for cost savings and environmental benefits.
- Complete the visual inventory of all tributaries within the watersheds for stream erosion. Enter data on GIS.

- Develop, distribute and complete a historic damage assessment of all properties immediately bordering streams.
- Develop and institute a centralized recording system for all stream erosion damages.
- Prioritize all identified problem sites and stream segments in the watersheds.
- Research various engineering sources of assistance and invite them to give educational presentation at watershed meetings on their approach to identified problem solutions.
- Solicit proposals from sources of engineering assistance to address technical assessment of identified problems.
- Actively seek funding to hire sources of engineering assistance.
- Select top ten identified problem sites and seek funding to correct as demonstration.
- Develop a sustainable funding source for ongoing technical assistance to landowners, municipalities, managers, and watershed groups working to rehabilitate stream channels and banks.
- Develop and implement a strategy to improve the regulation of streams and the ability of the regulated community to work with those regulations.
- Carry out an educational outreach program to the general public on stream regulations.
- Provide technical assistance for general public to secure permits for necessary work in streams in an environmentally sensitive manner.
- Develop a stream management educational outreach program for municipal officials, contractors and landowners.

Stream Category II – *Debris / Gravel*

- Establish a work group with agencies and other sources of assistance in identifying and implementing best management practices for gravel and debris removal.
- Work with Municipalities, Landowners and Contractors to educate them in proper maintenance of streams in an environmentally sensitive fashion.
- Develop an ongoing assistance program for stream debris clean up.
- Develop a guidance document/tool for individuals and municipalities responsible for stream gravel and debris removal.
- Seek causes, solutions, sources of technical and financial assistance to address the sources of excess debris and gravel in watershed streams.

Stream Category III – *Riparian Areas*

- Lay foundation for a Countywide Transfer of Development Rights (TDR) program.

- Review local ordinances to ensure that zoning protects sensitive resource areas.
- Preserve area streams and creeks, especially those stocked with (and/or sustaining) fish and/or drinking water.
- Enforce controls which result in stream buffers and avoid development in floodplain areas.
- Encourage stream buffers for their erosion control and water quality benefits.
- Provide support and funding for the development and implementation a riparian management plan for the watersheds.
- Provide funding for design and implementation of stream rehabilitation projects.
- Continue working with Chesapeake Bay Foundation, Natural Resources Conservation Service, Conservation District, and others to establish riparian planting efforts.
- Continue expansion of the micro-nursery concept in several locations in the watersheds.
- Identify and implement other best management practices that can be used as demonstrations in the watersheds.
- Implement County Open Space, Greenways and Outdoor Recreation Plan along stream corridors.
- Develop a source of plant material for riparian re-vegetation within the watersheds.

Stream Category IV – Stream Flooding & Floodplains

- Preserve 100-year floodplains and wetland areas so that they can perform their natural functions.
- Preserve the environmentally sensitive land such as floodplains, wetlands, and steeply sloped areas; historic, architecturally significant, and heritage resources; passive open and sporting areas; and natural resources and sensitive areas from inappropriate development.
- Implement existing plans to renovate the reservoir in the Valley on Smeads Creek.
- Enforce controls which result in stream buffers and avoid development in floodplain areas.
- Seek support and funding for stormwater management planning for the watersheds.
- Continue funding and outreach efforts related to community floodplain assistance project.
- Develop and institute a centralized recording system for all flooding damages.
- Develop a more detailed and improved flood hazard mapping tool.
- Implement the Bradford County Hazard Mitigation Plan.

Stream Category V – *Water Quality Related*

- Develop a Countywide water resources protection plan.
- Perform a County water resources study and develop a plan for County water resources protection.
- Develop a subdivision and land development and storm water management regulatory capacity with water quality provisions to protect the water resources of the region.
- Develop a localized sustainable water quality monitoring program.

Stream Category VI – *Watershed Related*

- Provide an outline and assistance for preparing watershed protection planning at the local level.
- Assist with development of a local zoning ordinance.
- Provide model ordinances, ordinance language, or ordinance topics for municipal and multi-municipal consideration.
- Assist municipalities in the drafting of local municipal and/or multi-municipal comprehensive plans.
- Coordinate zoning with designated growth areas.
- Encourage higher density development potential through mixed-use, clustered and traditional neighborhood development and transit-oriented development techniques.
- Develop a model agreement/memorandum of understanding for watershed municipalities, agencies, and organizations addressing watershed needs.
- Develop additional Act 167 Stormwater Management Plans for the County's watersheds.
- Encourage the use of stormwater best management practices.
- Encourage the development of watershed management strategies that promote best management practices for mining, agriculture and other land uses.
- Continue development and support of watershed organizations.
- Encourage the continuation of watershed groups to perform targeted enhancements to streams and watersheds.
- Support the efforts of the Towanda and Sugar Creek Watershed Associations and the Bradford County Conservation District to maintain and improve the quality of streams in the region.
- Recognize that our streams are a great natural resource with scenic, recreation, and environmental benefits that can be utilized and enjoyed; provided that we respect the periodic threat from flooding.
- Develop and implement a comprehensive educational strategy for watershed residents and managers on watershed issues.
- Participate in area schools' field days, etc. to promote watershed studies, understanding, and management.

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- Develop a stand alone display that can be utilized as part of area festivals, activities, etc. that tells the "watershed story".
- Develop a personal "watershed history" relating the importance of the stream and its historic connection to the people.
- Hold an Annual Watershed Meeting.
- Seek sustainable funding for watershed communications such as newsletter, etc.
- Identify, develop, and implement a watershed restoration and management strategy.

Transportation

Municipal roads in the watersheds are primarily dirt and gravel roads that, for the most part, meet the daily needs of residents in this predominantly rural area. Geology, soils, climate and hydrology all influence the make-up of these roads. Oftentimes, these influences, coupled with inadequate road design, drainage and maintenance, negatively impact receiving streams by increasing flows, sediment, and other non-point sources of pollution. In 1999, and again in 2008, the Conservation District conducted an inventory of these roads and identified hundreds of sites directly impacting water quality. Increased truck traffic as a result of the emerging gas exploration and development has put additional strains on the transportation system of the watersheds.

Compiled Stakeholder Input

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Transportation Category I – *Drainage*

Road systems in the Watersheds travel along streams and hillsides, intersecting drainageways and diverting natural drainage patterns. Inadequate and environmentally insensitive road maintenance practices can create problems for property and receiving streams alike. Poor drainage practices can jeopardize both the transportation system (road itself) as well as the surrounding landscape.

- ✓ Culvert installation and maintenance - technical and financial assistance is needed.
- ✓ There is undermining of 6 ft. pipe on E. Troy Back Rd.
- ✓ Road drainage systems are impacting on streams and roads.
- ✓ One particular, farm field diversion, outlet into the township road ditch causes problems with the road particularly in the winter.
- ✓ Township road ditch erosion on steep slopes and long slopes is a problem.

- ✓ Conservation District inventories have identified numerous water quality impact sites.
- ✓ Drainage from farms and driveways adversely impacts on road drainage systems.
- ✓ Saxton Hill Rd. Long ditch run on hill by Henry Saxton farm erodes township road ditch.

Transportation Category II – *Dirt & Gravel Road Maintenance*

As previously stated, due to the rural make-up of the Sugar and Towanda Creek Watersheds, dirt and gravel roads are the main transportation corridors. Proper construction and maintenance are critical to assure access and commerce in the area.

- ✓ Bradford County residents are choosing suburban and rural living over that found in the County's boroughs creating a greater demand on our rural transportation system.
- ✓ Residents' reliance on the personal automobile reflects Bradford County's dependence on the State and local roadway network, and many of our roads are not up to standards.
- ✓ Dirt and gravel road maintenance and repair is vitally needed.
 - Cummiskey, Laddisburg Hill, Heath, Meas Roads.
 - Brownback Road, Weed Hill Road, Kendall Hill Road.
 - Dirt and gravel road maintenance and repair of Pension Street.
 - Improve Mountain Road (to Sunfish Pond).
- ✓ Dirt and gravel roads runoff is creating water quality impacts on streams.
- ✓ Dirt and gravel road maintenance and repair – adequate funding needed to address erosion, drainage, and ditch stabilization.
- ✓ Surface waters across the County have been impacted by soil erosion and deposition.
- ✓ Examine and improve road grades, grading, and maintenance practices.
- ✓ Examine dust control options, applications, and effectiveness and improve maintenance / program options.
- ✓ Dust control – adequate funding is needed.
- ✓ Increased heavy traffic from gas well drilling is impacting on the road system.

Transportation Category III – *Driveways & Access Lanes*

Driveways, like roads, intersect natural drainage patterns and divert water onto neighboring properties or the municipal road system creating problems and adverse environmental impacts.

- ✓ Driveway construction and maintenance – a means or method is needed to insure that driveways are constructed and maintained in an environmentally sensitive manner; additional landowner education and outreach are needed.
 - Driveway on Madigan Rd across from wetland.
 - Driveway on Tennessee Gas Rd.
 - Driveway on E Troy Back Rd.
 - Redington Avenue driveway.
 - Fix Toothaker driveway.
- ✓ Resources and means to address and maintain driveways, farm lanes, and logging road interface with township roads are needed.
- ✓ One concern was a lack of timely State cooperation and support, with a slow and complicated grant process.

Transportation Category IV – *Miscellaneous*

- ✓ There is a need to take advantage of the scenic values of our transportation systems through the watersheds.
- ✓ Trees and windbreaks need to be established along roadsides.
- ✓ Major roads should provide safe bike and pedestrian lanes.
- ✓ A system and facility would be desirable for road materials storage and handling. Regarding cinder use, it is desired to develop adequate and proper storage for cinders as well as accessing information on the environmental implications related to their handling, storage, and use.
- ✓ There appears to be a discrepancy between the ability for municipalities/agencies to use cinders while individuals may not gain access to or use them. An explanation and understanding of this issue is desired, perhaps by having someone knowledgeable and experienced in such matters conduct an assessment and/or presentation.
- ✓ More coordinated efforts are needed between State, County and local governments in establishing bike/pedestrian routes.
- ✓ Road banks need to be stabilized to prevent sediment from entering water.
 - Slip-slide along Buttermilk Falls Road.

Transportation Strategies

The following are the strategies identified to address the transportation issues in the Sugar and Towanda Creeks Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N.

Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy

Transportation Category I – *Drainage*

- Work with NTRP&DC on establishing a regional position for contract administration of local bridge projects.
- Develop detailed Act 167 Stormwater Management Plans for the watersheds area.
- Continue and expand the technical and financial assistance provided under the Dirt & Gravel Roads Program.
- Inventory and evaluate all road drainage systems, including all culvert pipes and bridges.
- Develop a strategy for addressing identified priority needs.

Transportation Category II – *Dirt & Gravel Road Maintenance*

- Develop a County program to provide local matching monies for road and bridge improvements.
- Identify rural State roads that could be turned back to local municipalities for on-going maintenance.
- Continue and expand the technical and financial assistance provided under the Dirt & Gravel Roads Program.
- Enhance the education of local road maintenance officials on proper maintenance techniques.
- Provide cost share dollars for improvements.
- Provide an expanded source of technical assistance on drainage issues.

Transportation Category III – *Driveways*

- Develop an educational, technical, and financial program to assist landowners in planning, design, and construction of driveways and farm lanes.
- Provide municipalities with model ordinances for building and planning driveways and related drainage.
- Provide a technical assistance program.

Transportation Category IV – *Miscellaneous*

- Assist municipalities in the drafting of local municipal and/or multi-municipal comprehensive plans.

- Coordinate zoning with designated growth areas.
- Encourage higher density development potential through mixed-use, clustered and traditional neighborhood development and transit-oriented development techniques.
- Provide model ordinances, ordinance language, or ordinance topics for municipal and multi-municipal consideration.
- Continue providing financial assistance to EMTA.
- Seek to designate State Route 414 as a Pennsylvania Byway, bringing together transportation, land use, and natural resources.
- Maintain existing rail lines for freight and passenger movement.
- Formally request shoulder widening, surface improvements, pedestrian crossings, bike paths, and intersection improvements along major highways.
- Address regional oriented items.
- Improve pedestrian facilities within the region's more relatively densely populated boroughs.
- Administer "walking audits" to determine how community performs at the pedestrian level - examining such features as crosswalks, traffic calming needs, engineering and design, intersection geometry, pedestrian signals, signs and markings, sidewalks and pathways, grade separation, ADA compliance, and maintenance.
- Implement identified roadside trails and objectives in the Bradford County Open Space, Greenways and Outdoor Recreation Plan and the Northern Tier Bike-Pedestrian Transportation Plan.
- Shoulder improvements on PA 414 between Canton and Monroeton.
- Work with local, County, regional and State agencies to further develop and protect the scenic and historic values of our rural transportation system.
 - Berwick Turnpike.
 - PA Rt. 414.
 - PA Rt. 6.
 - Work with the EMHR and Pennsylvania Route 6 Heritage Coalition, and further recognize the importance and improve the visibility of US Route 6 in telling the story of the heritage of Troy.
 - Adopt Heritage tourism as an important component of the Downtown revitalization strategy involving Route 6, the agricultural/ rural ambiance, and the production and sale of local products.
 - Focus on the interrelationship between Route 6 and the agricultural, commerce, migration, and manufacturing heritage of Troy.
- Continue to develop and implement the goals and aims of the Northern Tier Scenic Corridors Inventory, Plan, and Strategy.

Wildlife

Compiled Stakeholder Input

The following is a distillation of issues in the Sugar and Towanda Creek Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watershed; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy

Wildlife Category I – Fisheries

- ✓ Habitat improvement and increased fisheries quality needed.
- ✓ There are poor fisheries in the watersheds.
- ✓ There is a lack of enforcement of fishing and boating rules for current river users.
- ✓ Fishing in the river has suffered with the introduction of non-native species and the disappearance of pan fish, grass, and clams.

Wildlife Category II – *Beaver*

- ✓ Wildlife and wetland management (beavers) is needed – Irish Settlement.
- ✓ Remove beaver dams that are causing flooding problems within the watershed.
- ✓ The abundance and quality of natural resources in the area provides numerous recreational opportunities for both residents and visitors, and demand for nature-based recreation and tourism is increasing.

Wildlife Category III – *Habitat*

- ✓ Surface waters across the County have been impacted by soil erosion and deposition.
- ✓ There are few local ordinances in place that protect the County's natural resources.
- ✓ Fish and wildlife health have been impacted by natural and man-made conditions.

Wildlife Strategies

The following are the strategies identified to address the transportation issues in the Sugar and Towanda Creek Watersheds. The following sources of information were utilized: direct input at public meetings in each of the municipalities in the watersheds; the Bradford County Comprehensive Plan; the Bradford County Open Space, Greenways and Outdoor Recreation Plan; the Endless Mountains Heritage Region Plan; the North Branch Susquehanna River - Rivers Conservation Plan; the Towanda Creek Watershed Association Plan; the Sugar Creek Watershed Association Plan; the Comprehensive Plans from Troy Borough, Troy Township, Joint Community (Granville Twp. – Canton Borough – Canton Twp.), Central Bradford Region (N. Towanda Twp. – Towanda Twp. – Towanda Borough), the Bradford County Conservation District Strategic Plan, the Bradford County Conservation District 2005 Chesapeake Bay – A Five Year Strategy

Wildlife Category I – *Fisheries*

- Develop a Countywide water resources plan.
- Improve habitat and increased fisheries quality.
- Incorporate habitat structures into stabilization projects where appropriate.
- Improve in-stream habitat (fish).
 - Work with PA Fish & Boat Commission and other aquatic habitat related agencies and groups to inventory needs and opportunities and develop strategy for improvements.
- Maintain and restore waterway – bank, vegetation, aquatic life.

Wildlife Category II – *Beaver*

- Work with wildlife and wetland management agencies to develop beaver management strategy for the watersheds.
- Remove beaver dams that are causing flooding problems within the watersheds.

Wildlife Category III – *Habitat*

- Perform detailed natural and scenic resource inventories.
- Perform a County water resources study and develop a plan for County water resources protection. Utilize the Bradford County Natural Areas Inventory.
- Review local ordinances to ensure that zoning protects sensitive resource areas.
- A variety of suggested projects to address these concerns include continued development of watershed organizations, creation of storm water

management plans and comprehensive plans to address stream bank erosion problems.

- Consider hunting preserve concept for elk, bison, deer, and other specialty species.
- Preserve identified areas (agricultural / rural areas) for wildlife, open space and recreation uses for the benefit of the community at large.
- Promote the management of woodlands as a renewable resource for wood products, wildlife and recreation uses.
- Promote the management of unutilized or underutilized farmland for productive uses (e.g. reforestation, wildlife habitat, and recreation).
- Encourage bio-diversity of wildlife and habitat.

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